

Fall 2022

Nutrition Facts Label Use Among U.S. Adolescents

Jennifer Beth Mandelbaum

Follow this and additional works at: <https://scholarcommons.sc.edu/etd>



Part of the [Public Health Education and Promotion Commons](#)

Recommended Citation

Mandelbaum, J. B.(2022). *Nutrition Facts Label Use Among U.S. Adolescents*. (Doctoral dissertation). Retrieved from <https://scholarcommons.sc.edu/etd/7038>

This Open Access Dissertation is brought to you by Scholar Commons. It has been accepted for inclusion in Theses and Dissertations by an authorized administrator of Scholar Commons. For more information, please contact digres@mailbox.sc.edu.

NUTRITION FACTS LABEL USE AMONG U.S. ADOLESCENTS

by

Jennifer Beth Mandelbaum

Bachelor of Arts
Brandeis University, 2014

Master of Public Health
Yale University, 2016

Submitted in Partial Fulfillment of the Requirements

For the Degree of Doctor of Philosophy in

Health Promotion, Education, and Behavior

The Norman J. Arnold School of Public Health

University of South Carolina

2022

Accepted by:

Rachel E. Davis, Major Professor

Edward A. Frongillo, Committee Member

James F. Thrasher, Committee Member

Lana Vanderlee, Committee Member

Cheryl L. Addy, Interim Vice Provost and Dean of the Graduate School

© Copyright by Jennifer Beth Mandelbaum, 2022
All Rights Reserved.

DEDICATION

This dissertation is dedicated to my dad, Eric Mandelbaum. Thank you for your unwavering support, pride, and love. I love and miss you.

ACKNOWLEDGEMENTS

Dr. Rachel Davis, your encouragement, guidance, and constructive feedback kept me going on this journey during the most difficult days, and I will be forever grateful. Thank you for helping me develop my voice as a public health researcher, and for making me think about scientific writing as storytelling. I hope the manuscripts that follow tell a compelling tale. I would also like to extend a heartfelt thank you to the other members of my dissertation committee, Drs. Edward Frongillo, James Thrasher, and Lana Vanderlee. I appreciate you sharing your expertise and thoughtful feedback on my dissertation. It has been a pleasure working with all of you. I also thank Dr. David Hammond and Christine White for their support in using data from the IFPS for my dissertation research. Additionally, this research was supported by a SPARC Graduate Research Grant from the Office of the Vice President for Research at the University of South Carolina.

To my supervisors and colleagues at the South Carolina Department of Environmental Health and Control, thank you for bringing me on as a graduate assistant nearly four years ago. It has been an honor and a privilege to support the work of the Division of Diabetes and Heart Disease Management.

Mom, Dad, and Jeremy, your love and support has meant the world to me. Beth and Bert, thank you for always being a soft place to land. Your house was truly a home away from home when I needed it. To my Brandeis friends, thank you for your kind words and encouragement throughout this process.

ABSTRACT

Despite the promise of Nutrition Facts label (NFL) use as a population-level intervention with broad reach, few studies have examined determinants of adolescents' NFL use, and how this label use may be associated with nutrition behaviors. This study used data from the International Food Policy Study, an online cross-sectional survey of trends in dietary patterns and policy-relevant behaviors in the U.S. and five other countries. First, this study examined 1) whether NFL use was associated with healthy eating efforts and 2) whether there were sociodemographic differences in NFL use among U.S. adolescents. Results demonstrated that NFL use was positively associated with a set of healthy eating behaviors among U.S. adolescents. Older adolescents had less frequent use of the NFL than younger adolescents, and this association was mediated by NFL understanding and nutrition knowledge. Next, this study examined potential 1) associations between weight change or maintenance efforts and NFL use and 2) relationships between three factors (body satisfaction, social media use, and weight teasing) predicted to be associated with weight change or maintenance efforts. Adolescents trying to change or maintain their weight were more likely to use the NFL than those not trying to change their weight. Compared to adolescents who were satisfied with their body size, those who perceived their body as smaller than ideal were more likely to try to gain weight, and those who perceived their body as larger than ideal were more likely to be trying to lose weight. Adolescents who had experienced weight teasing were more likely to engage in weight change or maintenance efforts than adolescents

who had not been teased for their weight. More time on social media was associated with trying to lose weight. Overall, this research makes significant contributions to public health research and practice. For one, unlike the literature among adults, little research has examined about the effect of adolescents' use of the NFL on healthy eating behaviors. As NFL understanding and nutrition knowledge may be barriers to NFL use, efforts to increase understanding and knowledge may lead to higher NFL use. Findings also point to the need for targeted efforts to promote body size satisfaction, reduce weight teasing, and encourage social media literacy among adolescents, which may help adolescents achieve and maintain healthy eating practices. The establishment of healthy eating behaviors during adolescence is important because nutrition habits established during this time period are likely to carry into adulthood.

TABLE OF CONTENTS

Dedication.....	iii
Acknowledgements	iv
Abstract.....	v
List of Tables	viii
List of Figures.....	ix
List of Abbreviations	x
Chapter 1: Introduction.....	1
Chapter 2: Background and Significance	9
Chapter 3: Research Design and Methods.....	41
Chapter 4: Results.....	62
Manuscript 1: Nutrition Facts Label Use, Healthy Eating Efforts, and Sociodemographic Characteristics Among U.S. Adolescents	62
Manuscript 2: Nutrition Facts Label Use and Weight Change Efforts Among U.S. Adolescents	104
Chapter 5: Conclusions and Implications.....	152
References	162
Appendix A: Supplementary Methods Tables	216
Appendix B: Supplementary Manuscript 1 Tables	226

LIST OF TABLES

Table 4.1 Sample characteristics (n=784)	98
Table 4.2 Fixed-effect variables used to estimate paths	100
Table 4.3 Estimates of paths illustrated in Figure 1 and the magnitude of indirect effects of sociodemographic characteristics on Nutrition Facts label (NFL) use (n=784)	101
Table 4.4 Magnitude and percentage of contribution of direct and indirect effects of sociodemographic characteristics on Nutrition Facts label (NFL) use (n=784)	103
Table 4.5 Sample characteristics (n=1,274)	146
Table 4.6 Linear regression showing associations between weight change or maintenance efforts and Nutrition Facts label (NFL) use among U.S. adolescents (n=1,274)	148
Table 4.7 Logistic regression showing associations between body size satisfaction, social media use, weight teasing, and weight change or maintenance efforts among U.S. adolescents (n=1,274)	149
Table 4.8 Logistic regression showing associations between body size satisfaction, social media use, weight teasing, and weight change or maintenance efforts among U.S. adolescent girls (n=648)	150
Table 4.9 Logistic regression showing associations between body size satisfaction, social media use, weight teasing, and weight change or maintenance efforts among U.S. adolescent boys (n=626)	151

LIST OF FIGURES

Figure 2.1 U.S. Nutrition Facts label image based on the version shown during data collection (November-December 2019).....	10
Figure 2.2 Conceptual model guiding Study 1	13
Figure 2.3 Conceptual model guiding Study 2	28
Figure 3.1 Conceptual model guiding Study 1	43
Figure 3.2 U.S. Nutrition Facts label image based on the version shown during data collection (November-December 2019).....	46
Figure 3.3 Conceptual model guiding Study 2	53
Figure 4.1 Paths from sociodemographic characteristics to Nutrition Facts label (NFL) use and healthy eating efforts	99

LIST OF ABBREVIATIONS

AAPOR.....	American Association for Public Opinion Research
BMI.....	Body Mass Index
CIHR.....	Canadian Institutes of Health Research
EAT	Healthy Eating Among Teens
FOP.....	Front-of-package
GUTS.....	Growing Up Today Study
IFPS	International Food Policy Study
ITHBC	Integrated Theory of Health Behavior Change
NFL.....	Nutrition Facts Label
NHANES	National Health and Nutrition Examination Survey
NLEA	Nutrition Labeling and Education Act
PHAC	Public Health Agency of Canada

CHAPTER 1

INTRODUCTION

Overweight and obesity are conditions characterized by “abnormal or excessive fat accumulation that may impair health” (World Health Organization, 2021). Overweight among adolescents is defined in the U.S. as having a body mass index (BMI) at or above the 85th percentile for age and sex and below the 95th percentile, and obesity is defined as having a BMI at or above the 95th percentile (Centers for Disease Control and Prevention, 2018).¹ These conditions are related to a constellation of behavioral, biological, and environmental factors, including energy intake (Romieu et al., 2017), physical activity and sedentary behaviors (Prentice-Dunn & Prentice-Dunn, 2012), neighborhood food and physical activity environments (Larson et al., 2009; Papas et al., 2007), family characteristics (e.g., maternal BMI during pregnancy, the home food environment; do Carmo et al., 2021; Rosenkranz & Dzewaltowski, 2008), hormone dysregulation (Kansra et al., 2021), the built environment (Jia et al., 2019), media influences (Cha et al., 2018), and socioeconomic status (Sanyaolu et al., 2019).

The prevalence of overweight and obesity in the United States (U.S.) has risen sharply in recent decades. Data from the National Health and Nutrition Examination Survey (NHANES) show that the prevalence of obesity among adolescents aged 12-19 rose from 6.1% in 1971-1974 to 21.2% in 2017-2018 (Robert Wood Johnson Foundation,

¹ For the purpose of this dissertation, the terms overweight and obesity are used to refer to these specific BMI ranges.

2020). However, both structural (e.g., built environment, economic) and sociocultural factors contribute to an uneven distribution of overweight and obesity across sociodemographic groups. For example, overweight and obesity are disproportionately higher among girls (Shah et al., 2020), older adolescents (Ogden et al., 2018), adolescents from low-income households (Weaver et al., 2019), and adolescents living in households with lower educational attainment (Ogden et al., 2018). There are also major differences in the prevalence of overweight and obesity across racial and ethnic groups in the U.S. For example, overweight and obesity risk is higher among non-Hispanic Black and Hispanic adolescents than among non-Hispanic white adolescents (Hayman, 2016).

Diet often emerges as a key element of obesity, which is influenced by both environmental and intra-individual factors (Campbell, 2016). While some studies have examined sociodemographic differences in adults' diet-related behaviors (Fanelli et al., 2020; Fang Zhang et al., 2018; Kris-Etherton et al., 2020; Lee-Kwan et al., 2017; Sijtsma et al., 2012; Wang et al., 2014; Wilcox et al., 2020), little is known about how differences in diet-related behaviors may present among adolescents. Research is needed to better understand the associations between sociodemographic factors and diet-related behaviors among adolescents, as this information provides context for understanding when and how adolescents make dietary changes. Findings from this research may highlight areas where health inequities exist and could be used to help target dietary interventions (e.g., identifying specific ages at which it could be most effective to intervene to help youth establish healthy dietary behaviors).

Adolescence may be an opportune time to intervene in eating behaviors and weight management, as it marks a critical period in human development when individuals

may be more responsive to health behavior change (Flodgren et al., 2020). Typically defined as the time between ages 10 and 19 years (United Nations Population Fund, 2012), adolescence is a transitional period characterized by physiological and psychological changes that often coincide with shifts in home, school, and social environments, such as increased autonomy (Daniels et al., 2005; Jaworska & MacQueen, 2015). Obesity follows an upward trajectory from adolescence to adulthood across gender and racial/ethnic groups (Gordon-Larsen et al., 2010). Children with obesity are at least twice as likely as children without obesity to have obesity as adults (Kruger et al., 2004). Childhood obesity is also a risk factor for comorbidities in adulthood, including cardiovascular disease, type 2 diabetes, and cancer (Bridger, 2009; Pulgaron, 2013; Weihrauch-Blüher et al., 2019). Few evidence-based strategies for long-term weight loss among adults exist, underscoring the importance of preventing and treating obesity in childhood and adolescence (Heymsfield et al., 2018).

This dissertation addresses two understudied yet important topics with implications for public health efforts to promote adolescent weight management: 1) associations between Nutrition Facts label (NFL) use and healthy eating efforts and sociodemographic differences in NFL use among U.S. adolescents;² and 2) factors associated with weight change efforts and Nutrition Facts label use among U.S. adolescents. Despite the promise of NFL use as a population-level intervention with broad reach, few quantitative studies have examined how adolescents' NFL use is associated with their nutrition behaviors (Campos et al., 2011). Only three such studies

² For the purpose of this dissertation, "Nutrition Facts label" refers to the U.S. government-mandated food labels on the back of packaged foods. This label includes serving information, calories, nutrients, and a quick guide to percent daily value. The term "food label" is only used in place of "Nutrition Facts label" when describing the label measure in the 2019 International Food Policy Study (IFPS) Youth Survey.

have been conducted among U.S. adolescents (Haidar et al., 2017; Huang et al., 2004; Wojcicki & Heyman, 2012), and only one such study has been completed outside of the U.S. (Talagala & Arambepola, 2016). Overall, these studies have found that adolescents infrequently use the NFL. Adolescents who use the NFL, however, appear to engage in healthier eating behaviors, including lower consumption of sugary beverages (Haidar et al., 2017), higher fruit and vegetable intake (Haidar et al., 2017), and higher healthy eating scores (Haidar et al., 2017), and healthier snacking (Talagala & Arambepola, 2016) than adolescents who do not use the NFL. The extant studies among adolescents also have several limitations, including a greater emphasis on awareness of the NFL than on use of the label (Wojcicki & Heyman, 2012), examining only one dietary outcome (e.g., dietary fat intake; Huang et al., 2004), or using samples with limited generalizability (e.g., patients at an urban primary care clinic, school-aged children in Texas, or Grade 12 students in Sri Lanka; Haidar et al., 2017; Huang et al., 2004; Talagala & Arambepola, 2016). Thus, we know relatively little about whether the frequency of NFL use among U.S. adolescents is associated with eating efforts. Study 1 in this dissertation helps to close this important gap in the literature, and its findings may inform interventions promoting NFL use among U.S. adolescents.

Study 2 builds on Study 1 by examining potential gender³ differences in factors that may be directly or indirectly associated with NFL use (Hypothesis 2E). Previous research suggests that body size satisfaction (Wang et al., 2019), social media use (Mahon & Hevey, 2021), and weight teasing (Valois et al., 2019) have differential effects

³ This study only considers boys and girls as gender categories. Although responses to the 2019 IFPS Survey were given as “male” or “female,” it is not clear whether respondents were thinking of biological sex or gender. This study uses the term gender to refer to the norms, behaviors, and roles typically associated with males and females (Phillips, 2005).

on boys and girls, yet little is known about potential gender differences in how these factors are associated with weight change efforts. Weight change efforts are, in turn, predicted to be associated with NFL use, with stronger effects among girls than boys. This research is important because adolescents are undergoing significant social and emotional development, and many of the views and habits they form during this time will follow them into adulthood (Bucchianeri et al., 2013; Winpenny et al., 2018). Nearly two-thirds of adolescents report attempting to lose weight, and this effort is especially common among girls (Houle-Johnson & Kakinami, 2018; McDow et al., 2019), suggesting weight change efforts is an important topic in adolescent health.

Understanding how gender influences factors associated with weight change efforts and NFL use may also inform the design of weight-related behavior change interventions. For example, interventions could be designed to help girls and boys use NFLs to achieve different weight-related goals in healthy ways. Previous research has suggested that the NFL could be promoted as a way to ensure that adolescent boys consume adequate nutrition for physical activity (Christoph, Larson, et al., 2018).

Specific Aims and Hypotheses

This dissertation comprises two studies. Study 1 (NFL, eating efforts, and sociodemographic characteristics among U.S. adolescents) addresses Specific Aims 1-2. “Healthy eating efforts” refers to adolescents’ report of efforts to engage in nine specific healthy eating behaviors: eating protein; eating less sugar or drinking fewer sugary drinks; eating fewer calories; eating less salt; eating vegetables and fruits; drinking lots of water; eating whole grains; eating less low-calorie sweeteners; and eating less processed foods. Study 2 (Nutrition Facts label use and weight change efforts among U.S.

adolescents) addresses Specific Aims 3-4. “Weight change efforts” refers to the actions an individual takes with regard to their body weight (i.e., not trying to change or maintain weight, stay the same weight, lose weight, gain weight; Hammond et al., 2021). Specific aims and hypotheses for each study are outlined below.

Study 1: Nutrition Facts label use, healthy eating efforts, and sociodemographic characteristics among U.S. adolescents

Specific Aim 1: To examine whether the frequency of NFL use among U.S. youth is associated with healthy eating efforts related to nutrition information that is shown versus not shown on the NFL.

- **Hypothesis 1A:** U.S. adolescents aged 14-17 who report more frequently using the NFL will be more likely to report engaging in nine healthy eating efforts (e.g., eating vegetables and fruits, eating fewer calories).
- **Hypothesis 1B:** Adolescents will be more likely to engage in eating efforts related to nutrition information that is shown on the NFL than eating efforts related to nutrition information that is not shown on the label.

Specific Aim 2: To determine potential sociodemographic differences by race/ethnicity, age, and gender in NFL use.

- **Hypothesis 2A:** The relationship between race/ethnicity and NFL use will be mediated by NFL understanding. Non-Hispanic white adolescents will be more likely than African American or Hispanic adolescents to have greater NFL understanding, which, in turn, will be associated with more frequent use of the NFL.

- **Hypothesis 2B:** The relationship between race/ethnicity and NFL use will be mediated by nutrition knowledge. Non-Hispanic white adolescents will be more likely than African American or Hispanic adolescents to have greater nutrition knowledge, which, in turn, will be associated with more frequent use of the NFL.
- **Hypothesis 2C:** The relationship between age and NFL use will be mediated by NFL understanding. Older adolescents will have higher levels of NFL understanding than younger adolescents, which, in turn, will be associated with more frequent use of the NFL.
- **Hypothesis 2D:** The relationship between age and NFL use will be mediated by nutrition knowledge. Older adolescents will have higher levels of nutrition knowledge than younger adolescents, which, in turn, will be associated with more frequent use of the NFL.
- **Hypothesis 2E:** The relationship between gender and healthy eating efforts will be mediated by NFL use. Girls will have more frequent use of the NFL than boys, which, in turn, will be associated with higher engagement in nine healthy eating efforts.

Study 2: Nutrition Facts label use and weight change efforts among U.S. adolescents

Specific Aim 3: To determine potential differences by gender in the relationships between three factors (body satisfaction, social media use, weight teasing) and weight change efforts among U.S. adolescents aged 10-17.

- **Hypothesis 3A:** Body satisfaction will be associated with weight change efforts such that adolescents perceiving their bodies to be larger than the ideal will try to

lose weight and adolescents perceiving their bodies to be smaller than the ideal will try to gain weight.

- **Hypothesis 3B:** Social media use will be associated with weight change efforts such that adolescents who spend more time using social media will be more likely to engage in weight change efforts.
- **Hypothesis 3C:** Weight teasing will be associated with weight change efforts such that adolescents being teased more about their weight will be more likely to engage in weight change efforts.
- **Hypothesis 3E:** The relationships examined in Hypotheses 3A-C will be stronger for girls than boys.

Specific Aim 4: To determine whether engaging in weight change efforts is associated with NFL use among U.S. adolescents aged 10-17.

- **Hypothesis 4A:** Adolescents engaging in weight change efforts (i.e., trying to stay the same weight, gain weight, or lose weight) will be more likely to use the NFL than adolescents not trying to change or maintain their weight.
- **Hypothesis 4B:** The relationship examined in Hypothesis 4A will be stronger for girls than boys.

CHAPTER 2

BACKGROUND AND SIGNIFICANCE

This dissertation comprises two studies. Study 1 examined Nutrition Facts label (NFL) use, healthy eating efforts, and sociodemographic characteristics among U.S. adolescents (Specific Aims 1-2). In this study, “healthy eating efforts” refers to adolescents’ reports of efforts to engage in the following healthy eating behaviors: eating protein; eating less sugar or drinking fewer sugary drinks; eating fewer calories; eating less salt; eating vegetables and fruits; drinking lots of water; eating whole grains; eating less low-calorie sweeteners; and eating less processed foods. Study 2 investigated relationships among body size satisfaction, weight change efforts, and NFL use among U.S. adolescents (Specific Aims 3-4). This chapter begins with a discussion of the relevant background information that guides Study 1, followed by additional background information that informs Study 2.

Study 1: Nutrition Facts label use, healthy eating efforts, and sociodemographic characteristics among U.S. adolescents

Study 1 examined 1) whether the frequency of food label use among U.S. adolescents is associated with healthy eating efforts related to nutrition information that is shown versus not shown on the NFL (Specific Aim 1) and 2) potential sociodemographic differences (by race/ethnicity, age, and gender) in NFL use among U.S. adolescents (Specific Aim 2).

Conceptual model

The conceptual model guiding this study is shown in Figure 2.2. As previously described, “healthy eating efforts” refers to adolescents’ report of efforts to engage in specific healthy eating behaviors, including eating protein, eating less sugar or drinking fewer sugary drinks, eating fewer calories, eating less salt, eating vegetables and fruits, drinking lots of water, eating whole grains, eating less low-calorie sweeteners, and eating less processed foods. Some of these healthy eating efforts (protein, sugar, calorie, and salt intake) could be guided by information shown on the NFL (Figure 2.1), while information needed to inform other behaviors (vegetable, fruit, water, whole grain, low-calorie sweetener, and processed food intake) was not shown on the label.

Nutrition Facts			
Serving Size 2/3 cup (55g)			
Servings Per Container About 8			
Amount Per Serving			
Calories 230		Calories from Fat 72	
% Daily Value*			
Total Fat 8g			12%
Saturated Fat 1g			5%
Trans Fat 0g			
Cholesterol 0mg			0%
Sodium 160mg			7%
Total Carbohydrate 37g			12%
Dietary Fiber 4g			16%
Sugars 12g			
Protein 3g			
Vitamin A			10%
Vitamin C			8%
Calcium			20%
Iron			45%
* Percent Daily Values are based on a 2,000 calorie diet. Your daily value may be higher or lower depending on your calorie needs.			
	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Figure 2.1 U.S. Nutrition Facts label image based on the version shown during data collection (November-December 2019; SNAP4CT, 2018)

Overall, this research aimed to examine potential influences on and consequences of NFL use among adolescents. The conceptual model (Figure 2.2) drew from components of the Integrated Theory of Health Behavior Change (ITHBC; Ryan, 2009) and the theoretical model of NFL use developed by Drichoutis et al. (2008). The ITHBC posits that knowledge and beliefs, self-regulation, and social facilitation (e.g., social support) support engagement in self-management behavior (a proximal outcome) and, in turn, influence health status (a distal outcome; Ryan, 2009). According to ITHBC, knowledge and beliefs are associated with increased behavior-specific self-efficacy, which supports preventative health behaviors (Ryan, 2009). In the present study, NFL understanding and nutrition knowledge (similar to knowledge and beliefs in the ITHBC) were hypothesized to mediate the association between sociodemographic characteristics and NFL use (a proximal health behavior). Unlike the ITHBC, however, the present study was unable to examine concepts related to self-regulation (e.g., self-evaluation and goal setting) that might have partially mediated the associations between NFL understanding and nutrition knowledge and NFL use. The ITHBC also posits that proximal health behaviors lead to distal health outcomes (Pfeiffer et al., 2018; Ryan, 2009). In the context of this study, Specific Aim 1 focused on how NFL use (a proximal health behavior) was expected to be associated with healthy eating efforts (a distal health outcome).

Specific Aim 2 sought to understand how sociodemographic characteristics (race/ethnicity, age, and gender), NFL understanding, and nutrition knowledge were associated with NFL use. This study drew from the theory of NFL use developed by Drichoutis et al. (2008), which posited that NFL use is a function of more than 20 social, economic, and demographic determinants. Several variables from the Drichoutis et al.

(2008) theory were hypothesized to be associated with NFL use in the present study, including age, gender, and nutrition knowledge. NFL understanding could be considered a proxy for *efficiency of reading nutritional labels* (e.g., locating information and choosing between foods). Other variables from the Drichoutis et al. (2008) theory were modeled as control variables in the present study, such as perceived income adequacy (a proxy for household income). While weight status was not included in the conceptual model, the present study controlled for weight change efforts. Because the present study concerned adolescents, some variables from the Drichoutis et al. (2008) theory were less applicable and therefore not included in the conceptual model (Figure 2.2). These variables included work-related variables (e.g., work hours, work flexibility, the physical demands of the job, needing to talk or stand often while working) and whether the respondent was head of household. The present study also did not include variables related to trustworthiness of health claims and the primary source of nutrition information (e.g., nutritionists, physicians, media, relatives, friends), as this information was not collected through the 2019 IFPS Youth Survey. Through these two aims, findings from this study may inform interventions targeting NFL use among U.S. adolescents and their dietary behaviors.

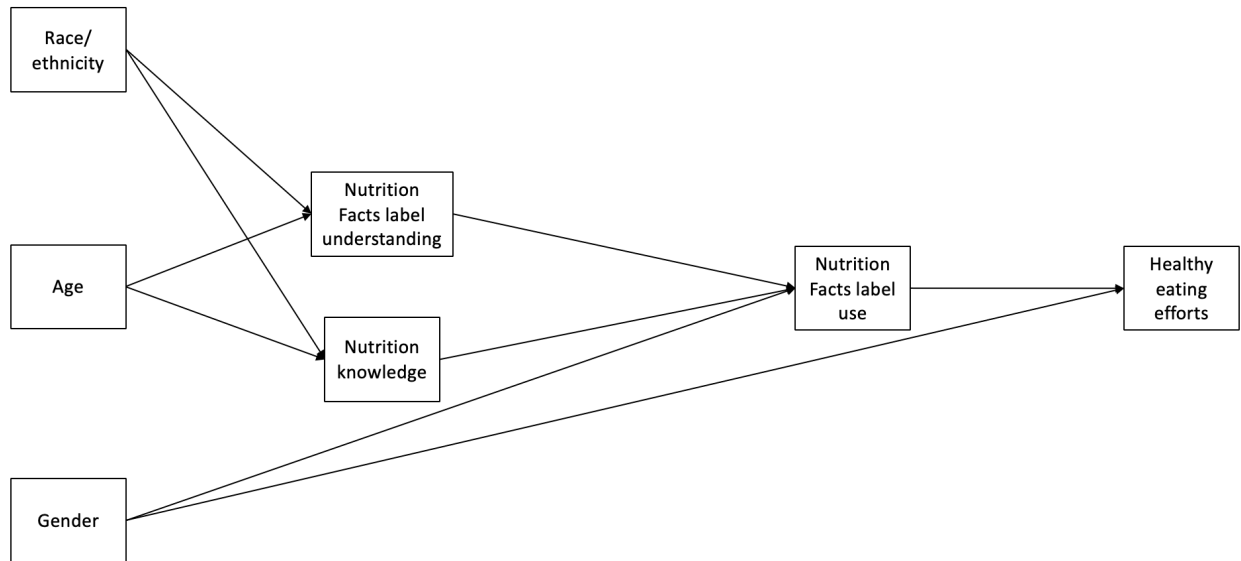


Figure 2.2 Conceptual model guiding Study 1

Nutrition Facts labeling in the United States

Prior to 1990, a substantial body of research had documented links between diet, health, and disease, yet only about 60% of packaged foods in the U.S. included the nutrition label (Greenberg, 1990). Public and political pressure over the twentieth century contributed to a series of federal laws requiring increasingly detailed labeling on food packages at the point of purchase (Gillett, 2011; Silverglade, 1996). At the time of the passage of the United States Nutrition Labeling and Education Act (NLEA) in November 1990, it was called “the most significant food labeling legislation in 50 years” (Institute of Medicine Committee on Examination of Front-of-Package Nutrition Rating Systems and Symbols; "Nutrition Labeling and Education Act of 1990," p. 23). This historic legislation mandated the inclusion of a uniform NFL for nearly all packaged foods beginning in 1993 (Institute of Medicine Committee on Examination of Front-of-Package Nutrition Rating Systems and Symbols; "Nutrition Labeling and Education Act of 1990"). The NLEA mandated that most foods have a label stating the number of servings,

calories, calories from fat per serving, total fat, saturated fat, cholesterol, sodium, total carbohydrates, complex carbohydrates, sugars, dietary fiber, total protein, and vitamins and minerals per serving (Greenberg, 1990). The NFL was designed to help American consumers make informed choices about food products (Christoph et al., 2016; Misra, 2007; Satia, 2009).

The market, food supply, and information on the label have changed substantially since the passage of the NLEA. Effective in 2016, the U.S. Food and Drug Administration (FDA) revised the NFL to emphasize existing information (e.g., calories) and add new information (e.g., added sugars; Neuhofer et al., 2020). These new requirements went into effect in January 2020 for manufacturers with \$10 million or more in annual food sales and January 2021 for manufacturers with less than \$10 million in annual food sales (U.S. Food and Drug Administration, 2018).

The U.S. NFL can be a convenient, cost-effective source of nutrition information (Buyuktuncer et al., 2018; Campos et al., 2011). The label has the potential to “serve as a population-level intervention with unparalleled reach” (Christoph et al., 2016, p. 2135), as they are present on most packaged food products in the U.S. (Miller & Cassady, 2015). Studies indicate that 87% of U.S. adults have looked at the food label (Lando et al., 2021), and 31.4% report using the label frequently (Christoph, Larson, et al., 2018). While few estimates of adolescent NFL use exist, one study using nationally representative data found that 37.6% of U.S. adolescents between ages 16 and 19 reported sometimes or always using the NFL (Wojcicki & Heyman, 2012).

Despite their intended population-wide use, research with U.S. adults suggests that the use and accessibility of the NFL varies across individuals (Roberto & Khandpur,

2014). Adults who report using the label more frequently are more likely to be white, female, physically active, well-educated, higher income, more knowledgeable about nutrition, and practicing healthier eating habits compared to non-label users, suggesting that there may be both individual-level and structural barriers to NFL use (Bleich & Wolfson, 2015; Campos et al., 2011; Christoph, Larson, et al., 2018; Cowburn & Stockley, 2005; Roberto & Khandpur, 2014). The NFL may also be more widely used by adult consumers who already have greater knowledge or motivation to eat healthier (Campos et al., 2011; Jasti & Kovacs, 2010; Mozaffarian et al., 2018). Research with adults also indicates that the relationship between the NFL use and diet may also be self-reinforcing; the label may promote healthier diets, and individuals with healthier diets may be more likely to use the label (Barker et al., 2012). We know relatively little, however, about the potential influences on and consequences of food label use among U.S. adolescents.

NFL use and healthy eating efforts among U.S. adults

Specific Aim 1 (Hypotheses 1A-B) examined whether the frequency of food label use among U.S. adolescents is associated with healthy eating efforts related to nutrition information that is shown versus not shown on the NFL. Although relatively little is known about how the NFL influences adolescents' dietary behaviors, the literature among adults provides some insights.

More than 30 years after the passage of the NLEA, much research has examined how the dietary information on the NFL may affect eating practices among adults (Campos et al., 2011; Christoph, Larson, et al., 2018; Christoph, Loth, et al., 2018; Kim et al., 2021; Variyam & Cawley, 2006; Zhang et al., 2017). These studies have found that

U.S. adults who use the NFL may be more likely to engage in eating behaviors related to nutrition information that is shown on the label, such as eating protein (Elbon, Johnson, Fischer, & Searcy, 2000; J. E. Lewis et al., 2009), eating less sugar or drinking fewer sugary drinks (Anastasiou et al., 2019; Christoph, Larson, et al., 2018; Haidar et al., 2017; Ollberding et al., 2010), consuming fewer calories (Campos et al., 2011; Elbon et al., 2000; J. E. Lewis et al., 2009), and eating less salt (Anastasiou et al., 2019; Fitzgerald et al., 2008; Kim et al., 2000; Lewis et al., 2009; Ollberding et al., 2010). A longitudinal study of sales data across several packaged food categories concluded that sales of low-sodium foods increased significantly after the NLEA was implemented (Balasubramanian & Cole, 2002). A systematic review and meta-analysis of 60 studies in the U.S., Canada, Europe, Australia, and Asia concluded that food labeling was associated with reduced consumption of total fat, lower intake of total energy, and increased vegetable consumption among adults (Shangguan et al., 2019). These findings with U.S. adults suggest that more frequent use of the NFL is positively associated with healthy eating efforts.

There is also evidence that adults who use the NFL are more likely to engage in eating behaviors related to nutrition information that is not shown on the label, including eating fruits and vegetables (Anastasiou et al., 2019; Christoph, Larson, et al., 2018; Haidar et al., 2017), drinking water (Haidar et al., 2017), and eating whole grains (Christoph, Larson, et al., 2018; Haidar et al., 2017; Lin & Yen, 2008). These findings suggest that the NFL may serve as an effective tool for motivating and enabling supporting adults to make healthier dietary choices. Alternatively, NFL use could reflect

social selection; that is, people who make healthier eating choices may be more likely to use the NFL.

There is limited though consistent evidence that NFL use precedes engaging in healthier dietary behaviors among adults (Baixauli et al., 2008; Kral et al., 2002; Miller et al., 2000; Miller et al., 1998). For example, an eye-tracking study, which produced objectively recorded data on NFL viewing, found that participants purchased healthier products after reading the NFL (Ni Mhurchu et al., 2018). In an analysis that corrected for potential self-selection bias on label use with a two-stage selectivity analysis, Guthrie et al. (1995) found that people who sometimes or always used the NFL had lower dietary cholesterol intake and consumed more vitamin C compared to people who never or rarely used the NFL. Using an endogenous switching regression analysis to control for heterogeneity in the decision to use the NFL, Kim et al. (2000) similarly found that adults using the NFL had higher intake of dietary fiber and lower intake of calories from total and saturated fat compared to non-label users. A qualitative study among women in the United Kingdom found that adults used NFL information to make informed decisions about their food purchases, and that the NFL helped facilitate healthier choices (Wahlich et al., 2013). This limited evidence suggests that further research is needed to investigate a causal path between NFL use and engaging in healthier dietary behavior among adolescents.

In addition to dietary changes, NFL use may be associated with other healthy behaviors and health-promoting psychosocial factors. Satia et al. (2005) noted that NFL use “may be part of a cluster of health-promoting behaviors” that includes psychosocial factors such as healthy eating self-efficacy and a belief that diet influences cancer risk

(Satia, Galanko, & Neuhouser, 2005, p. 400). For example, adults who use the NFL have been found to be less likely to engage in unhealthy behaviors such as smoking (Campos et al., 2011; Christoph, Loth, et al., 2018) and more likely to exercise regularly (Campos et al., 2011; Laz et al., 2015). NFL use has also been associated with reduced risk for overweight and obesity among adults (Anastasiou et al., 2019). NFL use may therefore reflect an individual's overall health-seeking behaviors (Barker et al., 2012).

NFL use and healthy eating efforts among U.S. adolescents

As compared to research with adults, relatively few studies have quantitatively examined associations between NFL use and dietary behaviors among adolescents. To the authors' knowledge, only three such studies have been conducted among U.S. adolescents (Haidar et al., 2017; Huang et al., 2004; Wojcicki & Heyman, 2012), and only one such study was completed outside of the U.S. (Talagala & Arambepola, 2016). Overall, these studies found that less than 40% of adolescents use the NFL; however, adolescents who used the NFL appeared to engage in healthier eating behavior, including lower consumption of sugary beverages (Haidar et al., 2017), higher fruit and vegetable intake, (Haidar et al., 2017) higher healthy eating scores⁴ (Haidar et al., 2017), and healthier snacking (Talagala & Arambepola, 2016) than adolescents who did not use the NFL. Huang et al. (2004) was the only study that concluded that NFL use was not associated with healthier eating behaviors among adolescents. Together, these findings suggest that NFL use may help promote healthy eating behaviors among adolescents who use them.

⁴ Healthy eating scores were based on the Texas School Physical Activity and Nutrition (SPAN) Healthy Eating Index and were used to determine overall healthfulness of adolescents' diets (Haidar et al., 2017; Ranjit et al., 2015).

In addition to the limited number of studies on adolescent use of the NFL, extant studies among adolescents also have several limitations, including a greater emphasis on awareness of the NFL than on use (Wojcicki & Heyman, 2012), examining only one dietary outcome (e.g., dietary fat intake; Huang et al., 2004), or using samples with limited generalizability (e.g., patients at an urban primary care clinic (Huang et al., 2004), school-aged children in Texas (Haidar et al., 2017), or Grade 12 students in Sri Lanka (Talagala & Arambepola, 2016)). Thus, we know relatively little about whether the frequency of NFL use among U.S. adolescents is broadly associated with healthy eating efforts. Evidence among adults, however, supports the hypothesis that more frequent use of the NFL will be positively associated with healthy eating efforts among U.S. adolescents aged 14-17 (Hypothesis 1A). Studies of adults also suggest that NFL use will be positively associated with healthy eating efforts related to nutrition information that is not shown on the NFL (Hypothesis 1B).

It is important to better understand how adolescents' use of the NFL may influence their dietary behaviors, as adolescence is a unique developmental period with implications for the life course. Adolescence is defined as a "transitional developmental period between childhood and adulthood" (Pringle et al., 2016, p. 2) that typically occurs between ages 12 and 18 and is characterized by physiological and psychological changes (Crosnoe & Johnson, 2011; Jaworska & MacQueen, 2015). Adolescence also marks "a transition from primarily parental-controlled eating to self-directed and peer-influenced eating" (Ziegler et al., 2021, p. 1). Most adolescents do not purchase food by themselves or with their parents (Hermans et al., 2020; Larson et al., 2006; Neufeld et al., 2022); thus, using the nutrition label may be a way for adolescents to exert control over their

dietary behaviors. Several studies have demonstrated how dietary intake tracks from adolescence into adulthood (Kvaavik et al., 2005; Lake et al., 2006; Lipsky et al., 2015; Movassagh et al., 2017). The skills, knowledge, and habits adolescents acquire during this time may therefore shape their life-long dietary behaviors (Hu et al., 2016; Nelson et al., 2008; Winpenny et al., 2017). Findings from this study may help to inform programs and policies to improve healthy eating efforts among adolescents.

NFL understanding and nutrition knowledge

Differences in NFL understanding and nutrition knowledge may influence NFL use among adolescents. NFL understanding refers to either self-reported or functional tests of individuals' ability to interpret information on the NFL (Bhawra et al., 2022). A scoping review of studies among adults from the U.S., Australia, Canada, and Singapore found that NFL understanding was generally associated with an increase in NFL use (Malloy-Weir & Cooper, 2017). Previous research suggests that poor NFL understanding is one of the main barriers to NFL use among adults (Jay et al., 2009). Many adults have difficulty interpreting information such as serving size on the NFL (Cowburn & Stockley, 2005), suggesting that interpretational aids at the point-of-purchase may improve selection of healthier choices. Little is known about NFL understanding among adolescents, although current evidence suggests that adolescents generally score low in assessments of their ability to read and compare NFLs (Hawthorne et al., 2006). Research with U.S. adults has found racial/ethnic and age differences in NFL understanding. For example, non-Hispanic white adults have been found to have higher average label understanding compared to English-speaking Hispanic and non-Hispanic Black adults (Persoskie et al., 2017). Research among adults also suggests that use of specific

information on the NFL (e.g., serving size, ingredients) increases with age (Ollberding et al., 2010), although some evidence has found that older adults (> age 60) may experience more difficulty with label comprehension (Miller et al., 2017). Based on these findings among adults, it was hypothesized that non-Hispanic white adolescents would be more likely than African American or Hispanic adolescents to have greater NFL understanding, which, in turn, would be associated with more frequent use of the NFL (Hypothesis 2A). It was further hypothesized that older adolescents would have higher levels of NFL understanding than younger adolescents, which, in turn, would be associated with more frequent use of the NFL (Hypothesis 2C).

Nutrition knowledge refers to knowledge of processes and concepts related to nutrition, including diet, health, disease, and dietary guidelines (Miller & Cassady, 2015). Nutrition knowledge may help consumers pay more attention to the NFL (as compared to marketing on the package), increase comprehension of the nutrition information on the label, and support consumers in applying nutrition information to food choice (Miller & Cassady, 2015). NFL use may require use of a set of cognitive processes related to attention, comprehension, and decision making that is aided by nutrition knowledge (Miller & Cassady, 2015). A systematic review of studies in the U.S., United Kingdom, Europe, Africa, Australia, and the Middle East found that adults with greater nutrition knowledge found it easier to understand information on the NFL, which led to increased NFL use (Miller & Cassady, 2015). Further, a cross-sectional survey of U.S. undergraduate and graduate students suggested that nutrition knowledge predicts NFL use (Misra, 2007). A few studies suggest that nutrition knowledge may vary across racial/ethnic and age groups among adolescents. For example, a study of U.S. middle

school students found that Black adolescents had lower nutrition knowledge than their white peers (Fahlman et al., 2010). Additionally, a study among Canadian adolescents found that nutrition knowledge increased with age (Brown et al., 2021). These findings suggest that differences in nutrition knowledge may partially explain racial/ethnic and age differences in NFL use. It was hypothesized that non-Hispanic white adolescents would be more likely than African American or Hispanic adolescents to have greater nutrition knowledge, which, in turn, would be associated with more frequent use of the NFL (Hypothesis 2B). It was also predicted that older adolescents would have higher levels nutrition knowledge than younger adolescents, which would be associated with more frequent use of the NFL (Hypothesis 2D).

NFL understanding and nutrition knowledge may also serve as proxy measures for nutritional literacy, which has been defined as “a specific health literacy domain that reflects the ability to access, interpret, and use nutrition information” (Velardo, 2015, p. 386). Researchers examining adolescent NFL use have questioned whether low label use among adolescents reflects difficulty translating information on the NFL into use (Huang et al., 2004). A study of young adults found that those with low health literacy were less likely to use the NFL than those with high health literacy (Cha et al., 2014). Qualitative research suggests that adult consumers have difficulty applying nutrition information to their own lives (Wahlich et al., 2013), which may indicate that adolescents face a similar challenge. For example, a qualitative study among adolescents and young adults in Canada found that participants often expressed confusion about how to apply percentage daily value information (Hobin et al., 2016). These findings support the hypotheses that

NFL understanding and nutrition knowledge were mediators of the relationships between sociodemographic variables and NFL use (Hypotheses 2A-D).

Sociodemographic characteristics

Specific Aim 2 (Hypotheses 2A-E) sought to examine associations between sociodemographic characteristics and adolescent NFL use. The hypotheses presented in this dissertation highlight several understudied areas of nutrition research, including potential racial/ethnic, age, and gender differences in NFL use, which present an opportunity for this dissertation to contribute new knowledge to the field. Exploring these differences gives us insight into how individuals use the NFL, and, in turn, seek to make dietary changes. This information could be used to help target interventions to promote healthy eating by addressing psychosocial barriers among specific adolescent subgroups, which is likely to be more effective than simply providing nutrition information (Dumoitier et al., 2019). Potential differences in the relationships between frequency of NFL use and healthy eating efforts are explored below by race/ethnicity, age, and gender.

Race/ethnicity

While only three studies have examined racial and ethnic differences in NFL use among U.S. adolescents, findings from these studies are consistent with studies among adults. Prior studies have shown that non-Hispanic white and Black adults are more likely than Hispanic adults to use the NFL (Campos et al., 2011; Gans et al., 2003; Ollberding et al., 2010). Among U.S. adolescents, Haidar et al. (2007) found that those categorized as “white/other” were more likely than African American or Hispanic adolescents to report using the NFL to make food choices, and Wojcicki and Heyman (2012) found that NFL use was lowest among non-Hispanic African Americans and Mexican American

adolescents. Huang et al. (2004) did not find a difference in NFL use between adolescents who were African American, white, or from other racial/ethnic groups. Although these results were inconsistent across studies, the two larger state or nationally representative surveys did report differences in NFL use between racial and ethnic groups (Haidar et al., 2007; Wojcicki & Heyman, 2012), suggesting that the racial and ethnic differences in label use observed among adults may also apply to adolescents. Based on the current literature, the authors predict that non-Hispanic white adolescents will be more likely than African American or Hispanic adolescents to have greater NFL understanding and nutrition knowledge, respectively, which, in turn, will be associated with more frequent use of the NFL (Hypotheses 2A-B)

Language barriers, differences in label comprehension, and acculturation may contribute to racial/ethnic variation in NFL use. Among adults, limited English proficiency has been associated with lower NFL use (Ollberding et al., 2010). Language barriers may also impede label comprehension among non-native English speakers (Lubman et al., 2012; Sharif et al., 2014). All NFLs are required by law to be in English, although information in another language may be optionally included in a separate panel (21 CFR 101.15, 2022). Previous research suggests that NFL use increases with the length of time foreign-born adults have lived in the U.S. (Ollberding et al., 2010). For example, a nationally representative study found a positive association between label use and dietary quality among Latinos with higher acculturation (defined as speaking only English or English more than Spanish at home), although this association was not found for less acculturated Latinos (Wilson et al., 2018). Research on potential racial/ethnic differences in NFL use is needed to better inform educational interventions to increase label

understanding or nutrition knowledge, which may reduce racial/ethnic disparities in NFL use.

Age

Adolescence and young adulthood may be periods when people are more likely to use the food label to establish healthy eating habits (Campos et al., 2011; Christoph, Larson, et al., 2018). Only one study has examined age differences in NFL use among U.S. adolescents (Haidar et al., 2017). This study found that 8th graders in the U.S. reported higher use of the NFL to make nutrition decisions compared to 11th graders. Little explanation was given for this finding, other than the fact that 8th and 11th grade are in distinct developmental stages (i.e., middle and high school; Haidar et al., 2017). One possibility is that 8th graders were just learning about the nutrition characteristics of foods, whereas older students may have had more nutrition knowledge and therefore not need to check the label as frequently. There is also evidence that adolescents aged 16-19 are more aware of federal dietary guidance (e.g., the Dietary Guidelines for Americans and the Food Guide Pyramid) compared to adults (Wright & Wang, 2011), which may be associated with increased use of the NFL (Miller et al., 2015). A study among Canadian adolescents ages 13-19 found that each one-year increase in age was associated with a 1% increase in nutrition knowledge, which was unlikely to translate to a meaningful difference in nutrition intake (Brown et al., 2021). These findings suggest that age and nutrition knowledge may interact with one another in complex ways to influence adolescents' nutrition decisions.

Little is known about potential age differences in NFL use among U.S. adolescents, or how understanding of the NFL and nutrition knowledge may mediate this

relationship. Research on the potential relationships among age, NFL understanding, nutrition knowledge, and NFL use is needed to develop age-appropriate communication campaigns to educate adolescents about how to use the NFL to guide healthy eating. For example, certain methods of communication may be more relevant for particular age groups. Potential age differences in adolescents' use of the NFL are examined in Hypotheses 2C-D, which posit that older adolescents will have higher levels NFL understanding and nutrition knowledge, respectively, than younger adolescents and that this will lead to more frequent use of the nutrition facts label.

Gender

Little is known about potential gender differences in NFL use among adolescents. Among studies of U.S. adolescents, Huang et al. (2004) found that girls were more likely than boys to report always reading the NFL, while Haidar et al. (2017) did not find a difference in NFL use by gender. Studies among adults, however, have consistently shown that women use the NFL more than men (Bryła, 2020; Christoph, Larson, et al., 2018; Nayga Jr, 2000; Rasberry et al., 2007; Satia et al., 2005; Stran & Knol, 2013; Su et al., 2015). While few studies have examined gender differences in NFL use among adolescents, the research among adults provides clear evidence that women use the label more than men.

Previous research has found that girls and boys may pay attention to different parts of the NFL. For one, boys and men may rely more on intuitive eating than girls (Denny, Loth, Eisenberg, & Neumark-Sztainer, 2013). Intuitive eating, which is also known as “normal eating” or “adaptive eating,” is a weight management approach in which individuals do not restrict the type of food they consume but, rather, eat when

hungry and stop eating when satiated (Van Dyke & Drinkwater, 2014). Adult women, however, were more likely to use the NFL to guide their selection of food to consume (Christoph et al., 2016; Arslanagić, Peštek, & Kadić-Maglajlić, 2014; Christoph, Larson, et al., 2018; Su et al., 2015). Other previous research also suggests that boys tend to use the label to assess macronutrients (e.g., protein) in an effort to gain body mass, whereas girls more often use the label to assess calories in an effort to stay thin (Huang et al., 2004). These studies suggest that boys pay attention to different parts of the label than girls.

Research on potential gender differences in NFL use among adolescents may inform public health practice. For example, interventions could be designed to help girls and boys use the NFL to achieve different goals in healthy ways. Previous research suggested that the NFL could be promoted as a way to ensure that adolescent boys consume adequate nutrition for physical activity (Christoph, Larson, et al., 2018). The current evidence of gender differences in NFL use provides support for Hypothesis 2E, which posits that regardless of NFL understanding or nutrition knowledge, girls will have more frequent use of the NFL than boys, which, in turn, will be associated with higher engagement in nine healthy eating efforts. Potential mechanisms underlying the potential association between gender and NFL use are explored in Study 2 (gender differences in factors associated with weight change efforts and Nutrition Facts label use among U.S. adolescents).

Study 2: Nutrition Facts label use and weight change efforts among U.S. adolescents

The second manuscript in this dissertation examines 1) potential differences by gender in the relationships between three factors (body satisfaction, social media use, and

weight teasing) and weight change efforts among U.S. adolescents (Specific Aim 3) and 2) whether engaging in weight change efforts is associated with NFL use among U.S. adolescents (Specific Aim 4). This research builds on Study 1 by examining gender differences in factors that may be directly or indirectly associated with NFL use (Hypothesis 2E). This research is important because adolescents are undergoing significant social and emotional development, and many of the views and habits they form during this time will follow them into adulthood (Bucchianeri et al., 2013; Winpenny et al., 2018). A better understanding of the relationships described by Specific Aims 3-4 could identify several points for intervention (e.g., communication campaigns to improve body satisfaction or NFL use) to promote healthy eating among adolescents.

Conceptual model

A conceptual model was developed to examine gender differences in the relationships among factors associated with weight change efforts and Nutrition Facts label use among U.S. adolescents (Figure 2.3). This model was informed by the extant empirical literature on these factors and three primary theories: regulatory focus theory, social comparison theory, and self-regulation theory. The constructs examined in Study 2 are described in more detail below.

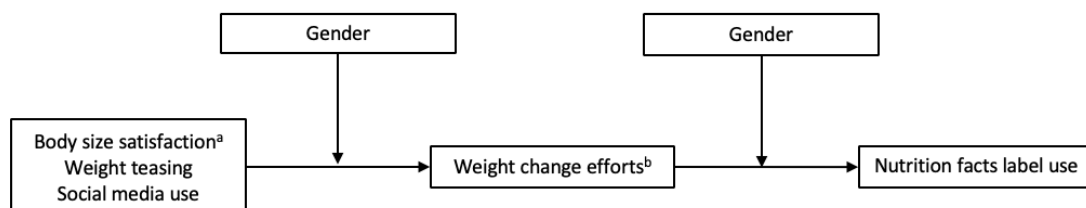


Figure 2.3 Conceptual model guiding Study 2

- a. *“Body size satisfaction” refers to the difference between body size ideal and body size perceptions.*
- b. *“Weight change efforts” refers to the actions an individual takes with regard to their body weight (i.e., not trying to change or maintain weight, stay the same weight, lose weight, gain weight; Hammond et al., 2021). This variable is called “weight loss efforts” in the 2019 IFPS Youth Survey.*

Body size satisfaction and weight change efforts

As their bodies and both intra- and interpersonal relationships change, adolescents tend to be particularly attuned to their physical appearance (Choukas-Bradley et al., 2020). Psychology research suggested that how adolescents perceive their physical appearance was the most significant predictor of their general sense of self (e.g., how they think of themselves in terms of social acceptance, popularity, and romantic appeal; Markey, 2010). Body size satisfaction refers to the extent to which an individual is satisfied with their physical appearance, with an emphasis on shape and weight (Holsen et al., 2012), and it is often measured by a respondent’s agreement with the statement, “I like the way my body looks” (Austin et al., 2009; Risica et al., 2008).

“Weight change efforts” refers to the actions an individual takes with regard to their body weight (i.e., not trying to change or maintain weight, stay the same weight, lose weight, gain weight; Hammond et al., 2021). Previous research has found that achieving a desired appearance is an important objective for adolescents wanting to lose weight (Murtagh et al., 2006). The relationship between body size satisfaction and weight change efforts could be explained by regulatory focus theory, which suggested that individuals who view themselves as having further from socially acceptable body types

(i.e., lower body size satisfaction) had higher motivation to alter their weight status (Bibiloni et al., 2017; Higgins, 1998). Two self-regulatory strategies are proposed by regulatory focus theory: prevention focus goals, which are about avoiding social rejection or illness, and promotion focus goals, which may include a desire to be attractive (Bouzas et al., 2019). Adolescents with lower body size satisfaction may be motivated to self-regulate their weight loss efforts to prevent social rejection and/or to be perceived as more attractive (Bouzas et al., 2019).

Research is needed to examine how body size satisfaction is associated with weight change efforts among U.S. adolescents. Body size dissatisfaction is associated with several unhealthy adolescent weight control practices (Adams et al., 2000; Calzo et al., 2012; Franko & Striegel-Moore, 2002; Jung et al., 2017; Liechty, 2010; Ojala et al., 2007; Voelker et al., 2015), suggesting that body size dissatisfaction is more than “simply a harmless form of self-assessment” (Eisenberg et al., 2006, p. 521). For example, female adolescents who reported being highly dissatisfied about their weight were more than five times as likely to binge eat than adolescents who did not report such concerns (Field et al., 2008). Adolescents with lower body size satisfaction are also more likely to restrict their diets (Heywood & McCabe, 2006; Zarychta et al., 2020), binge eat (Neumark-Sztainer, Paxton, et al., 2006; Sonnevile et al., 2012), have bulimic symptoms (Heywood & McCabe, 2006; Johnson & Wardle, 2005), and engage in emotional eating (Johnson & Wardle, 2005). Cognitive behavioral and emotional regulation theories suggested that self-esteem and depression help explain associations between body size dissatisfaction and unhealthy weight change efforts (Brechan & Kvaalem, 2015). A study of young adults in Norway, for example, found that the relationship between body size dissatisfaction and

three weight change strategies (restrained eating, binge eating, and compensatory behavior) was mediated by self-esteem and depression (Brechan & Kvalem, 2015). These studies suggest that lower body size satisfaction among adolescents is associated with behaviors that may lead to poorer overall health and weight gain.

Findings from this study may point to the need for targeted efforts to promote body size satisfaction in settings such as schools and health care provider-patient interactions (Hartman-Munick et al., 2020). For example, school-based interventions focusing on increasing self-esteem and life skills have produced modest improvements in body size satisfaction (Austin et al., 2009; Neumark-Sztainer, Levine, et al., 2006; O'Dea, 2004), which may combat decline in body size satisfaction over time and adverse impacts, such as unhealthy weight change efforts (Eisenberg et al., 2006; Kostanski et al., 2004). Based on the current literature and regulatory focus theory, it is hypothesized that body size satisfaction will be associated with weight change efforts such that adolescents perceiving their bodies to be larger than the ideal will try to lose weight and adolescents perceiving their bodies to be smaller than the ideal will try to gain weight (Hypothesis 3A).

Adolescent girls tend to be less satisfied with their body size than boys. Previous research suggests that approximately 24-46% of adolescent girls and 12-26% of adolescent boys report being dissatisfied with their bodies (Wang et al., 2019). Girls and boys also have different developmental trajectories regarding body size satisfaction; among girls, body size dissatisfaction tends to remain stable or increase during adolescence, while among boys, it tends to decrease over time (Mäkinen et al., 2012). These different trajectories may be due, in part, to differences in primary body concerns

for girls and boys. While girls often aspire to thinness (Buote et al., 2011), boys are driven more by a desire to obtain a lean and muscular body (Galioto & Crowther, 2013). Compared to boys and men, girls and women also view body size as a more important indicator of their self-worth (Owens et al., 2010). Further, body ideals for boys and men tend to include more divergent body types, including average weight men, while the standards for body ideals for girls and women are more homogenous (Buote et al., 2011). Body size dissatisfaction can have long-term consequences for adolescent health, including an increased risk for eating disorders, depressed mood, and weight gain among adolescents and adults of all genders (Bould et al., 2018). Research has shown that body size dissatisfaction has a stronger, more negative impact on body self-esteem among girls than boys (Mäkinen et al., 2012). It was therefore predicted that associations between body size satisfaction and weight change efforts would be stronger for girls than for boys (Hypothesis 3E).

Weight teasing and weight change efforts

Adolescents experiencing weight teasing, or a form of weight bias in which peers or family members mock an individual for being under- or overweight (Goldfield et al., 2010), may internalize biases about their body size and, thus, be more likely to seek out ways to change their body size. Weight teasing among adolescents is often an expression of weight stigma, defined as “the stigmatization of people with obesity” (Pont et al., 2017, p. 7). Weight stigma can be expressed indirectly or directly through subtle to harsh comments about an individual’s weight (Rand et al., 2017). People who are teased about their weight are more likely to have adverse psychological and behavioral outcomes, including mood or anxiety disorders and higher all-cause mortality risk (Farhat, 2015;

Tomiyama et al., 2018). Weight teasing is a social identity threat so pervasive that it has been reported by children as young as three years old (Hunger et al., 2015; Cramer & Steinwert, 1998; Romano et al., 2018). Studies suggest that weight-based teasing is especially prevalent among adolescents with overweight and obesity and does not differ across racial/ethnic groups (Hooper et al., 2021; McCormack et al., 2011; van den Berg et al., 2008).

The relationship between weight teasing and weight change efforts may be explained in part by social comparison theory, which describes the process through which social comparisons influence identity development (Kraye et al., 2007; Schaefer & Blodgett Salafia, 2014). Weight-based teasing may reinforce the ideal body types that adolescents are exposed to and to which they compare themselves (Kraye et al., 2007). For example, a study of U.S. middle school students found that social comparison (how often adolescents compare their physical appearance to the physical appearance of others) fully mediates the relationship between weight-based teasing and adolescent boys' drive for muscularity (Schaefer & Blodgett Salafia, 2014). Research has also found that weight teasing has differential impacts on adolescent boys' and girls' body esteem (Valois et al., 2019), which may translate to different weight management practices by gender (e.g., gaining muscularity for boys, losing weight for girls; Voelker et al., 2015).

Research is needed that examines the role of weight teasing in weight change efforts. Studies show that the effects of weight teasing during adolescence can extend into adulthood. For instance, a 15-year longitudinal study found that women who reported being teased about their weight by peers and family members as adolescents were more likely to engage unhealthy weight control behaviors in adulthood (Puhl et al., 2017).

These studies indicate that weight teasing may be a powerful influence on adolescents' weight management behaviors, the effects of which can carry over into adulthood. Adolescents who experience weight teasing may attempt to alleviate teasing through weight change efforts that bring their appearance closer to the ideal (Rodgers et al., 2011). Rather than encourage healthy weight management behaviors, though, weight-based teasing may discourage exercise (Sattler et al., 2018), increase unhealthy weight control behaviors (e.g., binge eating, skipping meals, using laxatives; Neumark-Sztainer et al., 2010), or decrease self-regulation (Goldschmidt et al., 2018; Puhl & Heuer, 2010; Rand et al., 2017; Tomiyama et al., 2018). For example, female adolescents in Brazil who were teased about their weight by family members were more likely to engage in unhealthy weight control behaviors, including vomiting, dieting, and using laxatives (Leme & Philippi, 2013). The relationships among weight teasing, gender, and weight change efforts will be further explored in Hypothesis 3C, which predicts that weight teasing will be associated with weight change efforts such that adolescents being teased more about their weight will be more likely to engage in weight change efforts.

Weight teasing may have a more negative impact on adolescent girls' perceptions of their body size compared to boys, as adolescent girls experience more weight teasing than boys and are more negatively affected by it (Neumark-Sztainer et al., 2002). Recent research found that 36.6% of U.S. girls had ever been teased for their weight, compared to 31.3% of boys ($p < 0.05$; Hooper et al., 2021). Additionally, a meta-analysis with studies among adolescents and adults found that the positive association between weight teasing and body size dissatisfaction was stronger among girls than boys (Menzel et al., 2010). Girls may experience weight teasing as more hurtful, while boys may value other

aspects of their appearance more highly (Rodgers et al., 2021). A study among students at U.S. public middle and high schools found that weight teasing in the school environment was associated with dieting among girls but not boys, although students of both genders who were teased for their weight experienced psychosocial concerns (i.e., lower self-esteem among boys and greater depressive symptoms among boys; Lampard et al., 2014). Gendered patterns of weight teasing also persist into adulthood. For example, a longitudinal study of U.S. adolescents found that girls who teased about their weight by family members had unhealthy weight change behaviors in later adolescence, although this same relationship was not found among boys (Rodgers et al., 2021). These studies suggest that the relationship between weight teasing and weight change efforts may be stronger among girls than boys. It is further predicted that this relationship will be stronger for girls than for boys (Hypothesis 3E).

Social media use and weight change efforts

The internet and social media are nearly ubiquitous in adolescents' lives. In a 2018 Pew Research Center survey of U.S. adolescents aged 13 to 17 years, 45% of teenagers said they used the internet "almost constantly," and an additional 44% reported going online several times a day (Anderson & Jiang, 2018). Recent reports show that more than 90% of adolescents have at least one social media account (Kucharczuk et al., 2022). Girls are more likely to be online than boys: 50% of teenage girls report near-constant online use, as compared to 39% of boys (Anderson & Jiang, 2018). These findings suggest that adolescents use social media often, and that girls are more online than boys. Researchers posit that spending more time engaged with social media and/or on the internet reduces time spent on other activities that have more beneficial effects on

adolescents' well-being (the “crowding out” hypothesis; McDool et al., 2020). The effect of social media use on weight change efforts during adolescence is an important topic given the social and emotional development happening during this period. Based on the current literature, the authors predict that social media use will be associated with weight change efforts such that adolescents who spend more time using social media will be more likely to engage in weight change efforts (Hypothesis 3B).

Social media use may have a stronger impact on girls' weight change efforts than boys. For one, girls engage and invest in body-related content more than boys (Mahon & Hevey, 2021). Social media tends to have a more negative effect on girls' body image, while boys are more likely to feel that bodies shown on social media are a motivating influence (Bell et al., 2019). Girls are also more likely to compare their bodies to standards portrayed in their social media feeds (Mahon & Hevey, 2021). For example, a recent study suggested that brief bouts of social media use were associated with reduced snack intake among female undergraduate students (Pink et al., 2022). There is also evidence that social media images related to weight change efforts are targeted more toward girls than boys; most (83%) “#weightloss” images on social media are of females (Jebeile et al., 2021). Adolescent girls may be especially vulnerable to being influenced by images on social media because of the psychosocial developmental phase they are in (Kleemans et al., 2018). Boys, on the contrary, tend to exhibit more active coping styles and greater positive agency over their social media use (Mahon & Hevey, 2021). These studies suggest that social media use may prompt adolescents to internalize gendered body ideals (e.g., for extreme thinness among girls and muscularity among boys; Rodgers et al., 2021). Internalization of body ideals, in turn, has been associated with an increase

in weight change efforts among adolescents (Daniel & Bridges, 2010; McCreary & Sasse, 2000). More research is needed on the potential moderating effect of gender on the relationship between social media use and weight change efforts to develop effective interventions. For example, interventions targeting social media literacy have been found to moderate the negative impact of social media use on dietary restraint among girls, but not boys (Gordon et al., 2021). It was therefore predicted that the positive association between social media use and weight change efforts would be stronger for girls than for boys (Hypothesis 3E).

Weight change efforts and NFL use

Few studies have examined how weight change efforts may be associated with NFL use, and none have explored these relationships among adolescents. Studies among adults, however, suggest that weight change efforts are associated with higher NFL use (Bleich & Wolfson, 2015; Christoph, Larson, et al., 2018). For example, compared to U.S. adults who did not have a weight change intention, adults wanting to lose weight were 67% more likely to use the NFL, those wanting to gain weight were 37% more likely to use the NFL, and those wanting to stay the same weight were 36% more likely to use the NFL (Christoph, Larson, et al., 2018). Another study of U.S. adults aged 20 and older found that those engaging in any weight loss activities (e.g., diet and physical activity behaviors) were 92% more likely to use the NFL than those not trying to lose weight (Bleich & Wolfson, 2015). Notably, NFL use is more strongly associated with weight change efforts than weight status (i.e., BMI; Christoph, Larson, et al., 2018). These data suggest that a desire to change one's weight may be a better predictor of NFL use than BMI.

This study draws from components of self-regulation theory to explain the theoretical context for the relationship between weight change efforts and NFL use. Self-regulation theory posits that individuals are motivated to avoid and treat health conditions and will take an active role in testing coping strategies (Leventhal et al., 1980; Munro et al., 2007). For example, previous studies have suggested that individuals may self-regulate their behavior (e.g., by monitoring their food intake) to achieve weight-related goals (Annesi, 2018; Frie et al., 2020; Johnson et al., 2012). Health conditions can be the product of a complex interplay of social and cultural factors (Munro et al., 2007). As described earlier, weight change efforts were predicted to be associated with interactions among a number of perceptions (e.g., body size satisfaction) and social factors (e.g., weight teasing). Through this theoretical lens, this study examines how weight change efforts are predicted to be associated with a coping strategy (NFL use; Hypothesis 4A). While beyond the scope of this study, a study more deeply grounded in self-regulation theory might examine how aspects of individuals' personalities and cultural context inform their use of the NFL as a means of regulating their weight (Edgar & Skinner, 2003). Research on the potential association between weight change efforts and NFL use among adolescents is needed to inform programs and policies targeting healthier weight management strategies (e.g., using the NFL). This study predicts adolescents engaging in weight change efforts (i.e., trying to stay the same weight, gain weight, or lose weight) will be more likely to use the NFL than adolescents not trying to change or maintain their weight (Hypothesis 4A).

A large share of adolescents is attempting to change their weight, and this effort is especially common among girls (Houle-Johnson & Kakinami, 2018; McDow et al.,

2019). A recent systematic review estimated that nearly two-thirds of U.S. and Canadian adolescents were trying to lose weight (Houle-Johnson & Kakinami, 2018). There are also gender differences in attempts to lose weight (Houle-Johnson & Kakinami, 2018). For example, NHANES data show that 45.2% of girls attempted to lose weight in the past year, compared to 30.1% of adolescent boys (McDow et al., 2019). Nationally representative data indicate that the majority of adolescent girls are trying to lose weight, despite the fact that most do not have overweight or obesity (Liechty, 2010). A study of U.S. high school students found that female students were more likely to be trying to lose weight compared to male students, despite being less likely to be overweight (Lowry et al., 2002). These findings imply that girls are more likely than boys to try to lose weight.

Girls attempting to change their weight status may pay more attention to the NFL than boys. Among the two studies with U.S. adolescents to examine gender differences in NFL use (Haidar et al., 2017; Huang et al., 2004), only one study reported that girls were more likely than boys to report always reading the NFL (Huang et al., 2004). Studies among adults, however, consistently show that women use the NFL more than men (Bryła, 2020; Christoph et al., 2018; Stran & Knol, 2013). One possible explanation is that men may be more likely than women to use intuitive eating (Denny et al., 2013), which is based on the idea that people eat when hungry and stop when satiated, rather than restricting the type of food they consume. (Van Dyke & Drinkwater, 2014). Girls may therefore be more likely than boys to use the NFL when trying to meet their weight-related goals. It was predicted that the positive association between weight change efforts and NFL use would be stronger for girls than boys (Hypothesis 4B). Understanding gender differences in NFL use and weight change efforts may inform the design of

tailored weight-related behavior change interventions, such as communication campaigns to improve NFL use among adolescents.

CHAPTER 3

RESEARCH DESIGN AND METHODS

The first study used a recursive path analysis to examine sociodemographic characteristics, Nutrition Facts label (NFL) use, and eating efforts among U.S. adolescents. The second study used a series of regression models to examine gender differences in factors associated with weight change efforts and Nutrition Facts label use among U.S. adolescents. The methods of this dissertation research are discussed by study below.

Study 1: Nutrition Facts label use, healthy eating efforts, and sociodemographic characteristics among U.S. adolescents

The following aims and hypotheses were addressed in Study 1:

Specific Aim 1: To examine whether the frequency of NFL use among U.S. youth is associated with healthy eating efforts related to nutrition information that is shown versus not shown on the NFL.

- **Hypothesis 1A:** U.S. adolescents aged 14-17 who report more frequently using the NFL will be more likely to report engaging in nine healthy eating efforts (e.g., eating vegetables and fruits, eating fewer calories).
- **Hypothesis 1B:** Adolescents will be more likely to engage in eating efforts related to nutrition information that is shown on the NFL than eating efforts related to nutrition information that is not shown on the label.

Specific Aim 2: To determine potential sociodemographic differences by race/ethnicity, age, and gender in NFL use.

- **Hypothesis 2A:** The relationship between race/ethnicity and NFL use will be mediated by NFL understanding. Non-Hispanic white adolescents will be more likely than African American or Hispanic adolescents to have greater NFL understanding, which, in turn, will be associated with more frequent use of the NFL.
- **Hypothesis 2B:** The relationship between race/ethnicity and NFL use will be mediated by nutrition knowledge. Non-Hispanic white adolescents will be more likely than African American or Hispanic adolescents to have greater nutrition knowledge, which, in turn, will be associated with more frequent use of the NFL.
- **Hypothesis 2C:** The relationship between age and NFL use will be mediated by NFL understanding. Older adolescents will have higher levels of NFL understanding than younger adolescents, which, in turn, will be associated with more frequent use of the NFL.
- **Hypothesis 2D:** The relationship between age and NFL use will be mediated by nutrition knowledge. Older adolescents will have higher levels of nutrition knowledge than younger adolescents, which, in turn, will be associated with more frequent use of the NFL.
- **Hypothesis 2E:** The relationship between gender and healthy eating efforts will be mediated by NFL use. Girls will have more frequent use of the NFL than boys, which, in turn, will be associated with higher engagement in nine healthy eating efforts.

Conceptual model

This study was guided by the conceptual model displayed in Figure 3.1. As discussed in Chapter 2, this model seeks to assess relationships among independent variables (race/ethnicity, race, and gender), mediating variables (NFL understanding, nutrition knowledge, and NFL use), and dependent variables (NFL use and healthy eating efforts). All variables included in the model were measured in this study.

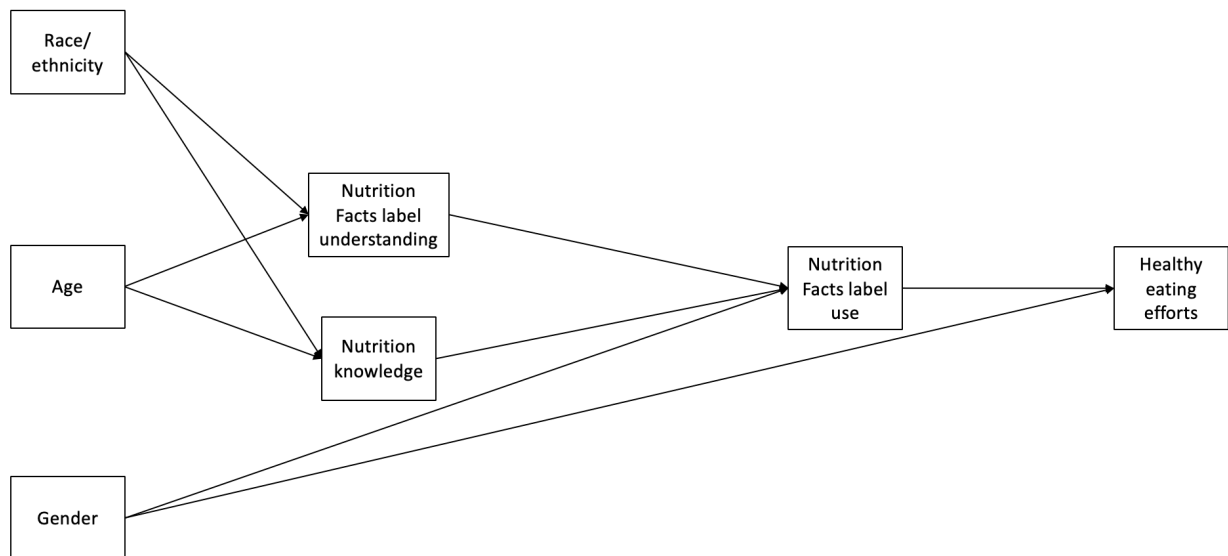


Figure 3.1 Conceptual model guiding Study 1

Data source

De-identified data were obtained from the International Food Policy Study (IFPS), an annual, repeated cross-sectional study of trends in dietary patterns and policy-relevant behaviors in the U.S. and five other countries. The IFPS Youth Survey was funded through an International Health Grant from the Public Health Agency of Canada (PHAC), with support from the Canadian Institutes of Health Research (CIHR). Study 1 used data from the 2019 IFPS Youth Survey in the U.S. (N=1,603). Data from the 2019

survey were selected for this study because it was the last year of survey data collected before the onset of the COVID-19 pandemic. This survey was the first wave of the IFPS Youth Survey, and data were collected online between November and December 2019.

Data collection

The sample was recruited through the Nielsen Consumer Insights Global Panel or their partner panels, which used both probability and non-probability sampling. Nielsen first issued email invitations to adult panelists, who were screened for eligibility, including having a child aged 10-17 living in their household. Panelists with a potentially eligible child were given information about the IFPS and asked for informed consent for their child to participate. Adolescents were screened directly to confirm eligibility based on age and sex. Quotas for age (an equal number of younger (age 10-13) and older (age 14-17) adolescents) and gender (an even split of boys and girls) were applied to facilitate a diverse sample, and the survey closed when these quotas were met. Only one child in each household was eligible to participate in the survey. Eligible adolescents who agreed to participate in the study provided assent before starting the survey. For this study, only adolescents aged 14-17 were included in the analytic sample (N=784), as younger adolescents were not asked about eating efforts.

Adolescents who failed to pass the data integrity check, which was located two-thirds through the questionnaire, or who completed the survey in less than 10 minutes were excluded from the analytic sample (n=81). The data integrity check involved showing respondents a list of five food items (bread, carrot, egg, apple, or milk) and asking, “Which of these foods is a fruit?” All survey data were collected online on a computer (i.e., desktop or laptop) or mobile device, which provided advantages such as

allowing the research team to include food product images in the survey. The majority of the U.S. adolescent sample (69.4%) completed the survey on a smartphone. Each adolescent's parent/guardian was compensated for their participation by the Nielsen Consumer Insights Panel through points-based or monetary rewards that could be exchanged for cash, donations, electronic gift cards, and/or chances to win monthly prizes.

The IFPS invited 16,596 adolescents in the U.S. to participate in the online survey, of which 1,603 (9.7%) completed the survey and met data quality standards (i.e., correctly stated their region, correctly answered quality check question, completed the survey in more than 10 minutes). The survey cooperation rate was 79.8% based on the American Association for Public Opinion Research (AAPOR) Cooperation Rate #2 ("the proportion of all cases interviewed of all eligible units ever contacted"; AAPOR). The survey was conducted in either English or Spanish, based on the panelist's language preference, and took an average of 22 minutes to complete (for English speakers, 22 minutes; for Spanish speakers, 24 minutes). The survey was translated into Spanish by Benton & Associates in Mexico City, Mexico, and bilingual research team members served as language and content experts, reviewing the translations.

The study received ethical clearance through the University of Waterloo Research Ethics Committee (ORE #414777). Work pertaining to the dissertation was reviewed by the University of South Carolina Institutional Review Board (Pro00113724), which determined that the study meets the Not Human Subjects criteria set forth by the Code of Federal Regulations (45 CFR 46).

Measures

Measures for Study 1 are described below. Question wording and variable names are provided in Appendix A.

Nutrition Facts label use. This measure was adapted from the 2014 FDA Health and Diet Survey (Jordan Lin, Zhang, Carlton, & Lo, 2016). Respondents were shown an image of the U.S. Nutrition Facts label before its 2020/2021 update (Figure 3.2) and asked, “Do you use this type of food label when deciding what to eat or buy?” Responses were recorded as 1=“never”, 2=“rarely”, 3=“sometimes”, 4=“often”, and 5=“all the time”. This question was asked only of respondents who answered affirmatively (i.e., “rarely”, “sometimes”, “often” or “all the time”) to the previous question (“Have you seen this type of food label on packages or in stores?”). Respondents who previously indicated that they were not aware of the NFL (n=6) were recoded from missing to “never” having used the label.

Nutrition Facts		
Serving Size 2/3 cup (55g)		
Servings Per Container About 8		
Amount Per Serving		
Calories 230	Calories from Fat 72	
	% Daily Value*	
Total Fat 8g		12%
Saturated Fat 1g		5%
Trans Fat 0g		
Cholesterol 0mg		0%
Sodium 160mg		7%
Total Carbohydrate 37g		12%
Dietary Fiber 4g		16%
Sugars 12g		
Protein 3g		
Vitamin A		10%
Vitamin C		8%
Calcium		20%
Iron		45%
* Percent Daily Values are based on a 2,000 calorie diet. Your daily value may be higher or lower depending on your calorie needs.		
	Calories:	2,000 2,500
Total Fat	Less than	65g 80g
Sat Fat	Less than	20g 25g
Cholesterol	Less than	300mg 300mg
Sodium	Less than	2,400mg 2,400mg
Total Carbohydrate		300g 375g
Dietary Fiber		25g 30g

Figure 3.2 U.S. Nutrition Facts Label Image Based on the version shown during data collection (November-December 2019; SNAP4CT, 2018)

Healthy eating efforts. This measure was loosely adapted from the Tracking Nutrition Trends (TNT) survey, which assessed national trends in nutrition knowledge, attitudes, and behaviors among Canadian adults between 1989 and 2018 (Goodman et al., 2011). Respondents were asked, “Do you make a special effort to do any of the following: (1) “eat protein”; (2) “eat less sugar or drink fewer sugary drinks”; (3) “eat less (fewer) calories”; (4) “eat less salt”; (5) “eat vegetables and fruits”; (6) “drink lots of water”; (7) “eat whole grains”; (8) “eat less low-calorie sweeteners”; or (9) “eat less processed foods.” Each behavior was queried independently, with “yes” responses coded as 1 and “no” responses coded as 0.

Nutrition Facts label understanding. This measure was adapted from a measure the IFPS Team at the University of Waterloo initially developed for the 2016 Canada Food Study, which was a precursor to the IFPS (Hammond et al., 2017). Respondents were shown an image of an NFL and asked, “Do you find this information... (1) very hard to understand; (2) hard to understand; (3) in the middle; (4) easy to understand; or (5) very easy to understand.

Nutrition knowledge. This measure was adapted from the TNT survey (Goodman et al., 2011) specifically for the IFPS Youth Survey. Respondents were asked to rate how much they knew about healthy eating and nutrition on a scale from 0 to 10, where 0=“nothing” and 10=“a lot.”

Race/ethnicity. A single item was used to classify respondents as White, Black or African American, Hispanic or Latino, other race (e.g., Asian/Pacific Islander or Native American Indian only), or two or more races/ethnicities (U.S. Census Bureau, 2021).

Age. Respondents reported their age 14, 15, 16, or 17 years. This variable was treated as continuous.

Gender. Respondents reported their gender as male or female.

Covariates

Weight change efforts. This measure referred to participants' intentions toward their weight and was adapted from the National Health and Nutrition Examination Survey (NHANES; National Center for Health Statistics, 2021), the GUTS (Growing Up Together) Study (Channing Division of Network Medicine, 2020), and Project-EAT (Eating and Activity over Time; University of Minnesota School of Public Health, 2021), among others (Hammond et al., 2021). Respondents were asked, "Which of the following are you trying to do about your weight?" with responses including 1="nothing", 2="stay the same weight", 3="gain weight", and 4="lose weight."

Food guide awareness. This measure was adapted for the U.S. context from the Canadian Community Health Survey (CCHS) food guide module (Government of Canada Health and Nutrition Surveys, 2021) and the TNT survey (Goodman et al., 2011).⁵ Respondents were asked if they had ever heard of MyPlate or the Food Guide Pyramid. "Yes" responses were coded as 1 and "no" responses were coded as 0.

Perceived income adequacy. This measure was adapted from a self-rated economic status indicator developed by Litwin and Sapir (2009). Perceived income adequacy was used as a proxy for household income, as actual household income was not collected in the survey. Previous research suggests that adolescents do not accurately

⁵ Canada's food guide and the USDA's MyPlate look similar but include different content (e.g., Canada's food guide includes recommendations such as "enjoy your food" and "eat meals with others"). Information on Canada's food guide can be found here: <https://food-guide.canada.ca/en/>.

state their household income (Anderson & Holt, 2017) and that this measure of perceived income adequacy may be a proxy for social processes rooted in economic marginalization (Doan et al., 2022). The use of a subjective measure like perceived income adequacy allows respondents to include other economic indicators (e.g., cost of living, wealth, societal norms around the standard of living) in their assessment (Olstad et al., 2022). Respondents were asked, “Does your family have enough money to pay for things your family needs?” Responses included 1=“not enough money”, 2=“barely enough money”, 3=“enough money”, and 4=“more than enough money,” with “enough money” used as the referent group.

Data analysis

Data were analyzed using the Stata statistical software version 15.1 (StataCorp, 2021). “Don’t know” (-77) and “refuse to answer” (-88) responses were recoded as missing (Appendix A), unless otherwise stated. Descriptive statistics (frequencies, means) were used to summarize the sample characteristics, and the “SEM” command was used to generate a correlation matrix of study variables. Categorical variables were checked to ensure adequate sample size for each category.

It was determined whether the nine eating efforts variables formed a single construct to justify making an additive scale (0-9) by using factor analysis to see if these variables loaded strongly together on one or more factors (e.g., eating efforts generally, information found on the NFL, information not found on the NFL). Principal components factor analysis with varimax rotation showed that the nine eating efforts reflected one factor (eigenvalue of 3.14). While it was expected that a two-factor solution would reflect nutrition information shown versus not shown on the NFL, this was not supported by the

results of the factor analysis. Instead, the rotated factor analysis yielded two factors, which appeared to be grouped as (1) eating efforts adolescents should do more of, according to food-based dietary guidance (i.e., eat more protein, eat more fruits/vegetables, drink more water, eat more whole grains) and (2) eating efforts adolescents should do less of (e.g., eat less sugar, eat fewer calories, eat less salt, eat fewer sugar-sweetened beverages, eat less processed foods). See Appendix A for the factor loadings. However, the items indicated in the two factors had lower internal consistency reliability (Kuder-Richardson Formula 20 (KR-20) = 0.74 and 0.81, respectively) than the items in the single factor containing all nine eating efforts (KR-20 = 0.82). Based on the fact that items did not group as was hypothesized, Hypothesis 1B was dropped (adolescents would be more likely to engage in eating efforts related to nutrition information that was shown on the label compared to efforts not shown on the label) and instead the combined, nine-item eating efforts scale was used in all subsequent analyses.

Linear regression models were used to understand basic unadjusted relationships between Study 1 variables and the dependent variables (NFL use and eating efforts). The model pictured in Figure 3.1 (Hypotheses 1A, 2A-E) was tested using a recursive path analysis that assumed correlated errors and no reverse causality. This model included sociodemographic characteristics (race/ethnicity, age, and gender) as independent variables, NFL use and healthy eating efforts as dependent variables, and NFL understanding and nutrition knowledge as mediators of the relationship between sociodemographic characteristics and NFL use. Direct paths were also examined between sociodemographic characteristics and NFL use and healthy eating efforts, respectively.

The model controlled for food guide awareness, perceived income adequacy, and weight change efforts, as some evidence suggests that these factors may confound relationships among sociodemographic characteristics, NFL use, and healthy eating efforts (Bleich & Wolfson, 2015; Christoph et al., 2018; Wojcicki & Heyman, 2012). These variables were modeled as having a direct influence on each of the endogenous variables (NFL use, eating efforts, NFL understanding, and nutrition knowledge). Indirect effects (the magnitude of effects through each path) were computed by multiplying the regression coefficients along each path. These coefficients were added together to calculate the cumulative effect of sociodemographic characteristics on eating efforts through NFL understanding and nutrition knowledge, respectively (Root Mean Squared Error of Approximation [RMSEA] = 0.29 (95% CI: 0.23, 0.35); comparative fit index [CFI] = 0.91). As a post-hoc analysis, separate recursive path analyses were conducted with each of the nine healthy eating efforts in place of the summative healthy eating efforts variable.

There was minimal missing data in the dataset (Appendix A). A full information maximum likelihood model (FIML; using the “mlmv” command in Stata) was used to run a structural equation model that included covariates with missing values. FIML produces unbiased parameter estimates and standard errors for values missing at random by estimating a likelihood function based on variables that are present. For example, while the variable for food guide awareness had data for 774 cases (missing 10, or 1.28%, of the sample), FIML fit the model based on all 784 cases in the analytic data set (Jakobsen et al., 2017; Newsom, 2020).

As a sensitivity test, each model was run with and without survey weights (Appendix A). The IFPS constructed post-stratification survey weights using a raking algorithm with population estimates based on ethnicity, age, and gender. The survey weights for the U.S. ranged from 0.49 to 3.09. To weight the data, the “svyset” command was used to tell Stata about the characteristics of the data (i.e., sampling units, sampling method). The “svy” command was then used to estimate the parameters with the settings specified in “svyset.” A preliminary analysis showed similar results for models using unweighted and weighted data. The results presented in this dissertation are unweighted, as previous research has found that unweighted regression models provide unbiased estimates when survey weights are a function of independent variables (e.g., race/ethnicity, age, sex; Gelman, 2007).

Study 2: Nutrition Facts label use and weight change efforts among U.S. adolescents

The following aims and hypotheses were addressed in Study 2:

Specific Aim 3: To determine potential differences by gender in the relationships between three factors (body size satisfaction, social media use, weight teasing) and weight change efforts among U.S. adolescents aged 10-17.

- **Hypothesis 3A:** Body size satisfaction will be associated with weight change efforts such that adolescents perceiving their bodies to be larger than ideal will try to lose weight and adolescents perceiving their bodies to be smaller than ideal will try to gain weight.
- **Hypothesis 3B:** Social media use will be associated with weight change efforts such that adolescents who spend more time using social media will be more likely to engage in weight change efforts.

- **Hypothesis 3C:** Weight teasing will be associated with weight change efforts such that adolescents being teased more about their weight will be more likely to engage in weight change efforts.
- **Hypothesis 3E:** The relationships examined in Hypotheses 3A-C will be stronger for girls than boys.

Specific Aim 4: To determine whether engaging in weight change efforts is associated with NFL use among U.S. adolescents aged 10-17.

- **Hypothesis 4A:** Adolescents engaging in weight change efforts (i.e., trying to stay the same weight, gain weight, or lose weight) will be more likely to use the NFL than adolescents not trying to change or maintain their weight.
- **Hypothesis 4B:** The relationship examined in Hypothesis 4A will be stronger for girls than boys.

Conceptual model

Figure 3.3 (below) displays the proposed relationships among factors predicted to be associated with weight change efforts and Nutrition Facts label use among U.S. adolescents.

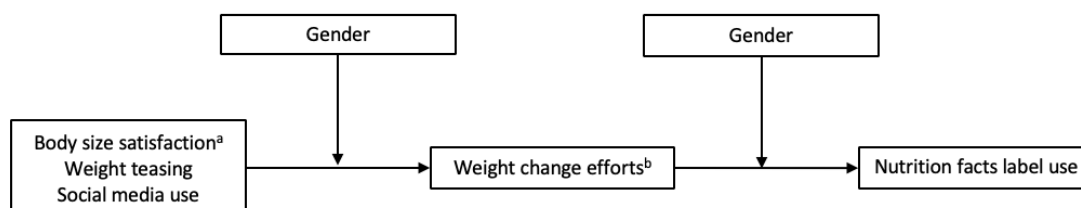


Figure 3.3 Conceptual model guiding Study 2

- a. *“Body size satisfaction” refers to the difference between body size ideal and body size perceptions.*

- b. *“Weight change efforts” refers to the actions an individual takes with regard to their body weight (i.e., not trying to change or maintain weight, stay the same weight, lose weight, gain weight; Hammond et al., 2021). This variable is called “weight loss efforts” in the 2019 IFPS Youth Survey.*

Data source

Data came from the International Food Policy Study (IFPS), an annual, repeated cross-sectional study of trends in dietary patterns and policy-relevant behaviors in the U.S. and five other countries. The IFPS Youth Survey received funding from an International Health Grant from the Public Health Agency of Canada (PHAC) and from the Canadian Institutes of Health Research (CIHR). Study 2 used data from the 2019 IFPS Youth Survey conducted in the U.S. (N=1,603), as this was the last year of data collected before the COVID-19 pandemic. Data were collected online between November and December 2019.

Data collection

Participants were recruited through the Nielsen Consumer Insights Panel or their partner panels, which used probability and non-probability sampling. Adult panelists received email invitations from Nielsen and were screened for eligibility. Eligibility criteria included having a child aged 10-17 living in their household. Panelists with a potentially eligible child were provided information about the IFPS and administered informed consent for their child to participate. Adolescents were then screened directly to confirm that they met eligibility criteria based on age and gender quotas. The study aimed to recruit a 50-50 split of boys and girls, as well as a 50-50 split of younger (age 10-13) and older (age 14-17) adolescents. Quotas were applied to ensure the survey included a

diverse sample, and the survey closed once they were met. No more than one child in each household could participate in the survey. Eligible adolescents provided assent before being administered the survey.

Adolescents who failed to pass the data integrity check, which was located two-thirds through the questionnaire, or completed the survey in less than 10 minutes were excluded from the analytic sample (n=81). For the data integrity check, respondents were a list of five food items (bread, carrot, egg, apple, or milk) and asked to identify which of those foods was a fruit. The survey was administered online using a computer or a mobile device, which allowed the research team to include product images. Most adolescents (69.4%) completed the survey using a smartphone. A data integrity check was located two-thirds through the survey. Adolescents who failed this check or completed the survey in under 10 minutes were excluded from the analytic sample (n=81). The adolescent's parent/guardian was compensated by the Nielsen Consumer Insights Panel with points-based or monetary rewards that could be exchanged for electronic gift cards, donations, cash, and/or chances to win monthly prizes.

The IFPS invited 16,596 U.S. adolescents to participate in the survey, of which 1,603 (9.7%) both completed the survey and met data quality standards (i.e., correctly answered quality check question, completed the survey in more than 10 minutes). Based on the American Association for Public Opinion Research (AAPOR) Cooperation Rate #2, the survey cooperation rate 79.8% ("the proportion of all cases interviewed of all eligible units ever contacted"; AAPOR). The survey was translated into Spanish by Benton & Associates (Mexico City, Mexico), and bilingual research team members reviewed the translations. The survey was conducted in either English or Spanish, based

on the panelist's language preference, and took an average of 22 minutes to complete (for English speakers, 22 minutes; for Spanish speakers, 24 minutes). This study received ethics clearance through the University of Waterloo Research Ethics Committee (ORE #414777) and the University of South Carolina Institutional Review Board (Pro00113724).

Measures

Measures for Study 2 are described below. Question wording and variable names are provided in Appendix A.

Body size satisfaction. This variable was created by subtracting scores from the *body size ideal* variable from *body size perception* scores. This method of calculating body size satisfaction has been used in previous studies (Bibiloni et al., 2017; Jung et al., 2017; Siervo et al., 2014). *Body size perception* was assessed by showing participants the same sex-specific, eight-figure body rating scale and asking, "Which picture looks most like your body shape?" Responses were coded on a scale from 1 (far left image; the thinnest) to 8 (far right image; the largest). *Body size ideal* was assessed by showing participants a sex-specific, eight-figure body rating scale and asking, "Which picture looks most like how you want your body to look?" Responses were coded on a scale from 1 (far left image; the thinnest) to 8 (far right image; the largest). The *body size perception* and *body size ideal* measures were both adapted from the GUTS (Growing Up Today) Study (Channing Division of Network Medicine, 2020). Negative body size satisfaction scores represented adolescents who felt their body was smaller than their perceived ideal, while positive body size satisfaction scores represented adolescents who felt their body was larger than their perceived ideal. A score of zero indicated no body size

dissatisfaction. The body size satisfaction variable was divided into separate terciles representing negative, positive, and neutral body size satisfaction scores. The middle category was used as the referent group.

Weight teasing. This measure was adapted from Project EAT (Eating Among Teens; Haines, Neumark-Sztainer, Eisenberg, & Hannan, 2006). Respondents were asked, “Do you get teased or made fun of because of your weight?” Responses included 1=“all the time”, 2=“a lot”, 3=“sometimes”, 4=“rarely”, and 5=“never.” Due to the distribution of responses, this variable was recoded such that 0=“never” and 1=“ever teased.”

Social media use. This measure was developed by the IFPS team. Respondents were asked how much time they spend on social media (including messaging, posting, or liking posts) on a normal weekday. Responses were recorded as 1=“0 hours (none)”, 2=“Up to 15 minutes”, 3=“Up to 30 minutes”, 4=“Up to 1 hour”, 5=“Up to 2 hours”, 6=“Up to 3 hours”, 7=“Up to 4 hours”, 8=“More than 4 hours.” Responses were coded as the upper value for the response (i.e., 1=0 hours, 2=0.25 hours, 3=0.50 hours, 4=1 hour, 5=2 hours, 6=3 hours, 7=4 hours, 8=more than four hours), and this variable was treated as continuous.

Weight change efforts. This measure was adapted from the National Health and Nutrition Examination Survey (National Center for Health Statistics, 2021), the GUTS (Growing Up Together) Study (Channing Division of Network Medicine, 2020), and Project-EAT (Eating and Activity over Time; University of Minnesota School of Public Health, 2021), among others (Hammond et al., 2021). Respondents were asked what they

were trying to do about their weight, with response options being 1=“nothing”, 2=“stay the same weight”, 3=“gain weight”, and 4=“lose weight.”

Nutrition Facts label use. This measure was adapted from the 2014 FDA Health and Diet Survey (Jordan Lin, Zhang, Carlton, & Lo, 2016). Respondents were asked, “Do you use this type of food label when deciding what to eat or buy?” Respondents were shown an image of the U.S. nutrition facts label before its 2020/2021 update. Responses were recorded as 1=“never”, 2=“rarely”, 3=“sometimes”, 4=“often”, and 5=“all the time.” Only respondents who answered affirmatively (i.e., “rarely”, “sometimes”, “often” or “all the time”) to the previous question (“Have you seen this type of food label on packages or in stores?”) were asked about nutrition facts label use. Adolescents who indicated they were not aware of nutrition facts labels (n=14) were not asked about nutrition facts label use. For this study, adolescents who reported they were not aware of nutrition facts labels were recoded as “never” having used a nutrition facts label.

Gender. Respondents reported whether they male or female.

Covariates

Perceived income adequacy. This measure was adapted from a self-rated economic status indicator developed by Litwin and Sapir (2009). Perceived income adequacy was used as a proxy for household income, as no household income measure was collected through the survey. A subjective measure allowed respondents to consider other economic indicators, such as wealth and cost of living, when making their assessment (Olstad et al., 2022), and it may better capture social processes rooted in economic marginalization (Doan et al., 2022). Research also suggests that adolescents are unable to accurately report their household income (Anderson & Holt, 2017).

Respondents were asked if their family has enough money to pay for things their family needs. Responses were recorded as 1=“not enough money”, 2=“barely enough money”, 3=“enough money”, and 4=“more than enough money.”

Nutrition Facts label understanding. This measure was adapted from a measure the IFPS Team at the University of Waterloo initially developed for the 2016 Canada Food Study, which was a precursor to the IFPS (Hammond et al., 2017). Respondents were shown an image of a nutrition facts label and asked, “Do you find this information...very hard to understand (1); hard to understand (2); in the middle (3); easy to understand (4); very easy to understand (5).”

Food guide awareness. was assessed by asking the respondent if they had ever heard of MyPlate or the Food Guide Pyramid. The IFPS team developed this variable specifically for the IFPS Youth Survey, although this is similar to the “self-reported nutrition knowledge” measure in the IFPS Adult Survey (adapted from the Tracking Nutrition Trends (TNT); Goodman et al., 2011). Responses were coded as 1=“yes” and 0=“no.”

Nutrition knowledge. This measure was adapted from the TNT survey (Goodman et al., 2011) for the IFPS Youth Survey. Respondents rated their knowledge of healthy eating and nutrition on a scale from 0 (“nothing”) to 10 (“a lot”).

BMI. BMI z-scores were calculated from self-reported height and weight and treated as a continuous variable. Values flagged as extreme (BMI z-scores ≤ -5 or > 5 , based on the WHO BMI classification; de Onis et al., 2007) were recoded as missing (n=25).

Race/ethnicity. Respondents self-identified as White, Black or African American, Hispanic or Latino, other race (e.g., Asian/Pacific Islander or Native American Indian only), two or more races/ethnicities, or not stated.

Age. Respondents reported their age as a discrete number between 10 and 17 years. This variable was treated as continuous.

Data analysis

Data were analyzed using Stata statistical software version 15.1 (StataCorp, 2021). Responses coded as “don’t know” (-77), “refuse to answer” (-88), and “not stated” (-99) were recoded as missing. Responses for the nutrition facts label use variable that were coded as missing because respondents indicated they were not aware of nutrition facts labels (n=14) were recoded as “never” having used nutrition facts labels. There was minimal missing data in the dataset (Appendix A). The outcome variables, weight change efforts and NFL use, were all missing at random. BMI z-scores, however, which were modeled as a covariate, were missing for 14.54% of the sample. Adolescents with missing BMI z-scores were more likely to be younger (OR=0.87, $p=0.001$) and Black or African American (OR=1.66, $p=0.025$).

Descriptive statistics (frequencies, means) were used to summarize the sample characteristics. Each hypothesis represented in the model pictured in Figure 3.3 was tested individually. For Specific Aim 3 (Hypotheses 3A-D), multinomial logistic regression was used to examine associations between the independent variables (body size satisfaction, weight teasing, and social media use, respectively) with the dependent variable (weight change efforts). To reduce potential confounding, the analysis for Specific Aim 3 controlled for the independent variables (body size satisfaction, weight

teasing, and social media use), BMI, perceived income adequacy (a proxy for household income), race/ethnicity, gender, and age (Calzo et al., 2012; Mahon & Hevey, 2021; Puhl et al., 2017; Rodgers et al., 2021; Wang et al., 2019). For Specific Aim 4 (Hypotheses 4A), the association between the independent variable (weight change efforts) and the dependent variable (nutrition facts label use) was tested using linear regression. This analysis controlled for perceived income adequacy (a proxy for household income), NFL understanding, food guide awareness, nutrition knowledge, race/ethnicity, gender, and age, as previous research suggests these factors may confound the relationship between weight change efforts and NFL use (Austin et al., 2009; Lemon et al., 2009; Mikolajczyk et al., 2012; Voelker et al., 2015). All analyses were stratified by gender.

As a sensitivity test, each model was run with and without survey weights. The IFPS constructed post-stratification survey weights using a raking algorithm with population estimates based on age, sex, and ethnicity. The survey weights for the U.S. ranged from 0.49 to 3.09. Appendix A indicates the categories used to develop these weights (table adapted from the IFPS User Guide – 2019 Youth Survey). To weight the data, the “svyset” command was used to tell Stata about the characteristics of the data (i.e., sampling units, sampling method). The “svy” command was used to account for the sampling characteristics specified in “svyset.” A preliminary analysis showed similar results for models using unweighted and weighted data. As previous research suggests that unweighted regression models provide unbiased estimates when survey weights are a function of independent variables (e.g., race/ethnicity, age, sex; Gelman, 2007), the results in this dissertation are unweighted.

CHAPTER 4

RESULTS

MANUSCRIPT 1

Nutrition Facts Label Use, Healthy Eating Efforts, and Sociodemographic Characteristics Among U.S. Adolescents⁶

⁶Mandelbaum, J., Davis, R. E., Frongillo, E.A., Thrasher, J. F., Vanderlee, L., Hammond, D. To be submitted to the *Journal of the Academy of Nutrition and Dietetics*.

Research Snapshot

Research Questions: Is the frequency of Nutrition Facts label use among U.S. adolescents associated with healthy eating efforts? Are there differences by race/ethnicity, age, or gender in Nutrition Facts label use among U.S. adolescents?

Key Findings: In this cross-sectional study of 784 U.S. adolescents aged 14-17, more frequent use of the Nutrition Facts label was positively associated with trying to engage in a range of healthy eating efforts. Older adolescents had less frequent use of the Nutrition Facts label than younger adolescents, and this association was mediated by both Nutrition Facts label understanding and nutrition knowledge.

Abstract

Background

Despite the promise of the U.S. Nutrition Facts label (NFL) as a population-level intervention with broad reach, few studies have examined whether adolescents' NFL use is associated with their nutrition behaviors or sociodemographic differences in label use.

Objective

This study examined whether NFL use was associated with healthy eating efforts and whether there were sociodemographic differences in NFL use among U.S. adolescents.

Design

A cross-sectional survey.

Participants and setting

Data were collected in 2019 through an online survey administered to 784 adolescents aged 14-17 in the U.S.

Main outcome measures

Nutrition Facts label use was measured by showing respondents an image of the U.S. NFL before its 2020/2021 update and asking, "Do you use this type of food label when deciding what to eat or buy?" "Healthy eating efforts" referred to adolescents' report of engaging in nine specific eating behaviors: eating protein; eating less sugar or drinking fewer sugary drinks; eating fewer calories; eating less salt; eating vegetables and fruits; drinking lots of water; eating whole grains; eating less low-calorie sweeteners; and eating less processed foods.

Statistical analyses performed

Structural equation modeling was used to examine relationships among healthy eating efforts, sociodemographic characteristics, and NFL use, with NFL understanding and nutrition knowledge modeled as mediators.

Results

Adolescents who reported more frequently using the NFL were more likely to report engaging in healthy eating efforts. Compared to white adolescents, being of two or more races/ethnicities was associated with less frequent use of the NFL. Overall, younger adolescents had more frequent use of the NFL than older adolescents. Among older adolescents, greater NFL understanding and nutrition knowledge were associated with more frequent NFL use. No other sociodemographic differences in NFL use were observed.

Conclusions

NFL use was positively associated with a set of healthy eating efforts among U.S. adolescents. As low NFL understanding and nutrition knowledge may be barriers to NFL use, efforts to increase understanding and knowledge may lead to higher NFL use.

Introduction

The U.S. Nutrition Facts label (NFL) was designed to be a convenient, cost-effective source of nutrition information.^{1,2} The label has the potential to “serve as a population-level intervention with unparalleled reach,”^{3 (p2135)} as it is present on most packaged food products in the U.S.⁴ Studies indicate that 87% of U.S. adults have looked at the NFL,⁵ and 31.4% report using the label frequently.⁶ Few estimates of adolescent NFL use exist, although one study using nationally representative data found that 37.6% of U.S. adolescents between ages 16 and 19 reported sometimes or always using the NFL when deciding to buy a food product.⁷

It is important to understand how adolescents’ use of the NFL may influence their dietary behaviors, as adolescence is a unique developmental period with longer-term implications for the life course.⁸ Adolescence typically occurs between ages 12 and 18 and is characterized by physiological and psychological changes.^{9,10} Adolescence also marks “a transition from primarily parental-controlled eating to self-directed and peer-influenced eating.”^{11(p1)} Most adolescents do not purchase food by themselves or with their parents;¹²⁻¹⁴ thus, using the nutrition label may be a way for adolescents to exert control over their dietary behaviors. Several studies have demonstrated how dietary intake tracks from adolescence into adulthood.¹⁵⁻¹⁸ The skills, knowledge, and habits adolescents acquire during this time may therefore shape their life-long dietary behaviors.¹⁹⁻²¹

Despite their intended population-wide use, research with U.S. adults suggests that the use and accessibility of the NFL varies across individuals.²² Adults who report using the label more frequently are also more likely to be white, female, physically

active, well-educated, higher income, more knowledgeable about nutrition, and practicing healthier eating habits compared to non-label users, suggesting that there may be both individual-level and structural barriers to NFL use.^{2,6,22-24} The NFL may also be more widely used by adults who already have greater knowledge or motivation to eat healthier.^{2,25,26} We know relatively little, however, about the potential influences on and consequences of food label use among U.S. adolescents.

The first aim of this study was to examine whether the frequency of food label use among U.S. adolescents was associated with healthy eating efforts. For the purposes of this study, “healthy eating efforts” refers to adolescents’ report of efforts to engage in specific healthy eating behaviors, including eating protein, eating less sugar or drinking fewer sugary drinks, eating fewer calories, eating less salt, eating vegetables and fruits, drinking lots of water, eating whole grains, eating less low-calorie sweeteners, and eating less processed foods. The second aim of this study sought to examine associations between sociodemographic characteristics and adolescent NFL use. Differences by race/ethnicity, age, and gender characteristics may help explain differences in NFL use among adolescents.

NFL use and healthy eating efforts

As compared to research with adults, relatively few studies have quantitatively examined associations between NFL use and dietary behaviors among adolescents. To the authors’ knowledge, only three such studies have been conducted among U.S. adolescents,^{7,27,28} and only one such study was completed outside of the U.S.²⁹ Overall, these studies found that less than 40% of adolescents use the NFL;⁷ however, adolescents who used the NFL appeared to engage in healthier eating behaviors, including lower

consumption of sugary beverages,²⁷ higher fruit and vegetable intake,²⁷ higher healthy eating scores,²⁷ and healthier snacking than adolescents who did not use the NFL.²⁹ Only one study concluded that NFL use was not associated with healthier eating behaviors among adolescents.²⁸ Together, these findings suggest that NFL use may help promote healthy eating behaviors among adolescents who use them.

In addition to the limited number of studies on adolescent use of the NFL, extant studies among adolescents have several limitations, including a greater emphasis on awareness of the NFL than on use,⁷ examining only one dietary outcome (e.g., dietary fat intake),²⁸ or using samples with limited generalizability (e.g., patients at an urban primary care clinic).²⁸ Thus, we know relatively little about whether the frequency of NFL use among U.S. adolescents is broadly associated with healthy eating efforts.

Although relatively little is known about how the NFL influences adolescents' dietary behaviors, the literature among adults may provide some insights. Previous studies have found that adults who use the NFL may be more likely to engage in behaviors such as eating protein,^{30,31} eating less sugar or drinking fewer sugary drinks,^{6,32,33} consuming less energy,^{2,30,31} and eating less salt.³¹⁻³⁵ A systematic review and meta-analysis of 60 studies in the U.S., Canada, Europe, Australia, and Asia concluded that food labeling was associated with reduced consumption of total fat, lower intake of total energy, and increased vegetable consumption among adults.³⁶ These findings with U.S. adults suggest that more frequent use of the NFL is positively associated with healthy eating efforts, which indicates that the NFL serves as an effective tool for motivating and supporting adults to make healthier dietary choices.

Sociodemographic characteristics

While only three studies have examined racial/ethnic differences in NFL use among U.S. adolescents, findings from these studies are consistent with studies among adults. Prior studies have shown that non-Hispanic white and Black adults are more likely than Hispanic adults to use the NFL.^{2,33,37} Among U.S. adolescents, two studies have found that white adolescents were more likely to report using the NFL to make food choices than Black or Hispanic adolescents.^{7,27} Huang et al.²⁸ did not find a difference in NFL use between adolescents who were Black, white, or from other racial/ethnic groups. Although these results were inconsistent across studies, the two larger state or nationally representative surveys did report differences in NFL use between racial/ethnic groups,^{7,27} suggesting that the racial/ethnic differences in NFL use observed among adults may also apply to adolescents.

Adolescence and young adulthood may be periods when people are more likely to use the food label to establish healthy eating habits.^{2,6} Only one study has examined age differences in NFL use among U.S. adolescents.²⁷ This study found that 8th graders in the U.S. reported higher use of the NFL to make nutrition decisions compared to 11th graders.²⁷ Little explanation was given for this finding, other than the fact that 8th and 11th grade are in distinct developmental stages (i.e., middle and high school).²⁷ There is also evidence that adolescents aged 16-19 are more aware of federal dietary guidance (e.g., the Dietary Guidelines for Americans and the Food Guide Pyramid) compared to adults,³⁸ which may be associated with increased use of the NFL.³⁹

Few studies have examined potential gender differences in NFL use among adolescents. Among studies of U.S. adolescents, Huang et al.²⁸ found that girls were more

likely than boys to report always reading the NFL, while Haidar et al.²⁷ did not find a difference in NFL use by gender. Studies among adults, however, have consistently shown that women use the NFL more than men.^{6,40-45} Previous research has also found that girls and boys may pay attention to different parts of the NFL. For one, boys tend to use the label to assess macronutrients (e.g., protein) in an effort to gain body mass, whereas girls more often use the label to assess calories in an effort to stay thin.²⁸ These studies suggest that boys pay attention to different parts of the label than girls.

NFL understanding and nutrition knowledge

Differences in NFL understanding and nutrition knowledge may influence NFL use among adolescents. NFL understanding refers to either self-reported or functional tests of individuals' ability to interpret information on the NFL.⁴⁶ A scoping review of studies among adults found that NFL understanding was generally associated with an increase in NFL use.⁴⁷ Previous research suggests that poor NFL understanding is one of the main barriers to NFL use among adults.⁴⁸ Little is known about NFL understanding among adolescents, although current evidence suggests that adolescents generally score low in assessments of their ability to read and compare NFLs.⁴⁹ Research with U.S. adults has found racial/ethnic and age differences in NFL understanding. For example, non-Hispanic white adults have been found to have higher average label understanding compared to English-speaking Hispanic and non-Hispanic Black adults.⁵⁰ Research among adults also suggests that use of specific information on the NFL (e.g., serving size, ingredients) increases with age,³³ although some evidence has found that older adults (> age 60) may experience more difficulty with label comprehension.⁵¹

Nutrition knowledge refers to knowledge of processes and concepts related to nutrition, including diet, health, disease, and dietary guidelines.⁴ Nutrition knowledge may cause consumers to direct their attention to the NFL (as compared to marketing on the package), increase comprehension of the nutrition information on the label, and support consumers in applying nutrition information to food choice.⁴ A systematic review found that adults with greater nutrition knowledge found it easier to understand information on the NFL, which led to increased NFL use.⁴ Some studies suggest that nutrition knowledge may vary across racial/ethnic and age groups among adolescents. For example, a study of U.S. middle school students found that Black adolescents had lower nutrition knowledge than their white peers.⁵² Additionally, a study among Canadian adolescents found that nutrition knowledge increased with age.⁵³ These findings suggest that differences in nutrition knowledge may partially explain racial/ethnic and age differences in NFL use.

Methods

Data source

De-identified data were obtained from the 2019 wave of the International Food Policy Study (IFPS) Youth Survey, which is an annual, repeated cross-sectional online survey of trends in dietary patterns and policy-relevant behaviors in the U.S. and five other countries.⁵⁴ The IFPS Youth Survey was funded by the Public Health Agency of Canada and the Canadian Institutes of Health Research. Data from the 2019 survey were selected for this study because it was the last year of survey data collected before the onset of the COVID-19 pandemic. This survey was the first wave of the IFPS Youth Survey, and data were collected online between November and December 2019.

Only one child in each household was eligible to participate in the survey. Eligibility criteria included being between the ages of 10 and 17 years, reporting gender as male or female, and meeting data quality standards (i.e., correctly stating their region, correctly answering the quality check question located two-thirds through the questionnaire, completing the survey in more than 10 minutes). Quotas for age (an equal number of younger (age 10-13) and older (age 14-17) adolescents) and gender (an even split of boys and girls) were applied to facilitate a diverse sample, and the survey closed with these quotas were met.

Data collection

The sample was recruited through the Nielsen Consumer Insights Global Panel or their partner panels, which used both probability and non-probability sampling. Panelists for the adult studies received email invitations from Nielsen and were screened to identify whether they had any children aged 10-17 living in their household.⁵⁵ Parents with a potentially eligible child were given information about the IFPS. If parents consented for their child to participate in the youth survey, they passed the survey directly to their child, who was screened to confirm eligibility based on age and gender. Eligible adolescents who agreed to participate in the study provided assent before starting the survey. Only adolescents aged 14-17 were included in the analytic sample for the present study, as younger adolescents were not asked about eating efforts.

The IFPS invited 16,596 adolescents in the U.S. to participate in the online survey, of which 1,603 (9.7%) completed the survey and met data quality standards. The survey cooperation rate was 79.8% based on the American Association for Public Opinion Research Cooperation Rate #2.⁵⁶ The final analytic sample included 784

adolescents. Each adolescent's parent/guardian was compensated for their participation by the Nielsen Consumer Insights Panel through points-based or monetary rewards that could be exchanged for cash, donations, electronic gift cards, and/or chances to win monthly prizes.

All survey data were collected online on a computer or mobile device. The survey was conducted in either English or Spanish, based on each participant's language preference, and took an average of 22 minutes to complete (22 minutes for English speakers; 24 minutes for Spanish speakers). All study protocols were reviewed by the University of Waterloo Research Ethics Committee and the University of South Carolina Institutional Review Board.

Measures

Nutrition Facts label use. This measure was adapted from the 2014 FDA Health and Diet Survey.⁵⁷ Respondents were shown an image of the U.S. NFL before its 2020/2021 update and asked, "Do you use this type of food label when deciding what to eat or buy?" Responses were recorded as 1="never", 2="rarely", 3="sometimes", 4="often", and 5="all the time". This question was asked only of respondents who answered affirmatively (i.e., "rarely", "sometimes", "often" or "all the time") to the previous question ("Have you seen this type of food label on packages or in stores?"). Respondents who previously indicated that they were not aware of the NFL (n=6) were recoded as "never" having used the label.

Healthy eating efforts. This measure was loosely adapted from the Tracking Nutrition Trends (TNT) survey.⁵⁸ Respondents were asked if they made a special effort to do any of the following: (1) "eat protein"; (2) "eat less sugar or drink fewer sugary

drinks”; (3) “eat [fewer] calories”; (4) “eat less salt”; (5) “eat vegetables and fruits”; (6) “drink lots of water”; (7) “eat whole grains”; (8) “eat less low-calorie sweeteners”; or (9) “eat less processed foods.” Each behavior was queried independently, with “yes” responses coded as 1 and “no” responses coded as 0.

Nutrition Facts label understanding. This measure was adapted from a measure used in the 2016 Canada Food Study, which was a precursor to the IFPS.⁵⁹ Respondents were shown an image of an NFL and asked how hard or easy they found the information on the NFL to understand. Responses were coded on a scale of 1 to 5, where 1=“very hard to understand” and 5=“very easy to understand.”

Nutrition knowledge. This measure was adapted from the TNT survey.⁵⁸ Respondents were asked to rate how much they knew about healthy eating and nutrition on a scale from 0 to 10, where 0 indicated “nothing” and 10 signified “a lot.”

Sociodemographics. A single item was used to classify respondents as white, Black, Hispanic or Latino, other race (e.g., Asian/Pacific Islander or Native American Indian only), two or more races/ethnicities, or not stated.⁶⁰ Respondents reported their age (14, 15, 16, or 17 years). Respondents reported their gender as male or female.

Control variables. A weight change efforts measure was adapted from the National Health and Nutrition Examination Survey,⁶¹ the GUTS Study,⁶² and Project-EAT,⁶³ among others,⁶⁴ to assess participants’ intentions toward their weight. Respondents were asked, “Which of the following are you trying to do about your weight?” with responses including 1=“nothing”, 2=“stay the same weight”, 3=“gain weight”, and 4=“lose weight.” *Food guide awareness* was measured using an item adapted for the U.S. context from the Canadian Community Health Survey (CCHS) food

guide module and the TNT survey.^{58,65} Respondents were asked, “Have you ever heard of MyPlate or the Food Guide Pyramid?” with “yes” responses coded as 1 and “no” responses coded as 0. *Perceived income adequacy* was assessed as a proxy for household income, as household income was not collected in the survey. Previous research suggests that adolescents do not accurately state their household income,⁶⁶ and that the use of a subjective measure like perceived income adequacy allows respondents to include other economic indicators (e.g., societal norms around the standard of living) in their assessment.^{67,68} Respondents were asked, “Does your family have enough money to pay for things your family needs?” Responses included 1=“not enough money”, 2=“barely enough money”, 3=“enough money”, and 4=“more than enough money,” with “enough money” used as the referent group.

Data analysis

Data were analyzed using Stata statistical software version 15.1.⁶⁹ All “don’t know” and “refuse to answer” responses were recoded as missing. Although there were minimal missing data in the dataset (missingness < 2.5%), full information maximum likelihood (FIML) was used to preserve variability and provide unbiased estimates under the assumption that the missing data were at random. Descriptive statistics (frequencies, means) were used to summarize the sample characteristics (Table 4.1), and the SEM command was used to generate a correlation matrix of study variables (Appendix B).

Principal components factor analysis with varimax rotation was used to determine whether the nine healthy eating effort variables formed a single construct. Factor analysis showed that the nine healthy eating efforts clearly reflected a single factor. The rotated factor analysis and scree plot revealed two orthogonal factors, which appeared to be

grouped as (1) eating efforts adolescents should do more of, according to food-based dietary guidance (i.e., eat more protein, eat more fruits/vegetables, drink more water, eat more whole grains) and (2) eating efforts adolescents should do less of (e.g., eat less sugar, eat fewer calories, eat less salt, eat fewer sugar-sweetened beverages, eat less processed foods). However, the items indicated in the two factors had lower internal consistency reliability (Kuder-Richardson Formula 20 (KR-20) = 0.74 for Factor 1 and 0.81 for Factor 2) than the items in the single factor containing all nine eating efforts (KR-20 = 0.82). Thus, the measure used in the analysis is an unweighted summary index of these nine healthy eating efforts.

Recursive path analysis was conducted that assumed no uncorrelated errors and no reverse causality, as previous findings used experimental or statistical methods to assess directionality.^{35,70-72} This model included NFL use and healthy eating efforts as dependent variables, sociodemographic characteristics (race/ethnicity, age, gender) as independent variables, and NFL understanding and nutrition knowledge as mediators of the relationships between sociodemographic characteristics and NFL use. Food guide awareness, perceived income adequacy, and weight change efforts were included as covariates in the model, as some evidence suggests that these factors may confound relationships among sociodemographic characteristics, NFL use, and healthy eating efforts.^{7,23,73} Indirect effects (the magnitude of effects through each path) were computed by multiplying the regression coefficients along each path. The coefficients from each path (detailed in Table 4.2) were added together to estimate the cumulative effect of sociodemographic characteristics on eating efforts through NFL understanding and nutrition knowledge, respectively (Root Mean Squared Error of Approximation

(RMSEA) = 0.29 (95% CI: 0.23, 0.35); comparative fit index (CFI) = 0.91). To explore potential associations between NFL use and individual healthy eating efforts, post-hoc recursive path analyses were conducted separately for each of the nine healthy eating efforts.

Results

The sample was 48.3% male (n=379) and 51.7% female (n=405; Table 4.1). Adolescents in the sample ranged in age from 14-17 years, with a mean age of 15.4 years (SD=1.11). Most adolescents were white (66.2%), followed by Black (11.6%) and Hispanic or Latino (7.7%). Most adolescents (55.5%) reported using the NFL sometimes, often, or all the time, and 89.8% had made at least one healthy eating effort.

NFL use and healthy eating efforts among U.S. adolescents

U.S. adolescents aged 14-17 who reported more frequently using the NFL were more likely to report engaging in the nine healthy eating efforts ($\beta=0.31$, $p<0.001$; Figure 4.1). Post-hoc analyses showed that adolescents who reported more frequently using the NFL were more likely to report engaging in all nine healthy eating efforts except for drinking water ($\beta=0.06$; $p=0.13$; Appendix B). Healthy eating efforts were associated with greater nutrition knowledge ($\beta=0.22$, $p<0.001$), trying to lose weight ($\beta=0.18$, $p<0.001$), trying to stay the same weight ($\beta=0.15$, $p<0.001$), and being Black ($\beta=0.07$, $p=0.03$). Adolescents with greater NFL understanding and nutrition knowledge also had more frequent use of the NFL ($\beta=0.28$ and 0.33 , respectively, $p<0.001$).

Sociodemographic characteristics

Compared to white adolescents, being of two or more races/ethnicities was associated with less frequent use of the NFL ($\beta=-0.07$, $p=0.02$; Figure 4.1). Older

adolescents had less frequent use of the NFL ($\beta=-0.08$, $p=0.01$). Gender was not directly associated with NFL use ($\beta=0.02$, $p=0.58$) or healthy eating efforts ($\beta=-0.04$, $p=0.21$). Post-hoc analyses using individual eating efforts measures found that girls were less likely to make an effort to eat protein than boys ($\beta= -0.11$; $p=0.001$).

Mediation by NFL understanding and nutrition knowledge

No racial differences in NFL understanding or nutrition knowledge were observed (Table 4.3). Among older adolescents, those with greater NFL understanding and nutrition knowledge had more frequent NFL use ($\beta=0.03$ and $\beta=0.03$, respectively). Compared to boys, girls who had greater NFL understanding and nutrition knowledge had more frequent NFL use ($\beta=0.01$ and $\beta=0.02$, respectively).

Covariates and adolescent NFL use

Although food guide awareness was not directly associated with NFL use ($\beta=0.004$, $p=0.88$), it was indirectly associated with NFL use. Among adolescents who were aware of food guides, those with greater NFL understanding and nutrition knowledge, respectively, reported more frequent use of the NFL ($\beta=0.03$ and $\beta=0.06$, respectively). Among adolescents reporting their household as having “not enough money” and “barely enough money,” NFL understanding and nutrition knowledge were associated with less frequent use of the NFL (For adolescents with “not enough money,” $\beta=-0.02$ $\beta=-0.01$, respectively, and for adolescents with “barely enough money,” $\beta=-0.03$ and $\beta=-0.003$, respectively). Among adolescents reporting “more than enough money,” however, NFL understanding and nutrition understanding were associated with more frequent NFL use ($\beta=0.03$ and 0.05 , respectively).

Weight change efforts were both directly and indirectly associated with NFL use. Adolescents trying to lose weight ($\beta=0.17$, $p<0.001$), stay the same weight ($\beta=0.21$, $p<0.001$), or gain weight ($\beta=0.09$, $p=0.01$) used the NFL more frequently than adolescents not trying to change or maintain their weight. NFL understanding and nutrition knowledge mediated the association between weight change efforts and NFL use. Adolescents trying to lose weight had lower NFL understanding and nutrition knowledge, and therefore less frequent NFL use ($\beta=-0.01$ and $\beta=-0.02$, respectively). Adolescents trying to stay the same weight or gain weight, however, had greater NFL understanding and nutrition knowledge, and they used the NFL more frequently (For adolescents trying to stay the same weight, $\beta=0.03$ and $\beta=0.05$, respectively, and for adolescents trying to gain weight, $\beta=0.003$ and $\beta=0.02$, respectively).

The indirect paths from sociodemographic characteristics (race, age, and gender, plus covariates) to NFL use were positive. About 16% of the total sociodemographic characteristic effect on NFL use was exerted through indirect paths (Table 4.4). Most of the total effect (83.92%) was direct from sociodemographic characteristics to NFL use.

Discussion

Just over half of U.S. adolescents in the study sample used the NFL, and adolescents who use the NFL more frequently were more likely to report engaging in healthy eating efforts. This finding is consistent with previous studies showing that NFL use is associated with healthier eating behavior among other samples of adolescents.^{27,29} Increasing NFL use among this population may be an important goal for promoting healthy eating. Since this study was conducted, there have been several federal initiatives to promote nutrition label use, such as the U.S. Food and Drug Administration's (FDA)

“The New Nutrition Facts Label: What’s in it for You?” education campaign.⁷⁴ The recent White House Conference on Hunger, Nutrition, and Health also included plans for a standardized front-of-package (FOP) labeling system to help people quickly and easily identify the nutritional value of food products.⁷⁵ Findings from the present study may provide a useful baseline for evaluating these programs in the future.

Based on the present study’s findings, interventions aiming to increase NFL use among adolescents might be more effective if they first seek to improve NFL understanding and nutrition knowledge. For example, schools can be a setting to teach adolescents how to understand food labels (i.e., improve nutritional literacy) and experience food choice.^{50,76} Nutrition education could be integrated into STEM (science, technology, engineering, and math) curricula,⁵⁰ and a web-based label reading intervention has been shown to improve nutrition label reading skills among college students.⁷⁷ Communication campaigns on social media sites different adolescent subgroups tend to use could also aim to increase NFL understanding and nutrition knowledge.⁷⁸ Findings from the present study suggest that older adolescents in particular may be better able to use cognitive processes related to attention, comprehension, and decision making to apply NFL understanding and nutrition knowledge.

The present study used an index which included a range of healthy eating efforts. The post-hoc analyses of individual healthy eating efforts generated similar results as the summative variable for healthy eating efforts. Some of these eating efforts represent areas of more general public health concern (e.g., sugar consumption) than others (e.g., protein intake) in the US.⁷⁹ We may not expect these healthy eating efforts to behave the same way, both from a public health perspective and how they are displayed on the label, yet

they do, which may suggest that people are using the whole label when making eating efforts.

Consistent with a prior study of adolescent NFL use,²⁸ few differences in NFL use by race or ethnicity were found. Unlike two previous studies which suggest that white adolescents have higher NFL use,^{7,27} no differences in frequency of NFL use were found between white and Black or Hispanic adolescents. These findings may suggest that the racial/ethnic disparities in NFL use observed within U.S. adult populations may not emerge until adulthood.^{2,33} Some researchers hypothesize that racial disparities in health trajectories may be due, in part, to differences in access to health-promoting resources, inequalities in access to health information and ability to act on this information,⁸⁰ and the burden of discrimination.⁸¹ For example, white households have greater access to broadband compared to other racial/ethnic groups,⁸² which may enable them to gather and communicate more health-related information. Due to medical mistrust and lack of health insurance, racial/ethnic minority adults are also less likely than white adults to have a primary care physician as a usual source of care,⁸³ which may limit the preventive care they receive (e.g., guidance on healthy eating). These racial disparities in primary care access are not as wide for adolescents,⁸⁴ which may be due, in part, to their eligibility for low-cost health care coverage such as the Children's Health Insurance Program.⁸⁵ It is also possible that this study's subsamples of Black, Hispanic or Latino, and Asian/Pacific Islander or Native American populations were too small to detect racial/ethnic differences in label use that have been observed in prior studies.^{7,27}

While previous studies among U.S. adults strongly suggested that girls would use the NFL more than boys,^{6,40,45} no gender differences in NFL use were observed in the

present study. This finding is consistent with a previous study of U.S. adolescents²⁷ and could suggest that gender differences in NFL use emerge with age (e.g., when young adults leave their adolescent households, where parents were more likely to purchase food). For example, adult women may be more likely to use the NFL than men because they have traditionally been the ones responsible for household food purchases and preparation.⁸⁶ Gender differences were also not found in the summative healthy eating efforts variable. The finding that girls were less likely to make an effort to eat protein than boys is consistent with previous studies suggesting that boys may use the NFL to assess macronutrients like protein to gain body mass.²⁸ No other differences by gender were observed in the post-hoc analyses.

The present study drew on the strengths of the IFPS Youth Survey, including its large and diverse sample. Administering the survey online allowed for researchers to include more graphical examples, including an image of the NFL. While the IFPS does not track individuals over time, it was designed to examine trends in dietary patterns and policy-relevant behaviors. Future studies, therefore, may be able to examine whether the present study's findings apply to the recently updated NFL, or what effects, if any, the COVID-19 pandemic had related to adolescent eating efforts. As the IFPS also surveyed adolescents in Australia, Canada, Chile, Mexico, and the United Kingdom, future research could also compare how the present study's finding about the NFL apply to adolescents using their country's version of the nutrition label.

The present study is subject to limitations. Respondents were shown an image of the U.S. NFL before its 2020/2021 update, and it is possible that adolescents may find the newer label easier to use. Recent evidence among adults, however, suggests that the

relatively minor updates to the NFL did not improve NFL comprehension.⁸⁷ Adolescents' reasons for trying to engage in healthy eating efforts were also not assessed. The authors controlled for weight change efforts as a means of addressing one potential reason adolescents might pursue healthy eating efforts. This study did not include gender non-binary participants or gender attitudes, meaning that these participants are not represented in the dataset. Data on gender attitudes could have provided insight into why NFL understanding and nutrition knowledge, respectively, mediated the association between gender and NFL use. Lastly, selection may have been a factor in study recruitment, as it may be that only parents interested in nutrition participate in the IFPS.

Additionally, the healthy eating efforts variable measured dietary intentions rather than actual behaviors. Previous research among adolescents, however, has found that dietary intentions are determinants of dietary behaviors,⁸⁸ and that implementation interventions can be effective at increasing fruit and vegetable intake and reducing high fat unhealthy snack intake among adolescents.⁸⁹

Conclusions

NFL use was positively associated with a set of healthy eating efforts among U.S. adolescents. Unlike the literature among adults, little has been known about the effect of adolescents' use of the nutrition facts label on healthy eating. This study expands the literature in this area and avoids some of the limitations of the four previous studies examining this association. Findings suggest that increasing NFL use may be an important goal for improving healthy eating among adolescents. Additionally, interventions aiming to increase NFL use among adolescents might be more effective if they first seek to improve NFL understanding and nutrition knowledge. Further, this

study examined differences in NFL use by several sociodemographic characteristics, which is something few studies among adolescents have done. Findings indicate that adolescents are a distinct group from adults and do not necessarily exhibit the same sociodemographic differences in NFL use. Future studies may examine how well U.S. adolescents understand and apply information from the nutrition facts label to their food choices.

References

1. Buyuktuncer Z, Ayaz A, Dedebayraktar D, Inan-Eroglu E, Ellahi B, Besler HT. Promoting a healthy diet in young adults: the role of nutrition labelling. *Nutrients*. 2018;10(10):1335. doi:10.3390/nu10101335.
2. Campos S, Doxey J, Hammond D. Nutrition labels on pre-packaged foods: a systematic review. *Public Health Nutr*. 2011;14(8):1496-506. doi:10.1017/S1368980010003290.
3. Christoph MJ, An R, Ellison B. Correlates of nutrition label use among college students and young adults: a review. *Public Health Nutr*. 2016;19(12):2135-48. doi:10.1017/s1368980015003183.
4. Miller LMS, Cassady DL. The effects of nutrition knowledge on food label use. a review of the literature. *Appetite*. 2015;92:207-216. doi:10.1016/j.appet.2015.05.029.
5. Lando A, Verrill L, Wu F. FSANS: FDA's Food Safety and Nutrition Survey. Accessed August 14, 2021. <https://www.fda.gov/media/146532/download>
6. Christoph MJ, Larson N, Laska MN, Neumark-Sztainer D. Nutrition facts panels: who uses them, what do they use, and how does use relate to dietary intake? *J Acad Nutr Diet*. 2018;118(2):217-228. doi:10.1016/j.jand.2017.10.014.
7. Wojcicki JM, Heyman MB. Adolescent nutritional awareness and use of food labels: results from the National Nutrition Health and Examination Survey. *BMC Pediatr*. 2012;12:55-55. doi:10.1186/1471-2431-12-55.
8. Pringle J, Mills K, McAteer J, et al. A systematic review of adolescent physiological development and its relationship with health-related behaviour: a protocol. *Syst Rev*. 2016;5(1):3. doi:10.1186/s13643-015-0173-5.

9. Jaworska N, MacQueen G. Adolescence as a unique developmental period. *J Psychiatry Neurosci.* 2015;40(5):291-293. doi:10.1503/jpn.150268.
10. Crosnoe R, Johnson MK. Research on adolescence in the twenty-first century. *Annu Rev Sociol.* 2011;37:439-460. doi:10.1146/annurev-soc-081309-150008.
11. Ziegler AM, Kasprzak CM, Mansouri TH, et al. An ecological perspective of food choice and eating autonomy among adolescents. *Front Psychol.* 2021;12: 654139. doi:10.3389/fpsyg.2021.654139.
12. Hermans RCJ, Smit K, van den Broek N, Evenhuis IJ, Veldhuis L. Adolescents' food purchasing patterns in the school food environment: examining the role of perceived relationship support and maternal monitoring. *Nutrients.* 2020;12(3):733. doi:10.3390/nu12030733.
13. Larson NI, Story M, Eisenberg ME, Neumark-Sztainer D. Food preparation and purchasing roles among adolescents: associations with sociodemographic characteristics and diet quality. *J Am Diet Assoc.* 2006;106(2):211-218. doi:10.1016/j.jada.2005.10.029.
14. Neufeld LM, Andrade EB, Ballonoff Suleiman A, et al. Food choice in transition: adolescent autonomy, agency, and the food environment. *Lancet.* 2022;399(10320):185-197. doi:10.1016/s0140-6736(21)01687-1.
15. Kvaavik E, Andersen LF, Klepp KI. The stability of soft drinks intake from adolescence to adult age and the association between long-term consumption of soft drinks and lifestyle factors and body weight. *Public Health Nutr.* 2005;8(2):149-57. doi:10.1079/phn2004669.

16. Lake AA, Mathers JC, Rugg-Gunn AJ, Adamson AJ. Longitudinal change in food habits between adolescence (11-12 years) and adulthood (32-33 years): the ASH30 Study. *J Public Health (Oxf)*. 2006;28(1):10-6. doi:10.1093/pubmed/fdi082.
17. Lipsky LM, Haynie DL, Liu D, et al. Trajectories of eating behaviors in a nationally representative cohort of U.S. adolescents during the transition to young adulthood. *The international journal of behavioral nutrition and physical activity*. 2015;12:138-138. doi:10.1186/s12966-015-0298-x.
18. Movassagh EZ, Baxter-Jones ADG, Kontulainen S, Whiting SJ, Vatanparast H. Tracking dietary patterns over 20 years from childhood through adolescence into young adulthood: the Saskatchewan Pediatric Bone Mineral Accrual Study. *Nutrients*. 2017;9(9):990. doi:10.3390/nu9090990.
19. Hu T, Jacobs DR, Jr., Larson NI, Cutler GJ, Laska MN, Neumark-Sztainer D. Higher diet quality in adolescence and dietary improvements are related to less weight gain during the transition from adolescence to adulthood. *J Pediatr*. 2016;178:188-193.e3. doi:10.1016/j.jpeds.2016.08.026.
20. Nelson MC, Story M, Larson NI, Neumark-Sztainer D, Lytle LA. Emerging adulthood and college-aged youth: an overlooked age for weight-related behavior change. *Obesity*. 2008;16(10):2205-2211. doi:10.1038/oby.2008.365.
21. Winpenny EM, Penney TL, Corder K, White M, van Sluijs EMF. Change in diet in the period from adolescence to early adulthood: a systematic scoping review of longitudinal studies. *Int J Behav Nutr Phys Act*. 2017;14(1):60-60. doi:10.1186/s12966-017-0518-7.

22. Roberto CA, Khandpur N. Improving the design of nutrition labels to promote healthier food choices and reasonable portion sizes. *Int J Obes*. 2014;38(1):S25-S33. doi:10.1038/ijo.2014.86.
23. Bleich SN, Wolfson JA. Differences in consumer use of food labels by weight loss strategies and demographic characteristics. *BMC Public Health*. 2015;15:1275-1275. doi:10.1186/s12889-015-2651-z.
24. Cowburn G, Stockley L. Consumer understanding and use of nutrition labelling: a systematic review. *Public Health Nutr*. 2005;8(1):21-28. doi:10.1079/PHN2004666.
25. Jasti S, Kovacs S. Use of trans fat information on food labels and its determinants in a multiethnic college student population. *J Nutr Educ Behav*. 2010;42(5):307-314. doi:10.1016/j.jneb.2009.06.004.
26. Mozaffarian D, Angell SY, Lang T, Rivera JA. Role of government policy in nutrition—barriers to and opportunities for healthier eating. *BMJ*. 2018;361:k2426. doi:10.1136/bmj.k2426.
27. Haidar A, Carey FR, Ranjit N, Archer N, Hoelscher D. Self-reported use of nutrition labels to make food choices is associated with healthier dietary behaviours in adolescents. *Public Health Nutr*. 2017;20(13):2329-2339. doi:10.1017/s1368980017001252.
28. Huang TT, Kaur H, McCarter KS, Nazir N, Choi WS, Ahluwalia JS. Reading nutrition labels and fat consumption in adolescents. *J Adolesc Health*. 2004;35(5):399-401. doi:10.1016/j.jadohealth.2004.02.005.

29. Talagala IA, Arambepola C. Use of food labels by adolescents to make healthier choices on snacks: a cross-sectional study from Sri Lanka. *BMC Public Health*. 2016;16(1):739. doi:10.1186/s12889-016-3422-1.
30. Elbon SM, Johnson MA, Fischer JG, Searcy CA. Demographic factors, nutrition knowledge, and health-seeking behaviors influence nutrition label reading behaviors among older American adults. *J Nutr Elder*. 2000;19(3):31-48. doi:10.1300/J052v19n03_03.
31. Lewis JE, Arheart KL, LeBlanc WG, et al. Food label use and awareness of nutritional information and recommendations among persons with chronic disease. *Am J Clin Nutr*. 2009;90(5):1351-1357. doi:10.3945/ajcn.2009.27684.
32. Anastasiou K, Miller M, Dickinson K. The relationship between food label use and dietary intake in adults: a systematic review. *Appetite*. 2019;138:280-291. doi:10.1016/j.appet.2019.03.025.
33. Ollberding NJ, Wolf RL, Contento I. Food label use and its relation to dietary intake among US adults. *J Am Diet Assoc*. 2010;110(8):1233-7. doi:10.1016/j.jada.2010.05.007.
34. Fitzgerald N, Damio G, Segura-Pérez S, Pérez-Escamilla R. Nutrition knowledge, food label use, and food intake patterns among Latinas with and without type 2 diabetes. *J Am Diet Assoc*. 2008;108(6):960-967. doi:10.1016/j.jada.2008.03.016.
35. Kim S-Y, Nayga RM, Capps O. The effect of food label use on nutrient intakes: an endogenous switching regression analysis. *J Agric Resour Econ*. 2000;25(1):215-231. doi:10.22004/ag.econ.30831.

36. Shangguan S, Afshin A, Shulkin M, et al. A meta-analysis of food labeling effects on consumer diet behaviors and industry practices. *Am J Prev Med*. 2019;56(2):300-314. doi:10.1016/j.amepre.2018.09.024.
37. Gans KM, Burkholder GJ, Risica PM, Lasater TM. Baseline fat-related dietary behaviors of white, Hispanic, and Black participants in a cholesterol screening and education project in New England. *J Am Diet Assoc*. 2003;103(6):699-706. doi:10.1053/jada.2003.50135.
38. Wright JD, Wang CY. Awareness of Federal Dietary Guidance in persons aged 16 years and older: results from the National Health and Nutrition Examination Survey 2005-2006. *J Am Diet Assoc*. 2011;111(2):295-300. doi:10.1016/j.jada.2010.10.049.
39. Miller LMS, Cassady DL, Applegate EA, et al. Relationships among food label use, motivation, and dietary quality. *Nutrients*. 2015;7(2):1068-1080. doi:10.3390/nu7021068.
40. Bryła P. Who reads food labels? selected predictors of consumer interest in front-of-package and back-of-package labels during and after the purchase. *Nutrients*. 2020;12(9):2605. doi:10.3390/nu12092605.
41. Nayga Jr RM. Nutrition knowledge, gender, and food label use. *J Consum Aff*. 2000;34(1):97-112. doi:10.1111/j.1745-6606.2000.tb00086.x.
42. Raspberry CN, Chaney BH, Housman JM, Misra R, Miller PJ. Determinants of nutrition label use among college students. *Am J Health Educ*. 2007;38(2):76-82. doi:10.1080/19325037.2007.10598947.
43. Satia JA, Galanko JA, Neuhaus ML. Food nutrition label use is associated with demographic, behavioral, and psychosocial factors and dietary intake among African

- Americans in North Carolina. *J Am Diet Assoc.* 2005;105(3):392-402; discussion 402-3. doi:10.1016/j.jada.2004.12.006.
44. Stran KA, Knol LL. Determinants of food label use differ by sex. *J Acad Nutr Diet.* 2013;113(5):673-679. doi:10.1016/j.jand.2012.12.014.
45. Su D, Zhou J, Jackson HL, Soliman GA, Huang TTK, Yaroach AL. A sex-specific analysis of nutrition label use and health, Douglas County, Nebraska, 2013. *Prev Chronic Dis.* 2015;12:E158-E158. doi:10.5888/pcd12.150167.
46. Bhawra J, Kirkpatrick SI, Hall MG, Vanderlee L, Thrasher JF, Hammond D. Correlates of self-reported and functional understanding of nutrition labels across 5 countries in the 2018 International Food Policy Study. *J Nutr.* 2022;152(Suppl 1):13s-24s. doi:10.1093/jn/nxac018.
47. Malloy-Weir L, Cooper M. Health literacy, literacy, numeracy and nutrition label understanding and use: a scoping review of the literature. *J Hum Nutr Diet.* 2017;30(3):309-325. doi:10.1111/jhn.12428.
48. Jay M, Adams J, Herring SJ, et al. A randomized trial of a brief multimedia intervention to improve comprehension of food labels. *Prev Med.* 2009;48(1):25-31. doi:10.1016/j.ypmed.2008.10.011.
49. Hawthorne KM, Moreland K, Griffin IJ, Abrams SA. An educational program enhances food label understanding of young adolescents. *J Am Diet Assoc.* 2006;106(6):913-916. doi:10.1016/j.jada.2006.03.004.
50. Persoskie A, Hennessy E, Nelson WL. US consumers' understanding of nutrition labels in 2013: the importance of health literacy. *Prev Chronic Dis.* 2017;14:E86. doi:10.5888/pcd14.170066.

51. Miller LM, Applegate E, Beckett LA, Wilson MD, Gibson TN. Age differences in the use of serving size information on food labels: numeracy or attention? *Public Health Nutr.* 2017;20(5):786-796. doi:10.1017/s1368980016003219.
52. Fahlman MM, McCaughy N, Martin J, Shen B. Racial and socioeconomic disparities in nutrition behaviors: targeted interventions needed. *J Nutr Educ Behav.* Jan-Feb 2010;42(1):10-6. doi:10.1016/j.jneb.2008.11.003.
53. Brown R, Seabrook JA, Stranges S, et al. Examining the correlates of adolescent food and nutrition knowledge. *Nutrients.* 2021;13(6):2044. doi:10.3390/nu13062044.
54. Hammond D, Vanderlee L, White CM, et al. The conceptual framework for the International Food Policy Study: evaluating the population-level impact of food policy. *J Nutr.* 2022;152(Supplement_1):1S-12S. doi:10.1093/jn/nxac042.
55. International Food Policy Study. Accessed September 5, 2022. <https://foodpolicystudy.com>
56. AAPOR. Response rates - an overview. Accessed August 1, 2021. <https://www.aapor.org/Education-Resources/For-Researchers/Poll-Survey-FAQ/Response-Rates-An-Overview.aspx>
57. Jordan Lin C-T, Zhang Y, Carlton ED, Lo SC. 2014 FDA Health and Diet Survey. Accessed August 1, 2021. <https://www.fda.gov/media/96883/download>
58. Goodman S, Hammond D, Pillo-Blocka F, Glanville T, Jenkins R. Use of nutritional information in Canada: national trends between 2004 and 2008. *J Nutr Educ Behav.* 2011;43(5):356-65. doi:10.1016/j.jneb.2011.02.008.
59. Hammond D, White CM, Reid JL. 2016 Canada Food Study: technical report – wave 2. Accessed June 17, 2021. <http://www.canadafoodstudy.ca/studydocs>

60. U.S. Census Bureau. Measuring racial and ethnic diversity for the 2020 Census. Accessed October 20, 2022. <https://www.census.gov/newsroom/blogs/random-samplings/2021/08/measuring-racial-ethnic-diversity-2020-census.html>
61. National Center for Health Statistics. National Health and Nutrition Examination Survey. Centers for Disease Control and Prevention. Accessed September 5, 2021. <https://www.cdc.gov/nchs/nhanes/index.htm>
62. Channing Division of Network Medicine. Growing Up Today Study (GUTS). Accessed August 26, 2021. <http://www.gutsweb.org>
63. University of Minnesota School of Public Health. Project EAT. Accessed September 5, 2021. <https://www.sph.umn.edu/research/projects/project-eat>
64. Hammond D, White CM, Rynard VL, Vanderlee L. International Food Policy Study: technical report – 2019 youth survey. 2021. <http://foodpolicystudy.com/methods>
65. Government of Canada Health and Nutrition Surveys. Canadian Community Health Survey. Accessed September 5, 2021. <https://www.canada.ca/en/health-canada/services/food-nutrition/food-nutrition-surveillance/health-nutrition-surveys/canadian-community-health-survey-cchs.html>
66. Anderson DM, Holt JK. *Do high school students know their parents' income?* <https://eric.ed.gov/?id=ED574698>. Published 2017. Accessed September 5, 2022.
67. Olstad DL, Nejatinamini S, Kirkpatrick SI, et al. Stress-related poor diet quality does not explain socioeconomic inequities in health: a structural equation mediation analysis of gender-specific pathways. *J Acad Nutr Diet*. 2022;122(3):541-554.e1. doi:10.1016/j.jand.2021.09.018.

68. Doan N, Olstad DL, Vanderlee L, Hammond D, Wallace M, Kirkpatrick SI. Investigating the intersections of racial identity and perceived income adequacy in relation to dietary quality among adults in Canada. *J Nutr*. 2022;152(Suppl 1):67s-75s. doi:10.1093/jn/nxac076.
69. *Stata Statistical Software* [Computer software]. Version 15.1. StataCorp LLC; 2021.
70. Ni Mhurchu C, Eyles H, Jiang Y, Blakely T. Do nutrition labels influence healthier food choices? analysis of label viewing behaviour and subsequent food purchases in a labelling intervention trial. *Appetite*. 2018;121:360-365. doi:10.1016/j.appet.2017.11.105.
71. Guthrie JF, Fox JJ, Cleveland LE, Welsh S. Who uses nutrition labeling, and what effects does label use have on diet quality? *J Nutr Educ*. 1995;27(4):163-172. doi:10.1016/S0022-3182(12)80422-5
72. Wahlich C, Gardner B, McGowan L. How, when and why do young women use nutrition information on food labels? a qualitative analysis. *Psychol Health*. 2013;28(2):202-16. doi:10.1080/08870446.2012.716439.
73. Christoph MJ, Loth KA, Eisenberg ME, Haynos AF, Larson N, Neumark-Sztainer D. Nutrition facts use in relation to eating behaviors and healthy and unhealthy weight control behaviors. *J Nutr Educ Behav*. 2018;50(3):267-274.e1. doi:10.1016/j.jneb.2017.11.001.
74. U.S. Food and Drug Administration. The new Nutrition Facts label. Accessed October 20, 2022. <https://www.fda.gov/food/nutrition-education-resources-materials/new-nutrition-facts-label>

75. The White House. *Biden-Harris Administration National Strategy on Hunger, Nutrition, and Health*. 2022.
76. Rana L, Alvaro R. Applying a Health Promoting Schools approach to nutrition interventions in schools: key factors for success. *Health Promot J Austr*. 2010;21(2):106-13. doi:10.1071/he10106.
77. Miller LMS, Beckett LA, Bergman JJ, Wilson MD, Applegate EA, Gibson TN. Developing nutrition label reading skills: a web-based practice approach. *J Med Internet Res*. 2017;19(1):e16-e16. doi:10.2196/jmir.6583.
78. Chau MM, Burgermaster M, Mamykina L. The use of social media in nutrition interventions for adolescents and young adults-A systematic review. *Int J Med Inform*. 2018;120:77-91. doi:10.1016/j.ijmedinf.2018.10.001.
79. Rippe JM, Angelopoulos TJ. Sugars and health controversies: what does the science say? *Adv Nutr*. Jul 2015;6(4):493S-503S. doi:10.3945/an.114.007195.
80. Viswanath K. Public communications and its role in reducing and eliminating health disparities. In: Thomson GE, Mitchell F, Williams MB, eds. *Examining the health disparities research plan of the National Institutes of Health: unfinished business* Institute of Medicine; 2006:215 –253.
81. Yang YC, Walsh CE, Johnson MP, et al. Life-course trajectories of body mass index from adolescence to old age: Racial and educational disparities. *Proc Natl Acad Sci USA*. 2021;118(17):e2020167118. doi:10.1073/pnas.2020167118.
82. Atske S., Perrin A. Home broadband adoption, computer ownership vary by race, ethnicity in the U.S. Pew Research Center. Accessed October 20, 2022.

<https://www.pewresearch.org/fact-tank/2021/07/16/home-broadband-adoption-computer-ownership-vary-by-race-ethnicity-in-the-u-s/>

84. Arnett MJ, Thorpe RJ, Jr., Gaskin DJ, Bowie JV, LaVeist TA. Race, medical mistrust, and segregation in primary care as usual source of care: findings from the Exploring Health Disparities in Integrated Communities Study. *J Urban Health*. Jun 2016;93(3):456-67. doi:10.1007/s11524-016-0054-9.

84. Bloom B, Jones LI, Freeman G. Summary health statistics for U.S. children: National Health Interview Survey, 2012. *Vital Health Stat 10*. Dec 2013;(258):1-81.

85. U.S. Centers for Medicare & Medicaid Services. The Children's Health Insurance Program (CHIP). Accessed October 20, 2022. <https://www.healthcare.gov/medicaid-chip/childrens-health-insurance-program/>

86. Crane MM, Tangney CC, French SA, Wang Y, Appelhans BM. Gender comparison of the diet quality and sources of food purchases made by urban primary household food purchasers. *J Nutr Educ Behav*. 2019;51(2):199-204. doi:10.1016/j.jneb.2018.07.016.

87. Kim EJ, Ellison B, Prescott MP, Nayga RM. Consumer comprehension of the Nutrition Facts label: a comparison of the original and updated labels. *Am J of Health Promot*. 2020;35(5):648-657. doi:10.1177/0890117120983128.

88. McClain AD, Chappuis C, Nguyen-Rodriguez ST, Yaroch AL, Spruijt-Metz D. Psychosocial correlates of eating behavior in children and adolescents: a review. *Int J Behav Nutr Phys Act*. Aug 12 2009;6:54. doi:10.1186/1479-5868-6-54.

89. Rasmussen M, Krølner R, Klepp KI, et al. Determinants of fruit and vegetable consumption among children and adolescents: a review of the literature. Part I:

quantitative studies. *Int J Behav Nutr Phys Act.* Aug 11 2006;3:22. doi:10.1186/1479-5868-3-22.

Table 4.1 Sample characteristics (n=784)¹

Race/ethnicity, n (%)	
White	519 (66.2)
Black	91 (11.6)
Hispanic or Latino	60 (7.7)
Asian/Pacific Islander or Native American	23 (2.9)
Two or more races/ethnicities	88 (11.2)
Age (years), mean (SE)	15.40 (1.1)
Female, n (%)	405 (51.7)
Nutrition Facts label use, n (%)	
Never	169 (21.6)
Rarely	172 (21.9)
Sometimes	263 (33.6)
Often	107 (13.7)
All the time	65 (8.3)
Healthy eating efforts, mean (SE)	4.00 (2.7)
Eat protein	435 (55.5)
Eat less sugar or drink fewer sugary drinks	366 (46.7)
Eat fewer calories	206 (26.3)
Eat less salt	227 (23.0)
Eat vegetables and fruits	513 (65.4)
Drink lots of water	615 (78.4)
Eat whole grains	284 (36.2)
Eat less low-calorie sweeteners	217 (27.7)
Eat less processed foods	272 (34.7)
Nutrition Facts label understanding, n (%)	
Very hard to understand	19 (2.4)
Hard to understand	71 (9.1)
In the middle	273 (34.8)
Easy to understand	271 (34.6)
Very easy to understand	143 (18.2)
Nutrition knowledge, mean (SE)	6.47 (2.2)
Aware of food guide, n (%)	626 (79.9)
Perceived income adequacy, n (%)	
Not enough money	46 (5.9)
Barely enough money	189 (24.1)
Enough money	424 (54.1)
More than enough money	123 (15.7)
Weight change efforts, n (%)	
Nothing	244 (31.1)
Stay the same weight	282 (36.0)
Gain weight	87 (11.1)
Lose weight	169 (21.6)

¹Totals may not sum to 784 or 100% due to missing data

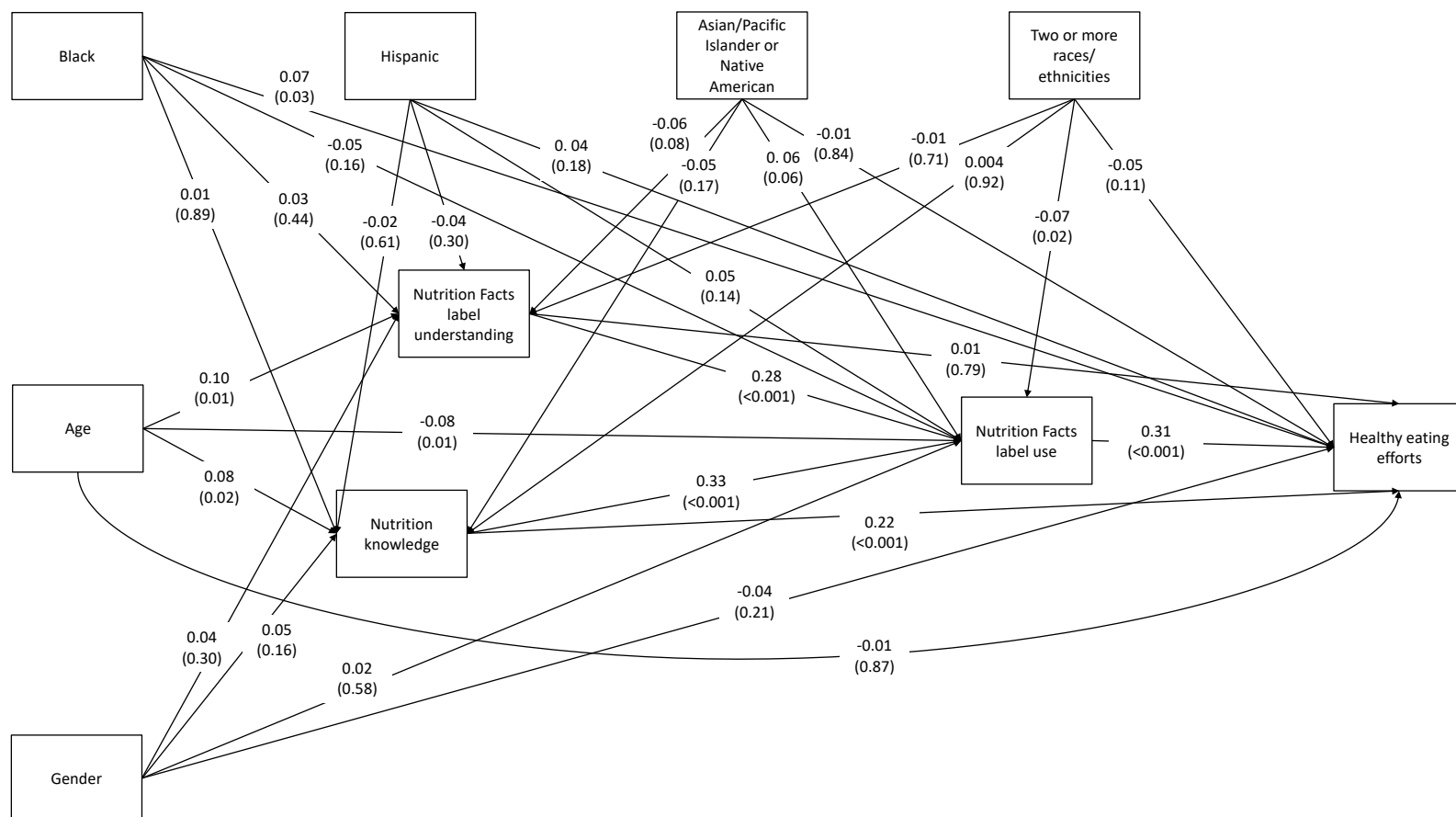


Figure 4.1 Paths from sociodemographic characteristics to Nutrition Facts label (NFL) use and healthy eating efforts⁷

⁷ The figure above shows coefficients and p-values (in parentheses) for the direct paths among sociodemographic characteristics, NFL use, and healthy eating efforts. The analysis controlled for food guide awareness, weight change efforts, and perceived income adequacy. To maintain focus on the primary dependent and independent variables, these covariates are not included in the figure.

Table 4.2 Fixed-effect variables used to estimate paths

Path abbreviation	Description of direct paths
A ₁	Sociodemographic characteristic (e.g., race/ethnicity, age, gender) to NFL understanding
A ₂	Sociodemographic characteristic (e.g., race/ethnicity, age, gender) to nutrition knowledge
X ₁	NFL understanding to NFL use
X ₂	Nutrition knowledge to NFL use

Table 4.3 Estimates of paths illustrated in Figure 1 and the magnitude of indirect effects of sociodemographic characteristics on Nutrition Facts label (NFL) use (n=784)^a

	Paths, β (p-value)				Indirect effects through mediators, β	
Sociodemographic characteristics	Socio-demographic characteristic to NFL understanding (A₁)	Socio-demographic characteristic to nutrition knowledge (A₂)	NFL understanding to NFL use (X₁)	Nutrition knowledge to NFL use (X₂)	Indirect effects through NFL understanding (A₁ x X₁)	Indirect effects through nutrition knowledge (A₂ x X₂)
Race/ethnicity ^b						
Black	0.03 (0.44)	0.01 (0.89)	0.28 (<0.001)	0.33 (<0.001)	0.01	0.002
Hispanic	-0.04 (0.30)	-0.02 (0.61)	0.28 (<0.001)	0.33 (<0.001)	-0.01	-0.006
Asian/Pacific Islander or Native American	-0.06 (0.08)	-0.05 (0.17)	0.28 (<0.001)	0.33 (<0.001)	-0.02	-0.02
Two or more races/ethnicities	-0.01 (0.71)	0.004 (0.92)	0.28 (<0.001)	0.33 (<0.001)	-0.004	0.001
Age	0.10 (0.01)	0.08 (0.02)	0.28 (<0.001)	0.33 (<0.001)	0.03	0.03
Gender ^c						
Girls	0.04 (0.30)	0.05 (0.16)	0.28 (<0.001)	0.33 (<0.001)	0.01	0.02
Food guide awareness	0.10 (0.004)	0.18 (<0.001)	0.28 (<0.001)	0.33 (<0.001)	0.03	0.06
Perceived income adequacy ^d						
Not enough money	-0.09 (0.01)	-0.01 (0.76)	0.28 (<0.001)	0.33 (<0.001)	-0.02	-0.01

Barely enough money	-0.06 (0.08)	-0.04 (0.26)	0.28 (<0.001)	0.33 (<0.001)	-0.03	-0.003
More than enough money	0.11 (0.002)	0.16 (<0.001)	0.28 (<0.001)	0.33 (<0.001)	0.03	0.05
Weight change efforts ^c						
Trying to stay the same weight	0.11 (0.01)	0.15 (<0.001)	0.28 (<0.001)	0.33 (<0.001)	0.03	0.05
Trying to lose weight	-0.04 (0.28)	-0.06 (0.13)	0.28 (<0.001)	0.33 (<0.001)	-0.01	-0.02
Trying to gain weight	0.01 (0.81)	0.06 (0.14)	0.28 (<0.001)	0.33 (<0.001)	0.003	0.02
Total indirect effects	—	—	—	—	0.05	0.17

^aPaths labeled A represent direct paths from sociodemographic characteristics to mediators. Paths labeled X represent direct paths from mediators to NFL use. Indirect effects (the magnitude of effects through each path) were computed by multiplying the regression coefficients along each path (e.g., $A_1 \times X_1$).

^bReferent group: White

^cReferent group: Boys

^dReferent group: Enough money

^eReferent group: Not trying to change or maintain their weight

Table 4.4 Magnitude and percentage of contribution of direct and indirect effects of sociodemographic characteristics on Nutrition Facts label (NFL) use (n=784)

Effect of the sociodemographic characteristics	Estimates contribution (%)
Indirect through mediators	
Paths through NFL understanding ($A_1 \times X_1$)	0.05 (3.74%)
Paths through nutrition knowledge ($A_2 \times X_2$)	0.17 (12.34%)
Direct	1.12 (83.92%)
Total effect	1.34 (100%)

MANUSCRIPT 2

Nutrition Facts Label Use and Weight Change Efforts Among U.S. Adolescents⁸

⁸Mandelbaum, J., Davis, R. E., Frongillo, E.A., Thrasher, J. F., Vanderlee, L., Hammond, D. To be submitted to the *Journal of Nutrition Education and Behavior*.

Abstract

Objective: To examine potential 1) associations between weight change or maintenance efforts and Nutrition Facts label (NFL) use and 2) relationships between three factors (body satisfaction, social media use, and weight teasing) predicted to be associated with weight change or maintenance efforts.

Design: Online cross-sectional survey.

Participants: U.S. adolescents aged 10-17 (n=1,274).

Main Outcome Measures: Weight change or maintenance efforts was measured by asking what respondents were trying to do about their weight (“not trying to change weight,” “maintain weight,” “gain weight,” or “lose weight”). NFL use was measured by asking if respondents used the NFL when deciding what to eat or buy.

Analysis: Associations between weight change or maintenance efforts and NFL use were tested using linear regression. Multinomial logistic regression was used to examine associations between body size satisfaction, weight teasing, and social media use, respectively, with weight change or maintenance efforts.

Results: Adolescents trying to maintain ($b=0.54$, $p<0.001$), gain ($b=0.33$, $p=0.001$), or lose weight ($b=0.38$, $p<0.001$) were more likely to use the NFL than those not trying to change their weight. Compared to adolescents who were satisfied with their body size, those who perceived their body as smaller than ideal were more likely to try to gain weight (relative risk ratio [RRR]=9.85, $p<0.001$), and those who perceived their body as larger than ideal were less likely to be trying to gain weight (RRR=0.29, $p=0.03$) and more likely to be trying to lose weight (RRR=12.97, $p<0.001$). Overall, adolescents who had experienced weight teasing were more likely to engage in weight change or

maintenance efforts than adolescents who had not been teased for their weight. The largest effect was observed on trying to lose weight (RRR=4.29, $p<0.001$). Among all adolescents, more time on social media was associated with trying to lose weight (RRR=1.17, $p=0.02$).

Conclusions and Implications: The establishment of healthy eating behaviors during adolescence is important because nutrition habits established during this time period are likely to carry into adulthood. Education campaigns about using the NFL could target adolescents engaging in weight change or maintenance efforts in order to promote healthy use of the NFL. These findings also point to the need for targeted efforts to promote body size satisfaction, reduce weight teasing, and encourage social media literacy among adolescents, which may help adolescents achieve and maintain healthy eating practices.

Introduction

The U.S. Nutrition Facts label (NFL) can be a convenient, cost-effective source of nutrition information,^{1,2} as it is present on most packaged food products in the U.S.³ Previous research suggests that adolescents who use the NFL are more likely to engage in healthy eating behaviors, including consuming fewer sugary beverages,⁴ more fruits and vegetables,⁴ more protein,⁵ less sugar,⁵ and fewer sugary drinks).⁵ Research suggests that most adolescents, however, are not using the NFL; a study using nationally representative data found that only 37.6% of U.S. adolescents between ages 16 and 19 reported sometimes or always using the NFL.⁶ Research is needed to better understand the influences on NFL use among U.S. adolescents, as the nutrition and health habits they establish at this age will carry into adulthood.⁷⁻⁹

Weight Change or Maintenance Efforts and Nutrition Facts Label Use

Weight change or maintenance efforts appear to have a strong influence on NFL use. Weight change or maintenance efforts refer to actions an individual takes with regard to their body weight, such as actions undertaken to maintain, lose, or gain weight.¹⁰ Recent data indicate that most U.S. adolescents are attempting to change their weight and that these efforts are especially common among girls.^{11,12} Nationally representative data indicate that 45.2% of adolescent girls attempted to lose weight in the past year in the U.S., as compared to 30.1% of adolescent boys.¹² Previous studies have suggested that individuals may self-regulate their behavior (e.g., monitoring their food intake) to achieve weight-related goals.¹³⁻¹⁵ Few studies have examined how weight change or maintenance efforts may be associated with NFL use, and none have explored these relationships among adolescents. Studies among adults, however, suggest that people engaging in

weight change or maintenance efforts are more likely to report using the NFL^{16,17} For example, compared to U.S. adults who did not have a weight change intention, adults wanting to lose weight were 67% more likely to use the NFL, those wanting to gain weight were 37% more likely to use the NFL, and those wanting to maintain weight were 36% more likely to use the NFL¹⁷ Another study of U.S. adults aged 20 and older found that those engaging in any weight loss activities (e.g., diet and physical activity behaviors) were 92% more likely to use the NFL than those not trying to lose weight.¹⁶ NFL use is more strongly associated with weight change efforts than weight status (i.e., body mass index (BMI)),¹⁷ suggesting that a desire to change one's weight may be a better predictor of NFL use than BMI.

Relationships between weight change or maintenance efforts and NFL use may differ among girls and boys. For example, girls have been found to be more likely than boys to report always reading the NFL.¹⁸ Studies among adults also consistently show that women use the NFL more than men.^{17,19,20} One possible explanation is that men may be more likely than women to use intuitive eating,²¹ which is based on the idea that people eat when hungry and stop when satiated, rather than restricting the type of food they consume.²² Girls may therefore be more likely than boys to use the NFL when trying to meet their weight-related goals.

Body Size Satisfaction and Weight Change or Maintenance Efforts

Body size satisfaction may also be an important influence on weight change or maintenance efforts among U.S. adolescents. Body size satisfaction refers to the extent to which an individual is satisfied with their physical appearance, with an emphasis on shape and weight,²³ and it is often measured by a respondent's agreement with the

statement, “I like the way my body looks”.^{24,25} Body size dissatisfaction is associated with several unhealthy adolescent weight control practices,²⁶⁻³² suggesting that body size dissatisfaction is more than “simply a harmless form of self-assessment”.^{33(p521)} For example, female adolescents who reported being highly dissatisfied about their weight were more than five times as likely to binge eat than adolescents who did not report such concerns.³⁴ Adolescents with lower body size satisfaction are also more likely to restrict their diets,^{35,36} binge eat,^{37,38} have bulimic symptoms,^{35,39} and engage in emotional eating.³⁹ As their bodies and both intra- and interpersonal relationships change, adolescents tend to be particularly attuned to their physical appearance.⁴⁰ Psychology research suggests that how adolescents perceive their physical appearance is the most significant predictor of their general sense of self (e.g., how adolescents think of themselves in terms of social acceptance, popularity, and romantic appeal).⁴¹ Previous research has found that achieving a desired appearance is an important objective for adolescents wanting to lose weight.⁴² The relationship between body size satisfaction and weight change or maintenance efforts could be explained by regulatory focus theory, which suggests that individuals who view themselves as having further from socially acceptable body types (i.e., lower body size satisfaction) have higher motivation to self-regulate their weight,^{43,44} either to prevent social rejection or to be perceived as more attractive.⁴⁵

Adolescent girls tend to be less satisfied with their body size, have different body concerns, and have different standards for body ideals than boys. Previous research suggests that approximately 24-46% of adolescent girls and 12-26% of adolescent boys report being dissatisfied with their bodies.⁴⁶ Girls and boys also have different

developmental trajectories regarding body size satisfaction; among girls, body size dissatisfaction tends to remain stable or increase during adolescence, while among boys, it tends to decrease over time.⁴⁷ These different trajectories may be due, in part, to differences in primary body concerns for girls and boys. While girls often aspire to thinness,⁴⁸ boys are driven more by a desire to obtain a lean and muscular body.⁴⁹ Compared to boys and men, girls and women also view body size as a more important indicator of their self-worth.⁵⁰ Further, body ideals for boys and men tend to include more divergent body types, including average weight men, while the standards for body ideals for girls and women are more homogenous.⁴⁸ These findings suggest that it may be important to examine the relationships between body size satisfaction and weight change of maintenance efforts separately for girls and boys.

Weight Teasing and Weight Change or Maintenance Efforts

Adolescents experiencing weight teasing, which is a form of weight bias in which peers or family members mock an individual for being underweight or overweight,⁵² may internalize biases about their body size and, thus, be more likely to seek out ways to engage in weight change or maintenance efforts. Weight teasing can be expressed indirectly or directly through subtle to harsh comments about an individual's weight.⁵³ A recent study estimated that 34.1% of U.S. adolescents had ever been teased for their weight.⁵⁴ People who are teased about their weight are more likely to have adverse psychological and behavioral outcomes, including mood or anxiety disorders and higher all-cause mortality risk.^{55,56} The adverse effects of weight teasing can also extend into adulthood.⁵⁷ Weight teasing is a social identity threat so pervasive that it has been reported by children as young as three years old.⁵⁸⁻⁶⁰ Adolescents who experience weight

teasing may attempt to alleviate teasing through weight change or maintenance efforts in order to bring their appearance closer to ideal.⁶¹ Rather than encouraging healthy weight management behaviors, however, weight-based teasing may discourage exercise,⁶² increase unhealthy weight control behaviors (e.g., binge eating, skipping meals, using laxatives),⁶³ or decrease self-regulation.^{53,56,64} Based on the current literature, it is unclear if weight teasing is associated with healthy or unhealthy food-related behaviors.

Weight teasing may have differential effects on girls and boys, as adolescent girls experience more weight teasing than boys and are more negatively affected by it.⁶⁵ Recent research found that 36.6% of U.S. girls had ever been teased for their weight, compared to 31.3% of boys ($p < 0.05$).⁵⁴ Additionally, a meta-analysis with studies among adolescents and adults found that the positive association between weight teasing and body size dissatisfaction was stronger among girls than boys.⁶⁶ Girls may experience weight teasing as more hurtful, while boys may value other aspects of their appearance more highly.⁶⁷ Gendered patterns of weight teasing also persist into adulthood. For example, a longitudinal study of U.S. adolescents found that girls who teased about their weight by family members had unhealthy weight change behaviors in later adolescence, although this same relationship was not found among boys.⁶⁷ These studies suggest that weight teasing may affect girls and boys differently, and that the effects of weight teasing may last beyond adolescence for girls.

Social Media Use and Weight Change or Maintenance Efforts

Social media has been shown to influence body image perceptions among adolescents, prompting them to engage in weight change or maintenance efforts to bring their body more in line with the body ideals they see pictured on social media.⁶⁸ The

internet and social media are nearly ubiquitous in adolescents' lives. In a 2018 Pew Research Center survey of U.S. adolescents aged 13 to 17 years, 45% of teenagers said they used the internet "almost constantly," and an additional 44% reported going online several times a day.⁶⁹ Recent reports show that more than 90% of adolescents have at least one social media account.⁷⁰ Researchers posit that spending more time engaged with social media and/or on the internet reduces time spent on other activities that have more beneficial effects on adolescents' well-being (the "crowding out" hypothesis).⁷¹ Social media also promotes frequent appearance-based comparisons between the user and the images appearing on-screen.⁷² The effect of social media use on weight change or maintenance efforts during adolescence is an important topic given the social and emotional development happening during this period.³²

Social media use may have a different impact on girls' weight change or maintenance efforts than boys. For one, girls engage and invest in body-related content more than boys.⁶⁸ Social media tends to have a more negative effect on girls' body image, while boys are more likely to feel that bodies shown on social media are a motivating influence.⁷³ Girls were also more likely to use social media sites like Facebook and Instagram to stay in contact with friends and post information about themselves online compared to boys, who were more likely to use social media for gaming.¹⁰⁹ The types of social media girls use most often (i.e., image-focused social media such as Facebook and Instagram) have been shown to promote internalizing symptoms (e.g., depression, anxiety, worry).¹¹⁰ Girls are also more likely to compare their bodies to standards portrayed in their social media feeds.⁶⁸ Adolescent girls may be especially vulnerable to being influenced by images on social media because of the

psychosocial developmental phase they are in.⁷⁴ Boys, on the contrary, tend to exhibit more active coping styles and greater positive agency over their social media use.⁶⁸ These studies suggest that social media use may prompt adolescents to internalize gendered body ideals (e.g., for extreme thinness among girls and muscularity among boys).⁶⁷ Internalization of body ideals, in turn, has been associated with an increase in weight change or maintenance efforts among adolescents.^{75,76}

The goals of the current study were to examine potential 1) associations between weight change or maintenance efforts and Nutrition Facts label (NFL) use and 2) relationships between three factors (body satisfaction, social media use, and weight teasing) predicted to be associated with weight change or maintenance efforts. The authors hypothesized that adolescents engaged in weight change or maintenance efforts would be more likely to use the NFL than adolescents not trying to change their weight. It was anticipated that NFL use would be most strongly associated with weight loss efforts among girls and weight gain efforts among boys. The authors also hypothesized that adolescents who perceived their bodies to be larger than ideal would try to lose weight, whereas adolescents who perceived their bodies to be smaller than ideal would try to gain weight. The authors further expected that engagement in weight change or maintenance efforts would be associated with perceiving one's body to be larger than ideal among girls and perceiving one's body to be smaller than ideal among boys. The authors also hypothesized that adolescents being teased about their weight would be more likely to engage in weight change or maintenance efforts than adolescents not experiencing weight tease. It was anticipated that weight teasing would be associated with weight loss efforts among girls and weight gain efforts among boys. Lastly, the

authors hypothesized that adolescents who spent more time using social media would be more likely to engage in weight change or maintenance efforts than those who spent less time on social media. It was anticipated that girls' social media use would be associated with weight loss efforts, while boys' social media use would be associated with weight gain efforts.

Methods

Data Source

Data came from the International Food Policy Study (IFPS), which is an annual, repeated cross-sectional online survey of trends in dietary patterns and policy-relevant behaviors in the U.S. and five other countries. The IFPS Youth Survey received funding from the Public Health Agency of Canada and the Canadian Institutes of Health Research. Data from the 2019 IFPS Youth Survey conducted in the U.S. (n=1,261) were used, as this was the last year of data collected before the COVID-19 pandemic. Data were collected online between November and December 2019.

Participants were recruited through the Nielsen Consumer Insights Global Panel, which used probability and non-probability sampling. Panelists for the adult studies received email invitations from Nielsen and were screened to identify whether they had any children aged 10-17 living in their household.⁷⁷ Parents or guardians of a potentially eligible child were then provided information about the IFPS, after which informed consent was administered to parents regarding their child's participation. Parents then passed the survey directly to their child, who was screened directly to confirm that they met the eligibility criteria based on age and gender quotas. Eligible adolescents provided assent before being proceeding to the survey. Only one child in each household was

eligible to participate in the survey. In order to be eligible to participate in the study, the child had to be between the ages of 10 and 17 years, male or female, and meet data quality standards (i.e., correctly stating their region, correctly answering a quality check question located two-thirds through the questionnaire, spending more than 10 minutes completing the survey). The study aimed to recruit a 50-50 split of boys and girls, as well as a 50-50 split of younger (age 10-13) and older (age 14-17) adolescents. Quotas were applied to ensure that the survey included a diverse sample.

Data Collection

A total of 16,596 U.S. adolescents were invited to participate in the survey, of which 1,603 (9.7%) completed the survey and met data quality standards. Based on the American Association for Public Opinion Research Cooperation Rate #2, the survey cooperation rate was 79.8%.⁷⁸ Each adolescent's parent/guardian was compensated by the Nielsen Consumer Insights Panel with points-based or monetary rewards that could be exchanged for electronic gift cards, donations, cash, and/or chances to win monthly prizes.

The survey was administered online using a computer or a mobile device, which allowed the research team to include product images. The survey was conducted in either English or Spanish, depending on the participant's preference, and took an average of 22 minutes for English speakers and 24 minutes for Spanish speakers to complete. All study protocols were reviewed by the University of Waterloo Research Ethics Committee and the University of South Carolina Institutional Review Board.

Measures

Nutrition Facts label use. This measure was adapted from an item included in the 2014 Food and Drug Administration Health and Diet Survey.⁷⁹ Respondents were shown an image of the U.S. Nutrition Facts label before its 2020/2021 update and asked, “Do you use this type of food label when deciding what to eat or buy?” The responses were coded as 1=“never”, 2=“rarely”, 3=“sometimes”, 4=“often”, and 5=“all the time.” This NFL use question was only administered to respondents who said that they had seen the NFL on packages or in stores “rarely”, “sometimes”, “often” or “all the time.” NFL use responses for adolescents who said they had “never” seen the NFL (i.e., the NFL use question was not administered; n=14) were recoded as “never” having used the NFL.

Weight change or maintenance efforts. This measure was adapted from similar measures used in the National Health and Nutrition Examination Survey⁸⁰ and other studies with adolescents and young adults.^{10,81,82} Respondents were asked, “Which of the following are you trying to do about your weight?” Responses were coded as 1=“not trying to change weight” (the referent group), 2=“maintain weight”, 3=“gain weight”, and 4=“lose weight.”

Body size satisfaction. Body size satisfaction was derived from participants’ responses to items measuring body size ideal and body size perceptions. For both items, participants were shown a sex-specific, eight-figure body rating scale. *Body size perception* was subsequently assessed by asking, “Which picture looks most like your body shape?” *Body size ideal* was assessed by asking, “Which picture looks most like how you want your body to look?” Responses to both items were coded on a scale from 1 (far left/thinnest image) to 8 (far right/largest image). The body size satisfaction variable

was created by first subtracting participants' *body size ideal* scores from their *body size perception* scores, as consistent with previous studies.^{29,43,81,83} These initial scores ranged from -7 to 6, with negative scores representing adolescents who felt their body was smaller than their perceived ideal, positive scores representing adolescents who felt their body was larger than their perceived ideal, and zero scores indicating that participants were satisfied with their body size. These scores were divided into terciles, with 1=adolescents who perceived their body as smaller than ideal, 2=adolescents who were satisfied with their body size (the referent group), and 3=adolescents who perceived their body as larger than ideal.

Weight teasing. This measure was adapted from an item used in a previous study with adolescents.⁸⁴ Respondents were asked, "Do you get teased or made fun of because of your weight?" Responses included 1="all the time", 2="a lot", 3="sometimes", 4="rarely", and 5="never." Due to low variability in responses, "never" responses were recoded as 0, whereas all other responses (1="all the time" through 4="rarely") were coded as 1.

Social media use. This measure was developed by the IFPS team. Respondents were asked, "On a normal weekday, how much time do you spend on social media (including messaging, posting, or liking posts)?" The response options included "0 hours", "up to 15 minutes", "up to 30 minutes", "up to 1 hour", "up to 2 hours", "up to 3 hours", "up to 4 hours", and "more than 4 hours." Responses were recoded as 1=0 hours, 2=0.25 hours, 3=0.50 hours, 4=1 hour, 5=2 hours, 6=3 hours, 7=4 hours, and 8=more than four hours.

Gender. Respondents reported whether they were male or female during the eligibility screener. Adolescents who reported “don't know” or “refuse to answer” for this variable were excluded from the analysis.

Control variables. *Perceived income adequacy* was measured using an adapted question from a self-rated economic status indicator used in prior research with adolescents:⁸⁵ “Does your family have enough money to pay for things your family needs?” Values included 1=“not enough money”, 2=“barely enough money”, 3=“enough money”, and 4=“more than enough money.” Perceived income adequacy was used as a proxy for household income, as actual household income was not collected because it was believed that adolescents would not be able to adequately report this. This subjective income measured allowed respondents to consider other economic indicators, such as wealth and cost of living, when making their assessment,⁸⁶ and was believed to better capture social processes rooted in economic marginalization.⁸⁷ *NFL understanding* was assessed by showing respondents an image of a NFL and asking them how hard or easy they found the information to understand.⁸⁸ Responses were coded from 1=“very hard to understand” to 5=“very easy to understand.” *Food guide awareness* and nutrition knowledge measures were adapted from a prior study among Canadian adults.⁸⁹ Food guide awareness was assessed by asking “Have you ever heard of MyPlate or the Food Guide Pyramid?” with “yes” responses coded as 1 and “no” responses coded as 0. *Nutrition knowledge* was measured by asking respondents to rate their knowledge of healthy eating and nutrition on a scale from 0 (“nothing”) to 10 (“a lot”). *BMI z-scores* were calculated from self-reported height and weight. Values flagged as extreme (≤ 5 or > 5)⁹⁰ were recoded as missing (n=25). Single items were used to measure race (white,

Black, Hispanic or Latino, Asian/Pacific Islander, two or more races/ethnicities)⁹¹ and age (between 10 and 17 years).

Data Analysis

The analytic sample included 1,274 adolescents (626 girls and 648 boys). Data were analyzed using Stata statistical software version 15.1.⁹² Responses coded as “don’t know” and “refuse to answer” were recoded as missing. Descriptive statistics were used first to summarize the sample characteristics. The association between weight change or maintenance efforts and nutrition facts label use was then tested using linear regression. Since different relationships were expected among girls than among boys, this analysis was stratified by gender. Both models controlled for perceived income adequacy, NFL understanding, food guide awareness, nutrition knowledge, race/ethnicity, and age, as previous research suggests these factors may confound the relationship between weight change or maintenance efforts and NFL use.^{24,32,93,94} Multinomial logistic regression was then used to examine associations between the independent variables (body size satisfaction, weight teasing, and social media use, respectively) and weight change or maintenance efforts (maintain, gain, or lose weight, with not trying to change weight as the referent category). These models were stratified by gender and controlled for BMI, perceived income adequacy, race/ethnicity, and age to reduce potential confounding.^{27,46,57,67,68}

Results

The sample was 50.9% girls (n=648) and 49.1% boys (n=626; p=0.54; Table 4.5). Adolescents in the sample ranged in age from 10-17 years, with a mean age of 13.61 years (SE=0.06). Most adolescents in the sample were white (66.3%), followed by two or

more races/ethnicities (12.8%) or Black (11.2%). The sample had a higher percentage of girls identified as Asian or Pacific Islander (4.2%) than boys (1.8%; $X^2 = 6.39$, $p=0.01$). Most adolescents (65.9%) were trying to do something about their weight: 20.9% were trying to lose weight, 34.9% were trying to maintain weight, and 10.1% were trying to gain weight. A higher percentage of girls (23.8%) were trying to lose weight compared to boys (17.9%; $X^2 = 6.65$, $p=0.01$), while a higher percentage of boys (14.4%) were trying to gain weight compared to girls (6.0%; $X^2 = 24.44$, $p<0.001$). Most adolescents (51.6%) reported using the NFL sometimes, often, or all the time. No gender differences in NFL use were observed.

Fewer than half (45.5%) of adolescents perceived their body size as ideal, while 18.8% perceived their body size as smaller than ideal, and 35.8% perceived their body size as larger than ideal. A higher percentage of boys reported their body size as smaller than ideal (23.0%) than girls (14.7%; $X^2 = 14.54$, $p<0.001$). Girls were more likely to report their body size as larger than ideal (39.0%) than boys (32.4%; $X^2 = 6.06$, $p=0.01$). About a third of adolescents (31.4%) had been teased for their weight, but no differences by gender were observed. Adolescents spent an average of 1.61 weekday hours (standard error (SE)=0.05) on social media. Girls spent an average of 1.88 weekday hours on social media, compared to 1.32 hours among boys ($p<0.001$).

Weight Change or Maintenance Efforts and Nutrition Facts Label Use

Compared to adolescents not trying to change their weight, those trying to maintain ($b=0.54$, $p<0.001$), gain ($b=0.33$, $p=0.001$), or lose weight ($b=0.38$, $p<0.001$) were more likely to use the NFL (Table 4.6). Among girls, those trying to maintain ($b=0.63$, $p<0.001$) or lose ($b=0.42$, $p<0.001$) weight had a higher likelihood of using the

NFL than those not trying to change their weight. Girls trying to gain weight were not more likely to use the NFL than girls not trying to change their weight ($b=0.31$, $p=0.08$). Among boys, those trying to maintain ($b=0.45$, $p<0.001$), gain (0.32 , $p=0.01$), or lose ($b=0.33$, $p=0.01$) weight were more likely to use the NFL than those not trying to change their weight.

Body Size Satisfaction and Weight Change Efforts

Compared to adolescents who were satisfied with their body size, those who perceived their body as smaller than ideal were more likely to try to gain weight (relative risk ratio [RRR]=9.85, $p<0.001$; Table 4.7), while those who perceived their body as larger than ideal were less likely to be trying to gain weight (RRR=0.29, $p=0.03$) and more likely to be trying to lose weight (RRR=12.97, $p<0.001$). Body size satisfaction was not associated with efforts to maintain weight. These findings among all adolescents were similar to those for girls and boys, respectively (Tables 4.8-4.9). For example, adolescents who perceived their body as larger than ideal were more likely to be trying to lose weight (among girls: RRR=11.21, $p<0.001$; among boys: RRR=18.53, $p<0.001$).

Weight Teasing and Weight Change Efforts

Overall, adolescents who had experienced weight teasing were more likely to engage in all weight change or maintenance efforts than adolescents who had not been teased (Table 4.7). Adolescents who had experienced weight teasing were more likely to try to maintain (RRR=1.96; $p<0.001$) or gain (RRR=3.68, $p<0.001$) weight, with the largest effect observed on trying to lose weight (RRR=4.29, $p<0.001$). Weight teasing was positively associated with all weight change and maintenance efforts for both girls and boys (Tables 4.8-4.9). Among girls, weight teasing had the largest effect on trying to

gain weight (RRR=3.48, $p=0.01$). Among boys, weight teasing had the largest effect on efforts to lose weight (RRR=6.74, $p<0.001$).

Social Media Use and Weight Change Efforts

Among all adolescents, more time on social media was associated with trying to lose weight (RRR=1.17, $p=0.02$; Table 4.7). Time on social media was not associated with efforts to maintain ($b=1.05$, $p=0.34$) or gain ($b=1.07$, $p=0.42$) weight. Among girls, social media use was not associated with any weight change or maintenance efforts (Table 4.8). Among boys, social media use was associated with trying to maintain weight (RRR=1.22, $p=0.01$) and trying to lose weight (RRR=1.23, $p=0.049$; Table 4.9).

Discussion

As predicted, adolescents in this study who were engaged in any weight change or maintenance efforts (i.e., trying to maintain, gain, or lose weight) were more likely to report using the NFL than those not trying to change their weight. This finding suggests that U.S. adolescents may use the NFL to self-regulate their dietary intake to achieve weight-related goals.^{13,14} Trying to maintain weight was most strongly associated with NFL use, suggesting that the NFL may be viewed more as a tool for maintaining weight than for gaining or losing weight. Among boys, all weight change efforts were associated with NFL use. In contrast, trying to maintain or lose weight were associated with NFL use only among girls. These findings may reflect gender differences in deeply ingrained social norms around weight-related goals. For example, girls' weight goals tend to be driven by a desire to be thin, while boys are most often motivated to gain muscle mass.³² These findings should be interpreted with caution, however, as fewer than 40 girls in the sample were trying to gain weight.

Consistent with the extant literature and regulatory focus theory,⁴³⁻⁴⁵ adolescents who viewed their bodies as smaller or larger than ideal reported taking actions to bring their body size more in line with their perceived ideal (i.e., those smaller than ideal tried to gain weight, while those larger than ideal tried to lose weight). These findings are consistent with prior research indicating that body size satisfaction may be a strong driver of weight change or maintenance efforts among U.S. adolescents⁹⁵⁻⁹⁷ and suggests that adolescents may engage in weight change or maintenance efforts to counteract body size dissatisfaction.

From a public health perspective, the hope is that adolescents will use tools like the NFL to make more informed, healthy choices to meet their weight-related goals, adolescents with body size dissatisfaction may take unhealthy or dangerous actions to align their body with their perceived ideal. For example, body size dissatisfaction has been linked to an increased risk for eating disorders, depressed mood, and weight gain among adolescents and adults of all genders.⁵¹ Previous studies among U.S. adolescents have found that lower body size satisfaction is associated with unhealthy weight control behaviors that may lead to poorer overall health and weight gain,^{29,30,32} although studies among European adolescents suggest that body size dissatisfaction is associated with higher intake of healthy foods.^{98,99} Research has also shown that body size dissatisfaction has a stronger, more negative impact on body self-esteem among girls in the U.S. than boys.⁴⁷ Given that more than half of U.S. adolescents in this sample thought their body was larger or smaller than ideal, adolescents may benefit from efforts by their primary care providers, with whom they may have built a long-term professional relationship, to provide preventive screening and identification of unhealthy weight change efforts or

disordered eating.^{100,101} Previous research has also found that motivational interviewing can help adolescents and their families feel more invested in healthy behavior change.¹⁰²

The positive relationship that was observed between weight teasing and all weight change or maintenance efforts is consistent with social comparison theory, which describes the process through which social comparisons influence identity development.^{103,104} as weight teasing may shape adolescents' perceptions of what ideal body types look like.¹⁰³ Research has found that weight teasing is associated with lower appearance esteem among girls than boys,¹⁰⁵ which may translate to different weight management goals by gender (e.g., a drive for thinness among girls and muscularity among boys).³² While it was hypothesized weight teasing would be associated with weight loss efforts among girls and weight gain efforts among boys, the current study found that weight teasing had the opposite effects. Weight teasing had the largest effect on trying to gain weight among girls and on efforts to lose weight among boys. This finding among girls is supported by some literature suggesting that girls who experience weight teasing are more likely to engage in binge-eating behavior or experience weight gain.¹⁰⁶⁻¹⁰⁹ The literature on adolescent weight teasing, however, focuses on weight gain instead of efforts to gain weight, as was used in the present study. Future research may be needed to disentangle the effects of weight teasing on weight intentions.

While time on social media was associated with weight loss among adolescents overall, there was no association with weight change or maintenance efforts among girls. One possible explanation is that girls have more social support for their appearance at this age than boys.¹¹⁰ For instance, previous research suggests that friendship groups share

similar views and behaviors related to body image and dieting.¹¹¹ Girls may therefore not be as influenced by images on social media as boys.

Limitations

This study only included adolescents who identified as male or female, and, based on the question wording, it is not clear whether respondents were thinking of biological sex or gender. Adolescents who reported “don't know” or “refuse to answer” for this variable were excluded from the analysis. It is estimated that 2.7% of high school students identify as transgender, genderqueer, genderfluid, or are unsure about their gender identity.¹¹² Since disordered eating and body size dissatisfaction may be more common among sexual and gender minority populations than cisgender heterosexual adolescents,¹¹³ future research that includes all gender identities may reveal different findings. Body size dissatisfaction in sexual and gender minority populations may be mediated, in part, by gender dysphoria (i.e., psychological distress that occurs when a person's sex assigned at birth does not align with their gender identity).^{113,114}

Additionally, the weight teasing measure also did not specify who was doing the teasing. Previous studies have found differences in the effects of teasing done by different groups (e.g., family, close friends, schoolmates).^{67,104} For example, adolescents who have experienced weight teasing from family members may have lower appearance and weight esteem¹⁰⁴ and be more likely to engage in unhealthy weight control behaviors in early adulthood⁶⁷ than adolescents who are teased by their peers. Adolescents in this study were also not asked about the actions they were taking to change their weight (e.g., eating and exercise behaviors). It is therefore unclear if body size satisfaction, weight teasing, and social media use are driving adolescents to engage in unhealthy weight management

behaviors. This topic may be an important direction for future research, as previous studies have found that body dissatisfaction is positively associated with both unhealthy weight control practices (e.g., restrictive dieting and binge eating)³⁵⁻³⁸ and higher intake of healthy foods.^{98,99}

This study used complete case analysis, which removed participants with missing data for any of the study variables. The outcome variables, weight change efforts and NFL use, were missing at random. BMI z-scores, however, were missing for 14.5% of the sample, and post-hoc analyses found that adolescents with missing BMI z-scores were more likely to be younger (OR=0.87, $p=0.001$) or Black (OR=1.66, $p=0.025$). Excluding these participants may introduced bias because the missing BMI z-scores are not random. As this study used cross-sectional data, we were also unable to determine whether adolescents exposed to the NFL were more likely to try to change their weight or vice versa. Lastly, respondents were shown an image of the U.S. NFL before it was updated in 2020/2021. Thus, it is possible that adolescents may use the slightly updated NFL more frequently than observed in the present study.

Implications for Research and Practice

Adolescents engaged in weight change or maintenance efforts were more likely to use the NFL, which could be used to inform programs and policies targeting healthier eating. For example, previous research suggests that education campaigns to promote using the NFL to make healthy food choices can be delivered in schools or through social media.¹¹⁵⁻¹¹⁷ Future campaigns could also teach adolescents how to properly use the NFL to manage adolescent weight concerns in a safe way. Previous research from outside of

the U.S. has also found that front-of-package warning labels may discourage adolescents and their parents from choosing foods with limited nutritional value.¹¹⁸⁻¹²⁰

Targeted efforts are needed to promote body size satisfaction, reduce weight teasing, and encourage social media literacy among adolescents, which may help adolescents achieve and maintain healthy eating practices. More than half of adolescents in the current study were dissatisfied with their weight, and body size dissatisfaction was associated with weight change or maintenance efforts among both girls and boys. School-based interventions focusing on increasing self-esteem and life skills have produced modest improvements in body size satisfaction,^{18,35,89} which may combat decline in body size satisfaction over time and adverse impacts, such as unhealthy weight change efforts.^{31,91}

Findings from the current study also provide further support for the need for interventions to improve adolescents' social media literacy, which have been shown to help adolescents learn to critically evaluate messages and images on social media that can contribute to a negative body image.⁹³ Such programs have also been found to moderate the negative impact of social media use on dietary restraint among girls.⁹⁴ Findings from the current study potentially have far-reaching implications for adolescent health, given that most adolescents have at least one social media account.⁷⁰ These findings suggest that time on social media could be encouraging a substantial number of adolescents to engage in weight change or maintenance efforts.

Further, the gendered effects of weight teasing is an understudied topic.⁶⁷ Previous research suggests that weight teasing during adolescents may be associated with unhealthy weight management behaviors among women in adulthood, but not among

men.⁴⁶ In the current study, weight teasing had an effect on both boys' and girls' weight change or maintenance. This finding points to the need for further research to examine both the short-term impacts of weight teasing among boys and long-term consequences that may not be related to weight (e.g., psychological impacts). About a third of adolescents in this sample had been teased for their weight, which highlights the pervasiveness of this problem. Previous research has found that adolescents experiencing weight-based teasing preferred interventions from friends and peers, social/emotional support (e.g., encouragement), and those focused on consequences for perpetrators of the teasing (e.g., verbal warnings) by parents and teachers.¹²¹ Governmental resources, such as the StopBullying.gov website run by the U.S. Department of Health and Human Services, may provide parents, teachers, and other adults with useful resources to prevent bullying and cultivate safer schools and communities.¹²² Future research could also examine whether the factors examined in the current study (body size satisfaction, weight teasing, and social media use) are driving adolescents to lose weight who do not need to, or to engage in other unhealthy behaviors. It is important to establish healthy eating behaviors during adolescence, as the nutrition and health habits established during this time period are likely to carry into adulthood.⁷⁻⁹

References

1. Buyuktuncer Z, Ayaz A, Dedebyraktar D, Inan-Eroglu E, Ellahi B, Besler HT. Promoting a healthy diet in young adults: the role of nutrition labelling. *Nutrients*. 2018;10(10):1335. doi:10.3390/nu10101335.
2. Campos S, Doxey J, Hammond D. Nutrition labels on pre-packaged foods: a systematic review. *Public Health Nutr*. 2011;14(8):1496-506. doi:10.1017/S1368980010003290.
3. Miller LMS, Cassady DL. The effects of nutrition knowledge on food label use. a review of the literature. *Appetite*. 2015;92:207-216. doi:10.1016/j.appet.2015.05.029.
4. Haidar A, Carey FR, Ranjit N, Archer N, Hoelscher D. Self-reported use of nutrition labels to make food choices is associated with healthier dietary behaviours in adolescents. *Public Health Nutr*. 2017;20(13):2329-2339. doi:10.1017/s1368980017001252.
5. Mandelbaum J, Davis RE, Frongillo E, Thrasher JF, Vanderlee L, Hammond D. Nutrition Facts Label Use, Healthy Eating Efforts, and Sociodemographic Characteristics Among U.S. Adolescents. N.D.
6. Wojcicki JM, Heyman MB. Adolescent nutritional awareness and use of food labels: results from the National Nutrition Health and Examination Survey. *BMC Pediatr*. 2012;12:55-55. doi:10.1186/1471-2431-12-55.
7. Hu T, Jacobs DR, Jr., Larson NI, Cutler GJ, Laska MN, Neumark-Sztainer D. Higher diet quality in adolescence and dietary improvements are related to less weight gain during the transition from adolescence to adulthood. *J Pediatr*. 2016;178:188-193.e3. doi:10.1016/j.jpeds.2016.08.026.

8. Nelson MC, Story M, Larson NI, Neumark-Sztainer D, Lytle LA. Emerging adulthood and college-aged youth: an overlooked age for weight-related behavior change. *Obesity*. 2008;16(10):2205-2211. doi:10.1038/oby.2008.365.
9. Winpenny EM, Penney TL, Corder K, White M, van Sluijs EMF. Change in diet in the period from adolescence to early adulthood: a systematic scoping review of longitudinal studies. *Int J Behav Nutr Phys Act*. 2017;14(1):60-60. doi:10.1186/s12966-017-0518-7.
10. Hammond D, White CM, Rynard VL, Vanderlee L. International Food Policy Study: technical report – 2019 youth survey. 2021. <http://foodpolicystudy.com/methods>
11. Houle-Johnson SA, Kakinami L. Do sex differences in reported weight loss intentions and behaviours persist across demographic characteristics and weight status in youth? a systematic review. *BMC Public Health*. 2018;18(1):1343. doi:10.1186/s12889-018-6179-x.
12. McDow KB, Nguyen DT, Herrick KA, Akinbami LJ. Attempts to lose weight among adolescents aged 16-19 in the United States, 2013-2016. *NCHS Data Brief*. 2019;(340):1-8.
13. Annesi JJ. Effects of self-regulatory skill usage on weight management behaviours: mediating effects of induced self-efficacy changes in non-obese through morbidly obese women. *Br J Health Psychol*. 2018;23(4):1066-1083. doi:10.1111/bjhp.12338.
14. Frie K, Hartmann-Boyce J, Jebb SA, Aveyard P. Effectiveness of a self-regulation intervention for weight loss: a randomized controlled trial. *Br J Health Psychol*. 2020;25(3):652-676. doi:10.1111/bjhp.12436.

15. Johnson F, Pratt M, Wardle J. Dietary restraint and self-regulation in eating behavior. *Int J Obes*. 2012;36(5):665-674. doi:10.1038/ijo.2011.156.
16. Bleich SN, Wolfson JA. Differences in consumer use of food labels by weight loss strategies and demographic characteristics. *BMC Public Health*. 2015;15:1275-1275. doi:10.1186/s12889-015-2651-z.
17. Christoph MJ, Larson N, Laska MN, Neumark-Sztainer D. Nutrition facts panels: who uses them, what do they use, and how does use relate to dietary intake? *J Acad Nutr Diet*. 2018;118(2):217-228. doi:10.1016/j.jand.2017.10.014.
18. Huang TT, Kaur H, McCarter KS, Nazir N, Choi WS, Ahluwalia JS. Reading nutrition labels and fat consumption in adolescents. *J Adolesc Health*. 2004;35(5):399-401. doi:10.1016/j.jadohealth.2004.02.005.
19. Bryła P. Who reads food labels? selected predictors of consumer interest in front-of-package and back-of-package labels during and after the purchase. *Nutrients*. 2020;12(9):2605. doi:10.3390/nu12092605.
20. Stran KA, Knol LL. Determinants of food label use differ by sex. *J Acad Nutr Diet*. 2013;113(5):673-679. doi:10.1016/j.jand.2012.12.014.
21. Denny KN, Loth K, Eisenberg ME, Neumark-Sztainer D. Intuitive eating in young adults. who is doing it, and how is it related to disordered eating behaviors? *Appetite*. Jan 2013;60(1):13-19. doi:10.1016/j.appet.2012.09.029.
22. Van Dyke N, Drinkwater EJ. Relationships between intuitive eating and health indicators: literature review. *Public Health Nutr*. 2014;17(8):1757-66. doi:10.1017/s1368980013002139.

23. Holsen I, Jones DC, Birkeland MS. Body image satisfaction among Norwegian adolescents and young adults: a longitudinal study of the influence of interpersonal relationships and BMI. *Body Image*. 2012;9(2):201-208. doi:10.1016/j.bodyim.2012.01.006.
24. Austin SB, Haines J, Veugelers PJ. Body satisfaction and body weight: gender differences and sociodemographic determinants. *BMC Public Health*. 2009;9(1):313. doi:10.1186/1471-2458-9-313.
25. Risica PM, Weinstock MA, Rakowski W, Kirtania U, Martin RA, Smith KJ. Body satisfaction effect on thorough skin self-examination. *Am J Prev Med*. 2008;35(1):68-72. doi:10.1016/j.amepre.2008.03.017.
26. Adams K, Sargent RG, Thompson SH, Richter D, J. Corwin S, J. Rogan T. A study of body weight concerns and weight control practices of 4th and 7th grade adolescents. *Ethn Health*. 2000;5(1):79-94. doi:10.1080/13557850050007374.
27. Calzo JP, Sonnevile KR, Haines J, Blood EA, Field AE, Austin SB. The development of associations among body mass index, body dissatisfaction, and weight and shape concern in adolescent boys and girls. *J Adolesc Health*. 2012;51(5):517-23. doi:10.1016/j.jadohealth.2012.02.021.
28. Franko DL, Striegel-Moore RH. The role of body dissatisfaction as a risk factor for depression in adolescent girls: are the differences Black and White? *J Psychosom Res*. 2002;53(5):975-983. doi:10.1016/S0022-3999(02)00490-7.
29. Jung F, Spahlholz J, Hilbert A, Riedel-Heller SG, Luck-Sikorski C. Impact of weight-related discrimination, body dissatisfaction and self-stigma on the desire to weigh less. *Obes Facts*. 2017;10(2):139-151. doi:10.1159/000468154.

30. Liechty JM. Body image distortion and three types of weight loss behaviors among nonoverweight girls in the United States. *J Adolesc Health*. 2010;47(2):176-182. doi:10.1016/j.jadohealth.2010.01.004.
31. Ojala K, Vereecken C, Välimaa R, et al. Attempts to lose weight among overweight and non-overweight adolescents: a cross-national survey. *Int J Behav Nutr Phys Act*. 2007;4(1):50. doi:10.1186/1479-5868-4-50.
32. Voelker DK, Reel JJ, Greenleaf C. Weight status and body image perceptions in adolescents: current perspectives. *Adolesc Health Med Ther*. 2015;6:149-158. doi:10.2147/AHMT.S68344.
33. Eisenberg ME, Neumark-Sztainer D, Paxton SJ. Five-year change in body satisfaction among adolescents. *J Psychosom Res*. 2006;61(4):521-527. doi:10.1016/j.jpsychores.2006.05.007.
34. Field AE, Javaras KM, Aneja P, et al. Family, peer, and media predictors of becoming eating disordered. *Arch Pediatr Adolesc Med*. 2008;162(6):574-9. doi:10.1001/archpedi.162.6.574.
35. Heywood S, McCabe MP. Negative affect as a mediator between body dissatisfaction and extreme weight loss and muscle gain behaviors. *J Health Psychol*. 2006;11(6):833-44. doi:10.1177/1359105306069077.
36. Zarychta K, Chan CKY, Kruk M, Luszczynska A. Body satisfaction and body weight in under- and healthy-weight adolescents: mediating effects of restrictive dieting, healthy and unhealthy food intake. *Eat Weight Disord*. 2020;25(1):41-50. doi:10.1007/s40519-018-0496-z.

37. Neumark-Sztainer D, Levine MP, Paxton SJ, Smolak L, Piran N, Wertheim EH. Prevention of body dissatisfaction and disordered eating: what next? *Eat Disord*. 2006;14(4):265-85. doi:10.1080/10640260600796184.
38. Sonnevile KR, Calzo JP, Horton NJ, Haines J, Austin SB, Field AE. Body satisfaction, weight gain and binge eating among overweight adolescent girls. *Int J Obes*. 2012;36(7):944-949. doi:10.1038/ijo.2012.68.
39. Johnson F, Wardle J. Dietary restraint, body dissatisfaction, and psychological distress: a prospective analysis. *J Abnorm Psychol*. 2005;114(1):119-25. doi:10.1037/0021-843x.114.1.119.
40. Choukas-Bradley S, Nesi J, Widman L, Galla BM. The Appearance-Related Social Media Consciousness Scale: development and validation with adolescents. *Body Image*. 2020;33:164-174. doi:10.1016/j.bodyim.2020.02.017.
41. Markey CN. Invited commentary: why body image is important to adolescent development. *J Youth Adolesc*. 2010;39(12):1387-91. doi:10.1007/s10964-010-9510-0.
42. Murtagh J, Dixey R, Rudolf M. A qualitative investigation into the levers and barriers to weight loss in children: opinions of obese children. *Arch Dis Child*. 2006;91(11):920-3. doi:10.1136/adc.2005.085712.
43. Bibiloni MdM, Coll JL, Pich J, Pons A, Tur JA. Body image satisfaction and weight concerns among a Mediterranean adult population. *BMC Public Health*. 2017;17(1):39. doi:10.1186/s12889-016-3919-7.
44. Higgins ET. Promotion and prevention: regulatory focus as a motivational principle. In: Zanna MP, ed. *Advances in Experimental Social Psychology*. Academic Press; 1998:1-46.

45. Bouzas C, Bibiloni MDM, Tur JA. Relationship between body image and body weight control in overweight ≥ 55 -year-old adults: a systematic review. *Int J Environ Res Public Health*. 2019;16(9):1622. doi:10.3390/ijerph16091622.
46. Wang SB, Haynos AF, Wall MM, Chen C, Eisenberg ME, Neumark-Sztainer D. Fifteen-year prevalence, trajectories, and predictors of body dissatisfaction from adolescence to middle adulthood. *Clin Psychol Sci*. 2019;7(6):1403-1415. doi:10.1177/2167702619859331.
47. Mäkinen M, Puukko-Viertomies LR, Lindberg N, Siimes MA, Aalberg V. Body dissatisfaction and body mass in girls and boys transitioning from early to mid-adolescence: additional role of self-esteem and eating habits. *BMC Psychiatry*. 2012;12:35. doi:10.1186/1471-244x-12-35.
48. Buote VM, Wilson AE, Strahan EJ, Gazzola SB, Papps F. Setting the bar: divergent sociocultural norms for women's and men's ideal appearance in real-world contexts. *Body Image*. 2011;8(4):322-334. doi:10.1016/j.bodyim.2011.06.002.
49. Galioto R, Crowther JH. The effects of exposure to slender and muscular images on male body dissatisfaction. *Body Image*. 2013;10(4):566-573. doi:10.1016/j.bodyim.2013.07.009.
50. Owens TE, Allen MD, Spangler DL. An fMRI study of self-reflection about body image: sex differences. *Pers Individ Differ*. 2010;48(7):849-854. doi:10.1016/j.paid.2010.02.012.
51. Bould H, Carnegie R, Allward H, et al. Effects of exposure to bodies of different sizes on perception of and satisfaction with own body size: two randomized studies. *R Soc Open Sci*. 2018;5(5):171387. doi:10.1098/rsos.171387.

52. Goldfield G, Moore C, Henderson K, Buchholz A, Obeid N, Flament M. The relation between weight-based teasing and psychological adjustment in adolescents. *Paediatr Child Health*. 2010;15(5):283-288. doi:10.1093/pch/15.5.283.
53. Rand K, Vallis M, Aston M, et al. "It is not the diet; it is the mental part we need help with." a multilevel analysis of psychological, emotional, and social well-being in obesity. *Int J Qual Stud Health Well-being*. 2017;12(1):1306421-1306421. doi:10.1080/17482631.2017.1306421.
54. Hooper L, Puhl R, Eisenberg ME, Crow S, Neumark-Sztainer D. Weight teasing experienced during adolescence and young adulthood: cross-sectional and longitudinal associations with disordered eating behaviors in an ethnically/racially and socioeconomically diverse sample. *Int J Eat Disord*. 2021;54(8):1449-1462. doi:10.1002/eat.23534.
55. Farhat T. Stigma, obesity and adolescent risk behaviors: current research and future directions. *Curr Opin Psychol*. 2015;5:56-66. doi:10.1016/j.copsyc.2015.03.021.
56. Tomiyama AJ, Carr D, Granberg EM, et al. How and why weight stigma drives the obesity 'epidemic' and harms health. *BMC Med*. 2018;16(1):123. doi:10.1186/s12916-018-1116-5.
57. Puhl RM, Wall MM, Chen C, Bryn Austin S, Eisenberg ME, Neumark-Sztainer D. Experiences of weight teasing in adolescence and weight-related outcomes in adulthood: a 15-year longitudinal study. *Prev Med*. 2017;100:173-179. doi:10.1016/j.ypmed.2017.04.023.

58. Hunger JM, Major B, Blodorn A, Miller CT. Weighed down by stigma: how weight-based social identity threat contributes to weight gain and poor health. *Soc Personal Psychol Compass*. 2015;9(6):255-268. doi:10.1111/spc3.12172.
59. Cramer P, Steinwert T. Thin is good, fat is bad: how early does it begin? *J Appl Dev Psychol*. 1998;19(3):429-451. doi:10.1016/S0193-3973(99)80049-5.
60. Romano E, Haynes A, Robinson E. Weight perception, weight stigma concerns, and overeating. *Obesity (Silver Spring)*. 2018;26(8):1365-1371. doi:10.1002/oby.22224.
61. Rodgers R, Chabrol H, Paxton SJ. An exploration of the tripartite influence model of body dissatisfaction and disordered eating among Australian and French college women. *Body Image*. 2011;8(3):208-15. doi:10.1016/j.bodyim.2011.04.009.
62. Sattler KM, Deane FP, Tapsell L, Kelly PJ. Gender differences in the relationship of weight-based stigmatisation with motivation to exercise and physical activity in overweight individuals. *Health Psychol Open*. 2018;5(1):2055102918759691. doi:10.1177/2055102918759691.
63. Neumark-Sztainer D, Bauer KW, Friend S, Hannan PJ, Story M, Berge JM. Family weight talk and dieting: how much do they matter for body dissatisfaction and disordered eating behaviors in adolescent girls? *J Adolesc Health*. 2010;47(3):270-6. doi:10.1016/j.jadohealth.2010.02.001.
64. Goldschmidt AB, Wall MM, Choo T-HJ, et al. Fifteen-year weight and disordered eating patterns among community-based adolescents. *Am J Prev Med*. 2018;54(1):e21-e29. doi:10.1016/j.amepre.2017.09.005.
65. Neumark-Sztainer D, Falkner N, Story M, Perry C, Hannan PJ, Mulert S. Weight-teasing among adolescents: correlations with weight status and disordered eating

behaviors. *Int J Obes Relat Metab Disord*. 2002;26(1):123-131.

doi:10.1038/sj.ijo.0801853.

66. Menzel JE, Schaefer LM, Burke NL, Mayhew LL, Brannick MT, Thompson JK. Appearance-related teasing, body dissatisfaction, and disordered eating: a meta-analysis. *Body Image*. 2010;7(4):261-270. doi:10.1016/j.bodyim.2010.05.004.

67. Rodgers RF, Simone M, Franko DL, Eisenberg ME, Loth K, Neumark-Sztainer D. The longitudinal relationship between family and peer teasing in young adulthood and later unhealthy weight control behaviors: the mediating role of body image. *Int J Eat Disord*. 2021;54(5):831-840. doi:10.1002/eat.23492.

68. Mahon C, Hevey D. Processing body image on social media: gender differences in adolescent boys' and girls' agency and active coping. *Front Psychol*. 2021;12: 626763 doi:10.3389/fpsyg.2021.626763.

69. Anderson M, Jiang J. Teens, social media and technology 2018. Pew Research Center. Accessed May 3, 2022. <https://www.pewresearch.org/internet/2018/05/31/teens-social-media-technology-2018/>

70. Kucharczuk AJ, Oliver TL, Dowdell EB. Social media's influence on adolescents' food choices: a mixed studies systematic literature review. *Appetite*. 2022;168:105765. doi:10.1016/j.appet.2021.105765.

71. McDool E, Powell P, Roberts J, Taylor K. The internet and children's psychological wellbeing. *J Health Econ*. 2020;69:102274. doi:10.1016/j.jhealeco.2019.102274.

72. Saiphoo AN, Vahedi Z. A meta-analytic review of the relationship between social media use and body image disturbance. *Comput Hum Behav.* 2019;101:259-275. doi:10.1016/j.chb.2019.07.028.
73. Bell BT, Deighton-Smith N, Hurst M. ‘When you think of exercising, you don’t really want to think of puking, tears, and pain’: young adolescents’ understanding of fitness and #fitspiration. *J Health Psychol.* 2019;26(7):1046-1060. doi:10.1177/1359105319869798.
74. Kleemans M, Daalmans S, Carbaat I, Anschütz D. Picture perfect: the direct effect of manipulated Instagram photos on body image in adolescent girls. *Media Psychol.* 2018;21(1):93-110. doi:10.1080/15213269.2016.1257392.
75. Daniel S, Bridges SK. The drive for muscularity in men: media influences and objectification theory. *Body Image.* 2010;7(1):32-38. doi:10.1016/j.bodyim.2009.08.003.
76. McCreary DR, Sasse DK. An exploration of the drive for muscularity in adolescent boys and girls. *J Am Coll Health.* 2000;48(6):297-304. doi:10.1080/07448480009596271.
77. Hammond D. *International Food Policy Study: 2019 youth survey – United States.* 2021. Accessed June 17, 2021. http://foodpolicystudy.com/wp-content/uploads/2021/02/2019-IFPS-Youth-Survey-USA_20210225.pdf
78. AAPOR. Response rates – an overview. Accessed August 1, 2021. <https://www.aapor.org/Education-Resources/For-Researchers/Poll-Survey-FAQ/Response-Rates-An-Overview.aspx>
79. Jordan Lin C-T, Zhang Y, Carlton ED, Lo SC. 2014 FDA Health and Diet Survey. Accessed August 1, 2021. <https://www.fda.gov/media/96883/download>

80. National Center for Health Statistics. National Health and Nutrition Examination Survey. Centers for Disease Control and Prevention. Accessed September 5, 2021. <https://www.cdc.gov/nchs/nhanes/index.htm>
81. Channing Division of Network Medicine. Growing Up Today Study (GUTS). Accessed August 26, 2021. <http://www.gutsweb.org>
82. University of Minnesota School of Public Health. Project EAT. Accessed September 5, 2021. <https://www.sph.umn.edu/research/projects/project-eat>
83. Siervo M, Montagnese C, Muscariello E, et al. Weight loss expectations and body dissatisfaction in young women attempting to lose weight. *J Hum Nutr Diet*. 2014;27 Suppl 2:84-9. doi:10.1111/jhn.12078.
84. Haines J, Neumark-Sztainer D, Eisenberg ME, Hannan PJ. Weight teasing and disordered eating behaviors in adolescents: longitudinal findings from Project EAT (Eating Among Teens). *Pediatrics*. 2006;117(2):e209-15. doi:10.1542/peds.2005-1242.
85. Litwin H, Sapir EV. Perceived income adequacy among older adults in 12 countries: findings from the survey of health, ageing, and retirement in Europe. *Gerontologist*. 2009;49(3):397-406. doi:10.1093/geront/gnp036.
86. Olstad DL, Nejatinamini S, Kirkpatrick SI, et al. Stress-related poor diet quality does not explain socioeconomic inequities in health: a structural equation mediation analysis of gender-specific pathways. *J Acad Nutr Diet*. 2022;122(3):541-554.e1. doi:10.1016/j.jand.2021.09.018.
87. Doan N, Olstad DL, Vanderlee L, Hammond D, Wallace M, Kirkpatrick SI. Investigating the intersections of racial identity and perceived income adequacy in

relation to dietary quality among adults in Canada. *J Nutr*. 2022;152(Suppl 1):67s-75s. doi:10.1093/jn/nxac076.

88. Hammond D, White CM, Reid JL. 2016 Canada Food Study: technical report – wave 2. Accessed June 17, 2021. <http://www.canadafoodstudy.ca/studydocs>

89. Goodman S, Hammond D, Pillo-Blocka F, Glanville T, Jenkins R. Use of nutritional information in Canada: national trends between 2004 and 2008. *J Nutr Educ Behav*. 2011;43(5):356-65. doi:10.1016/j.jneb.2011.02.008.

90. de Onis M, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. Development of a WHO growth reference for school-aged children and adolescents. *Bull World Health Organ*. 2007;85(9):660-7. doi:10.2471/blt.07.043497.

91. U.S. Census Bureau. Measuring racial and ethnic diversity for the 2020 Census. Accessed October 20, 2022. <https://www.census.gov/newsroom/blogs/random-samplings/2021/08/measuring-racial-ethnic-diversity-2020-census.html>

92. *Stata Statistical Software* [Computer software]. Version 15.1. StataCorp LLC; 2021.

93. Fyler M, Schumacher J, Banning J, Gam HJ. Influence of body satisfaction, body mass index, and diet quality on healthy eating attitudes among college students. *Fam Consum Sci Res J*. 2014;42(4):330-340. doi:10.1111/fcsr.12067.

94. Mikolajczyk RT, Iannotti RJ, Farhat T, Thomas V. Ethnic differences in perceptions of body satisfaction and body appearance among U.S. schoolchildren: a cross-sectional study. *BMC Public Health*. 2012;12:425. doi:10.1186/1471-2458-12-425.

95. Yost J, Krainovich-Miller B, Budin W, Norman R. Assessing weight perception accuracy to promote weight loss among U.S. female adolescents: a secondary analysis. *BMC Public Health*. 2010;10(1):465. doi:10.1186/1471-2458-10-465.
96. Dues K, Kandiah J, Khubchandani J, Haroldson A. Adolescent body weight perception: association with diet and physical activity behaviors. *J Sch Nurs*. 2019;36(5):339-347. doi:10.1177/1059840518824386.
97. Gaylis JB, Levy SS, Hong MY. Relationships between body weight perception, body mass index, physical activity, and food choices in Southern California male and female adolescents. *Int J Adolesc Health*. 2020;25(1):264-275. doi:10.1080/02673843.2019.1614465.
98. Zarychta K, Mullan B, Luszczynska A. Am I overweight? a longitudinal study on parental and peers weight-related perceptions on dietary behaviors and weight status among adolescents. *Front Psychol*. 2016;7:83. doi:10.3389/fpsyg.2016.00083.
99. Almenara CA, Fauquet J, López-Guimerà G, Pàmias-Massana M, Sánchez-Carracedo D. Sociocultural influences and body change strategies in Spanish adolescent boys of different weight status. *Eat Behav*. 2014;15(4):654-7. doi:10.1016/j.eatbeh.2014.09.001.
100. Yarborough BJ, DeBar LL, Wu P, Pearson J, Stevens VJ. Responding to pediatric providers' perceived barriers to adolescent weight management. *Clin Pediatr (Phila)*. Nov 2012;51(11):1063-70. doi:10.1177/0009922812459269.
101. Lebow J, Narr C, Mattke A, et al. Engaging primary care providers in managing pediatric eating disorders: a mixed methods study. *J Eat Disord*. 2021;9(1):11. doi:10.1186/s40337-020-00363-8.

102. Mandelbaum J, Harrison SE. Perceived challenges to implementing childhood obesity prevention strategies in pediatric primary care. *SSM - Qualitative Research in Health*. 2022;2:100185. doi:10.1016/j.ssmqr.2022.100185
103. Kraye A, Ingledew DK, Iphofen R. Social comparison and body image in adolescence: a grounded theory approach. *Health Educ Res*. 2007;23(5):892-903. doi:10.1093/her/cym076.
104. Schaefer MK, Blodgett Salafia EH. The connection of teasing by parents, siblings, and peers with girls' body dissatisfaction and boys' drive for muscularity: the role of social comparison as a mediator. *Eat Behav*. 2014;15(4):599-608. doi:10.1016/j.eatbeh.2014.08.018.
105. Valois DD, Davis CG, Buchholz A, et al. Effects of weight teasing and gender on body esteem in youth: a longitudinal analysis from the REAL study. *Body Image*. 2019;29:65-73. doi:10.1016/j.bodyim.2019.02.009.
106. Neumark-Sztainer D, Falkner N, Story M, Perry C, Hannan PJ, Mulert S. Weight-teasing among adolescents: correlations with weight status and disordered eating behaviors. *Int J Obes*. 2002;26(1):123-131. doi:10.1038/sj.ijo.0801853.
107. Schvey NA, Marwitz SE, Mi SJ, et al. Weight-based teasing is associated with gain in BMI and fat mass among children and adolescents at-risk for obesity: a longitudinal study. *Pediatr Obes*. Oct 2019;14(10):e12538. doi:10.1111/ijpo.12538.
108. Suelter CS, Schvey N, Kelly NR, et al. Relationship of pressure to be thin with gains in body weight and fat mass in adolescents. *Pediatr Obes*. Jan 2018;13(1):14-22. doi:10.1111/ijpo.12179.

109. Hooper L, Puhl R, Eisenberg ME, Crow S, Neumark-Sztainer D. Weight teasing experienced during adolescence and young adulthood: Cross-sectional and longitudinal associations with disordered eating behaviors in an ethnically/racially and socioeconomically diverse sample. *Int J Eat Disord*. Aug 2021;54(8):1449-1462. doi:10.1002/eat.23534.
110. Kneavel M. Relationship between gender, stress, and quality of social support. *Psychol Rep*. 2021;124(4):1481-1501. doi:10.1177/0033294120939844.
111. Woelders LCS, Larsen JK, Scholte RHJ, Cillessen AHN, Engels RCME. Friendship group influences on body dissatisfaction and dieting among adolescent girls: a prospective study. *J Adolesc Health*. 2010;47(5):456-462. doi:10.1016/j.jadohealth.2010.03.006.
112. Eisenberg ME, Gower AL, McMorris BJ, Rider GN, Shea G, Coleman E. Risk and protective factors in the lives of transgender/gender nonconforming adolescents. *J Adolesc Health*. 2017;61(4):521-526. doi:10.1016/j.jadohealth.2017.04.014.
113. Nagata JM, Ganson KT, Austin SB. Emerging trends in eating disorders among sexual and gender minorities. *Curr Opin Psychiatry*. Nov 2020;33(6):562-567. doi:10.1097/ycp.0000000000000645.
114. American Psychiatric Association. What is gender dysphoria? Accessed November 1, 2022. <https://www.psychiatry.org/patients-families/gender-dysphoria/what-is-gender-dysphoria>
115. Persoskie A, Hennessy E, Nelson WL. US consumers' understanding of nutrition labels in 2013: the importance of health literacy. *Prev Chronic Dis*. 2017;14:E86. doi:10.5888/pcd14.170066.

116. Rana L, Alvaro R. Applying a Health Promoting Schools approach to nutrition interventions in schools: key factors for success. *Health Promot J Austr.* 2010;21(2):106-13. doi:10.1071/he10106.
117. Chau MM, Burgermaster M, Mamykina L. The use of social media in nutrition interventions for adolescents and young adults-a systematic review. *Int J Med Inform.* 2018;120:77-91. doi:10.1016/j.ijmedinf.2018.10.001
118. Arrúa A, Curutchet MR, Rey N, et al. Impact of front-of-pack nutrition information and label design on children's choice of two snack foods: comparison of warnings and the traffic-light system. *Appetite.* Sep 1 2017;116:139-146. doi:10.1016/j.appet.2017.04.012.
119. Bopape M, Taillie LS, Swart R. Perceived effect of warning label on parental food purchasing and drivers of food selection among South African parents-an exploratory study. *Front Public Health.* 2022;10:939937. doi:10.3389/fpubh.2022.939937.
120. Hamlin R, Hamlin B. An experimental comparison of the impact of 'warning' and 'health star rating' FoP labels on adolescents' choice of breakfast cereals in New Zealand. *Nutrients.* May 26 2020;12(6)doi:10.3390/nu12061545.
121. Puhl RM, Peterson JL, Luedicke J. Strategies to address weight-based victimization: youths' preferred support interventions from classmates, teachers, and parents. *J Youth Adolesc.* Mar 2013;42(3):315-27. doi:10.1007/s10964-012-9849-5.
122. U.S. Department of Health and Human Services. StopBullying.gov. Accessed October 29, 2022. <https://www.stopbullying.gov/>

Table 4.5 Sample characteristics (n=1,274)

	Overall	Girls (n=648)	Boys (n=626)	Difference between Girls and Boys (p- value) ^a
Body size perception, n (%)				
Smaller than ideal	239 (18.8)	95 (14.7)	144 (23.0)	<0.001
Ideal	579 (45.5)	300 (46.3)	279 (44.6)	0.54
Larger than ideal	456 (35.8)	253 (39.0)	203 (32.4)	0.01
Had been teased, n (%)	396 (31.4)	212 (32.7)	191 (30.5)	0.40
Weekday social media use, mean hours (SE) ^b	1.61 (0.05)	1.88 (0.07)	1.32 (0.06)	<0.001
Weight change efforts, n (%)				
Not trying to change weight	435 (34.1)	234 (36.1)	201 (32.1)	0.13
Lose weight	266 (20.9)	154 (23.8)	112 (17.9)	0.01
Maintain weight	444 (34.9)	221 (34.1)	223 (35.6)	0.57
Gain weight	129 (10.1)	39 (6.0)	90 (14.4)	<0.001
Nutrition Facts label use, n (%)				
Never	306 (24.0)	145 (22.4)	161 (25.7)	0.16
Rarely	295 (23.2)	161 (24.9)	134 (21.4)	0.15
Sometimes	408 (32.0)	204 (31.5)	204 (32.6)	0.67
Often	166 (13.0)	89 (13.7)	77 (12.3)	0.45
All the time	99 (7.8)	49 (7.6)	50 (8.0)	0.78
BMI, mean (SE)	22.37 (0.15)	22.15 (0.21)	22.59 (0.21)	0.12
Perceived income adequacy, n (%)				
Not enough money	68 (5.3)	37 (5.7)	31 (5.0)	0.55
Barely enough money	299 (23.5)	143 (22.1)	156 (24.9)	0.23
Enough money	703 (55.2)	377 (58.2)	326 (52.1)	0.03
More than enough money	204 (16.0)	91 (14.0)	113 (18.1)	0.05
Nutrition Facts label understanding, mean (SE)	3.37 (0.03)	3.38 (0.04)	3.35 (0.04)	0.70
Aware of food guide, n (%)	1,018 (79.9)	521 (80.4)	497 (79.4)	0.65

Nutrition knowledge, mean (SE)	6.43 (0.06)	6.51 (0.09)	6.35 (0.09)	0.20
Race/ethnicity, n (%)				
White	844 (66.3)	417 (64.4)	427 (68.2)	0.15
Black	142 (11.2)	77 (11.9)	65 (10.4)	0.40
Hispanic or Latino	87 (6.8)	41 (6.3)	46 (7.4)	0.47
Asian/Pacific Islander	38 (3.0)	27 (4.2)	11 (1.8)	0.01
Two or more races/ethnicities	163 (12.8)	86 (13.3)	77 (12.3)	0.60
Age, mean (SE)	13.61 (0.06)	13.61 (0.09)	13.61 (0.09)	0.97

^aCalculated from chi-square tests for categorical variables and t-tests for continuous variables

^bSE=standard error

Table 4.6 Linear regression showing associations between weight change or maintenance efforts and Nutrition Facts label (NFL) use among U.S. adolescents (n=1,274)

	Overall Sample, b (p-value)	Girls, b (p-value)	Boys, b (p-value)
Weight change efforts ^a			
Maintain weight	0.54 (<0.001)	0.66 (<0.001)	0.40 (<0.001)
Gain weight	0.33 (0.001)	0.36 (0.04)	0.31 (0.01)
Lose weight	0.38 (<0.001)	0.40 (<0.001)	0.35 (0.003)
Gender ^b	0.02 (0.67)		
NFL understanding	0.43 (<0.001)	0.42 (<0.001)	0.42 (<0.001)
Nutrition knowledge	0.13 (<0.001)	0.08 (<0.001)	0.19 (<0.001)
Food guide awareness	-0.02 (0.75)	0.0002 (0.999)	-0.05 (0.60)
Race/ethnicity ^c			
Black	-0.07 (0.46)	-0.12 (0.34)	.01 (0.93)
Hispanic or Latino	0.18 (0.12)	0.04 (0.83)	0.34 (0.03)
Asian/Pacific Islander	0.37 (0.03)	0.55 (0.01)	-0.12 (0.68)
Two or more races/ethnicities	-0.08 (0.37)	-0.17 (0.17)	0.01 (0.94)
Age	-0.04 (0.01)	-0.03 (0.06)	-0.04 (0.04)
Perceived income adequacy ^d			
Not enough money	0.02 (0.88)	0.13 (0.48)	-0.12 (0.52)
Barely enough money	0.04 (0.52)	0.11 (0.27)	-0.004 (0.97)
More than enough money	0.15 (0.07)	0.05 (0.71)	0.24 (0.03)

^areferent category=not trying to change weight

^breferent category=male

^creferent category=white

^dreferent category=enough money

Table 4.7 Logistic regression showing associations between body size satisfaction, social media use, weight teasing, and weight change or maintenance efforts among U.S. adolescents (n=1,274)

	Weight Change Efforts, ^a RRR (p-value) ^b		
	Maintain weight	Gain weight	Lose weight
Body size satisfaction ^b			
Body perceived as smaller than ideal	0.92 (0.68)	9.85 (<0.001)	0.80 (0.66)
Body perceived as larger than ideal	0.88 (0.46)	0.29 (0.03)	12.97 (<0.001)
Weight teasing	1.96 (<0.001)	3.68 (<0.001)	4.29 (<0.001)
Social media use	1.05 (0.34)	1.07 (0.42)	1.17 (0.02)
Gender	0.82 (0.17)	0.39 (<0.001)	1.19 (0.40)
Race/ethnicity			
Black	1.53 (0.06)	1.25 (0.56)	2.26 (0.02)
Hispanic or Latino	1.86 (0.05)	1.64 (0.33)	3.77 (0.001)
Asian/Pacific Islander	1.48 (0.33)	0.78 (0.76)	2.33 (0.15))
Two or more races/ethnicities	1.55 (0.05)	1.51 (0.25)	3.05 (<0.001)
Age	1.09 (0.88)	1.13 (0.04)	1.10 (0.05)
BMI	1.01 (0.88)	0.89 (0.18)	1.44 (<0.001)
Perceived income adequacy			
Not enough money	0.36 (0.004)	0.71 (0.42)	0.73 (0.47)
Barely enough money	1.04 (0.85)	1.43 (0.21)	1.08 (0.74)
More than enough money	0.91 (0.62)	1.29 (0.43)	0.78 (0.41)

^areferent category=not trying to change weight

^bRRR=relative risk ratio

^creference category=body perceived as ideal size

Table 4.8 Logistic regression showing associations between body size satisfaction, social media use, weight teasing, and weight change or maintenance efforts among U.S. adolescent girls (n=648)

	Weight Change Efforts, ^a RRR (p-value) ^b		
	Maintain weight	Gain weight	Lose weight
Body size satisfaction ^b			
Body perceived as smaller than ideal (n=95)	0.79 (0.43)	13.23 (<0.001)	0.78 (0.72)
Body perceived as larger than ideal (n=253)	0.81 (0.39)	9.26e-07 (0.97)	11.21 (<0.001)
Weight teasing	2.04 (0.003)	3.48 (0.01)	3.10 (<0.001)
Social media use	0.94 (0.32)	1.05 (0.67)	1.13 (0.13)
Race/ethnicity			
Black	1.57 (0.14)	1.38 (0.63)	2.23 (0.06)
Hispanic or Latino	1.37 (0.51)	2.29 (0.30)	4.85 (0.003)
Asian/Pacific Islander	1.59 (0.37)	1.45 (0.69)	3.62 (0.06)
Two or more races/ethnicities	1.34 (0.35)	2.48 (0.10)	3.15 (0.004)
Age	1.12 (0.02)	1.14 (0.17)	1.17 (0.02)
BMI	0.94 (0.48)	1.09 (0.61)	1.33 (0.02)
Perceived income adequacy			
Not enough money	0.26 (0.01)	0.77 (0.72)	1.00 (<0.001)
Barely enough money	1.11 (0.68)	1.29 (0.61)	1.40 (0.29)
More than enough money	0.96 (0.90)	1.52 (0.47)	0.87 (0.72)

^areferent category=not trying to change weight

^bRRR=relative risk ratio

^creference category=body perceived as ideal size

Table 4.9 Logistic regression showing associations between body size satisfaction, social media use, weight teasing, and weight change or maintenance efforts among U.S. adolescent boys (n=626)

	Weight Change Efforts, ^a RRR (p-value) ^b		
	Maintain weight	Gain weight	Lose weight
Body size satisfaction ^b			
Body perceived as smaller than ideal (n=144)	1.03 (0.93)	9.12 (<0.001)	0.89 (0.89)
Body perceived as larger than ideal (n=203)	1.01 (0.96)	0.52 (0.28)	18.53 (<0.001)
Weight teasing	1.90 (0.02)	3.62 (<0.001)	6.74 (<0.001)
Social media use	1.22 (0.01)	1.18 (0.14)	1.23 (0.049)
Race/ethnicity			
Black	1.56 (0.19)	1.18 (0.74)	2.40 (0.12)
Hispanic or Latino	2.14 (0.07)	1.06 (0.93)	2.78 (0.09)
Asian/Pacific Islander	1.18 (0.80)	1.32e-06 (0.98)	1.17 (0.90)
Two or more races/ethnicities	1.76 (0.08)	1.18 (0.73)	3.17 (0.02)
Age	1.06 (0.21)	1.12 (0.14)	1.01 (0.88)
BMI	1.03 (0.71)	0.83 (0.06)	1.55 (0.002)
Perceived income adequacy			
Not enough money	0.48 (0.16)	0.70 (0.62)	0.45 (0.24)
Barely enough money	0.91 (0.73)	1.48 (0.28)	0.79 (0.53)
More than enough money	0.89 (0.65)	1.20 (0.64)	0.71 (0.49)

^areferent category=not trying to change weight

^bRRR=relative risk ratio

^creference category=body perceived as ideal size

CHAPTER 5

CONCLUSIONS AND IMPLICATIONS

This dissertation addresses two understudied yet important topics with implications for public health efforts to promote healthy eating and weight management among U.S. adolescents: 1) Nutrition Facts label (NFL) use, healthy eating efforts, and sociodemographic characteristics and 2) NFL use and weight change or maintenance efforts. In the 30 years since the passage of the U.S. Nutrition Labeling and Education Act (Institute of Medicine Committee on Examination of Front-of-Package Nutrition Rating Systems and Symbols; “Nutrition Labeling and Education Act of 1990”), much research has studied how the NFL may influence adult eating behaviors. Few studies, however, have examined the potential influences on and consequences of NFL use among U.S. adolescents. NFL use among this population is an important topic, given that adolescence may be a time when people are more receptive to health behavior change (Flodgren et al., 2020), and that the habits people form during this time will likely carry into adulthood (Hu et al., 2016; Nelson et al., 2008; Winpenny et al., 2017). This dissertation therefore addresses a gap in the literature by suggesting that increasing adolescents’ NFL use may be an important part of promoting healthy eating among this population.

Strengths of the IFPS Youth Survey

This dissertation drew upon the strengths of the IFPS Youth Survey. A notable strength of the IFPS Youth Survey is its large and diverse sample (e.g., by using quotas for age and sex; Hammond et al., 2022). Of the four prior studies on adolescent NFL use, three used samples with limited generalizability (i.e., patients at an urban primary care clinic, school-aged children in Texas, or Grade 12 students in Sri Lanka; Haidar et al., 2017; Huang et al., 2004; Talagala & Arambepola, 2016). On the contrary, the present study used a large sample of adolescents across the U.S. The online survey also allowed for researchers to include visual stimuli, including an image of an NFL. Visual aids have been shown to help survey participants provide more reliable responses (dell'Olio et al., 2018; Jones et al., 2013).

The IFPS Youth Survey is also notable in that it collected information on dietary patterns (e.g., healthy eating efforts) and policy-relevant behaviors (e.g., NFL use), in addition to sociodemographic characteristics and variables that are not often examined in the context of adolescent NFL use. For example, few studies among adolescents have studied relationships among healthy eating efforts, body size satisfaction, and weight change or maintenance efforts. Although some research among U.S. adolescents has emphasized NFL awareness (Wojcicki & Heyman, 2012), this dissertation makes an important contribution to the literature by examining the effects of adolescents' reported NFL use. While previous research among U.S. adolescents has only examined associations between NFL use and a singular dietary outcome (e.g., dietary fat intake; Huang et al., 2004), the healthy eating efforts variables in the IFPS Youth Survey allowed for an examination of how NFL use may be associated with a range of dietary intentions

and an index of healthy eating efforts. For instance, while previous research and the information listed on the NFL (i.e., number of servings, calories, calories from fat per serving, total fat, saturated fat, cholesterol, sodium, total carbohydrates, complex carbohydrates, sugars, dietary fiber, total protein, and vitamins and minerals per serving; Greenberg, 1990) might suggest that NFL use may have different associations with specific healthy eating efforts (Dumoitier et al., 2019, this dissertation research found that NFL use was positively associated with eight of the nine healthy eating efforts (drinking water was the exception). This finding suggests that adolescents using the NFL are also engaging in other healthy eating behaviors, rather than looking for specific pieces of nutrition information on the NFL.

Another strength of this dissertation is its examination of adolescents' intentions toward their diets and weight change or maintenance efforts. The healthy eating efforts variable measured dietary intentions rather than actual nutrition behavior. This distinction is important, as previous research has found that dietary intentions are determinants of dietary behaviors among adolescents (McClain et al., 2009). For example, a systematic review among adolescents from the U.S. and fifteen other countries found that an intention to eat healthy was positively associated with fruit, vegetable, and juice intake (McClain et al., 2009). Using healthy eating efforts in this dissertation research, as opposed to a measure of dietary intake, allowed us to examine potential aims or goals adolescents had related to their diets. These study findings could be used to develop implementation intention-based interventions (e.g., to increase fruit and vegetable intake or reduce high fat unhealthy snack intake; Rasmussen et al., 2006), which link situational cues with goal-directed responses (Chapman et al., 2009).

Front-of-package food labeling

This dissertation research is also timely, given potential changes to U.S. packaged food labeling. At the Conference on Hunger, Nutrition, and Health held in September 2022, the White House outlined several initiatives to make food labeling more accessible to the public and help people feel more empowered to make healthy food choices (The White House, 2022). For example, the Biden-Harris administration announced plans to research and propose a standardized front-of-package (FOP) food labeling system to help people more quickly and easily identify the nutritional value of a food product (The White House, 2022). FOP labels have been shown to encourage healthier food purchases, especially among individuals with low nutrition literacy (Franco-Arellano et al., 2020; Roberto et al., 2021). Compared to the NFL, FOP labels have also been shown to increase fiber intake and decrease sugar intake among Danish adults (Rønnow, 2020). If the U.S. does adopt an FOP food labeling policy, findings from this dissertation research on adolescents' use of the NFL may provide a baseline from which to evaluate the effects of added FOP labels on eating efforts among U.S. adolescents.

FOP labeling, however, may not necessarily be more effective at promoting healthy eating efforts than the NFL. Research suggests that some FOP label designs may be more easily understood than others. For example, a single-traffic-light summary label may be more effective than multiple-traffic-light labels (Roberto et al., 2021). A randomized controlled trial among Australian adults compared the standard nutrition information panel to seven different FOP labeling schemes and found that more than half of participants using star rating or percent daily intake schemes (i.e., FOP labeling schemes that do not include specific nutrient information) still referred to the nutrition

information panel to determine the health of the product (Watson et al., 2014). These findings suggest that effective FOP labels depend on widespread uptake, and that consumers need communication and education on new labeling systems (Roberto et al., 2021; Watson et al., 2014). As this dissertation research suggests that NFL understanding and nutrition knowledge are positively associated with NFL use among U.S. adolescents, future research is similarly needed to examine how FOP label understanding and nutrition knowledge may be related to FOP label use among adolescents. For example, a study using IFPS data from adults in five countries (Australia, Canada, Chile, Mexico, the U.K., and the U.S.) found differences in label understanding between FOP labels and the NFL (Acton et al., 2023). While respondents from Australia and the U.K. had greater understanding of FOP labels than the NFL using the Health Star Ratings and Traffic light labelling systems, respectively, respondents from Mexico had lower understanding of the numeric FOP label than the NFL (Acton et al., 2023). These findings from adults suggest that FOP labels and NFLs may be understood differently by adolescents as well. Furthermore, FOP labels in the U.S. may influence understanding and use of NFLs. Should the Biden-Harrison administration propose a standardized FOP food labeling system (The White House, 2022), it will be important to determine how receptive adolescents are to this new label, and how it may affect their use of the label and healthy eating efforts.

Recent revisions to the NFL

This dissertation's findings could also be used to evaluate the slightly revised U.S. NFL that went into effect in 2020-2021. The U.S. Food and Drug Administration revised the NFL to emphasize existing information (e.g., calories) and add new information (e.g.,

added sugars; Neuhofer et al., 2020). These new requirements went into effect in January 2020 for manufacturers with \$10 million or more in annual food sales and January 2021 for manufacturers with less than \$10 million in annual food sales (U.S. Food and Drug Administration, 2018). Little research has compared the former and updated versions of the NFL, and none has included adolescents. Evidence among adults is mixed on whether the updated NFL improves label comprehension or leads to healthier food choices. For example, an online survey of U.S. adults found that the relatively minor updates to the NFL did not improve NFL comprehension (Kim et al., 2020), whereas a recent eye tracking study found that the updated NFL design improved label comprehension (Ma & Zhuang, 2021). Both studies concluded that adults using the updated NFL may have difficulty using information from the label correctly to make food choices (Ma & Zhuang, 2021), especially in regard total and added sugars (Kim et al., 2020). These findings suggest that further research on the updated NFL is needed to determine how its use may be related to healthy eating efforts, particularly among adolescents. Additional efforts to educate the public on how to use the new NFL may help improve its utility for helping adolescents and other populations to make healthier food choices.

COVID-19

The IFPS Study design is an annual, repeated cross-sectional survey that allows for tracking population trends over time. Future administrations of the IFPS and other studies might examine what effects the COVID-19 pandemic may have had on adolescent healthy eating efforts or weight change or maintenance efforts. For example, recent research has found that the pandemic exacerbated eating disorder symptoms among adolescents (Spettigue et al., 2021), likely due in part to societal disruptions brought by

the pandemic (e.g., restrictions on adolescent activities and education; Surén et al., 2022). Nearly two-thirds of adolescents in this dissertation reported engaging in weight change or maintenance efforts prior to the COVID-19 pandemic. Future studies may consider how weight change or maintenance efforts among this age group shifted during the pandemic and in future post-pandemic years.

Adolescent social media use also increased during early pandemic lockdowns, although its reported effects on adolescents' well-being have been mixed. For example, recent research suggests that increased social media use may have lessened the effects of anxiety and helped adolescents who were feeling lonely connect with other people (Cauberghe et al., 2020). On the other hand, a worldwide systematic review found that adolescents who spent more time on social media had overall poorer mental health than those with less social media engagement (Marciano et al., 2022). Given the recent increases in both disordered eating and social media use among adolescents, and the dissertation finding that time on social media was associated with efforts to lose weight, future studies should consider how the relationship between social media use and weight change or maintenance efforts may have been effected by the COVID-19 pandemic.

Additionally, there is some evidence that weight stigmatization and bullying increased during the COVID-19 pandemic (Lessard & Puhl, 2021a). Despite spending more time in remote schooling (as compared to in person) in the fall of 2020, some researchers speculate that electronic or cyber bullying may have replaced in-person bullying (Lessard & Puhl, 2021b). More than 50% of U.S. adolescents in one study reported they had been exposed to weight stigmatizing social media during the COVID-19 pandemic (Lessard & Puhl, 2021b). Stigmatizing social media may affect adolescent

body size satisfaction. For example, 64% of adolescents in this study who had increased exposure to weight stigmatizing social media reported that they were less satisfied with their bodies (Lessard & Puhl, 2021b). These studies highlight the importance of understanding the intersections between social media use, weight stigma, and body size satisfaction among adolescents during the pandemic years, which could be explored in future studies.

Cross-country comparisons

Since the IFPS surveyed adolescents in six countries in 2019, future research could compare the current findings and other nutrition behaviors among adolescents in the U.S., Australia, Canada, Chile, Mexico, and the U.K. For instance, a recent study of adult IFPS survey participants across five countries (Australia, Canada, Mexico, the U.K., and the U.S.) found that between one-third and half of respondents reported using their country's respective NFL "often" or "all the time" (i.e., 43-45% in Australia, 27-50% in Canada, 36-39% in Mexico, 32-34% in the U.K., and 47-49% in the U.S.; Acton et al., 2023). These findings suggest that NFL use varies by country, perhaps due to differences in labeling policies, and that the relationships among NFL use, healthy eating efforts, weight teasing, social media use, and weight change or maintenance efforts among adolescents may also differ by country.

Conclusion

The NFL has the potential to "serve as a population-level intervention with unparalleled reach" (Christoph et al., 2016, p. 2135) as it is present on most packaged food products in the U.S. (Miller & Cassady, 2015). We know relatively little, however, about the potential influences on NFL use and its consequences among U.S. adolescents.

This dissertation contributes to the scant literature on U.S. adolescent NFL use by examining associations among NFL use, healthy eating efforts, sociodemographic characteristics, and weight change or maintenance efforts. Using novel data from the IFPS Youth Survey, Study 1 found that NFL use was positively associated with a set of healthy eating efforts among U.S. adolescents. As low NFL understanding and nutrition knowledge may be barriers to NFL use, efforts to increase understanding and knowledge may lead to higher NFL use.

Study 2 extended these findings by showing that adolescents making an effort to change or maintain their weight were more likely to use the NFL than those not trying to change their weight. This study also examined how three factors (body size satisfaction, weight teasing, and social media use) may be associated with weight change or maintenance efforts. Compared to adolescents who were satisfied with their body size, those who perceived their body as smaller than ideal were more likely to try to gain weight, and those who perceived their body as larger than ideal were less likely to be trying to gain weight and more likely to be trying to lose weight. Overall, adolescents who had experienced weight teasing were more likely to engage in weight change or maintenance efforts than adolescents who had not been teased for their weight, with the largest effect observed on trying to lose weight. Among all adolescents, more time on social media was associated with trying to lose weight, and these findings were driven by boys. Stratifying by gender allowed us to examine potential differences in the relationships among these variables between girls and boys. Prior research suggests that while girls often aspire to thinness (Buote et al., 2011), boys are driven more by a desire to obtain a lean and muscular body (Galioto & Crowther, 2013). It is therefore important

to understand the relationship between factors like body size satisfaction, weight teasing, and social media use with girls' and boys' intentions toward their weight.

Both studies in this dissertation underscore the importance of establishing healthy eating behaviors during adolescence, as nutrition habits established during this time period are likely to carry into adulthood (Hu et al., 2016; Nelson et al., 2008; Winpenny et al., 2017). Education campaigns about using the NFL could target adolescents engaging in weight change or maintenance efforts in order to promote healthy use of the NFL. These findings also point to the need for targeted efforts to promote body size satisfaction, reduce weight teasing, and encourage social media literacy among adolescents, which may help adolescents achieve and maintain healthy eating practices.

REFERENCES

21 CFR 101.15 Food; prominence of required statements, (2022).

AAPOR. *Response rates - An overview*. Retrieved August 1, 2021 from

<https://www.aapor.org/Education-Resources/For-Researchers/Poll-Survey-FAQ/Response-Rates-An-Overview.aspx>

Acton, R. B., Rynard, V. L., Adams, J., Bhawra, J., Cameron, A. J., Contreras-Manzano, A., Davis, R. E., Jáuregui, A., Sacks, G., Thrasher, J. F., Vanderlee, L., White, C. M., & Hammond, D. (2023). Awareness, use and understanding of nutrition labels among adults from five countries: Findings from the 2018–2020 International Food Policy Study. *Appetite*, 180, 106311.

<https://doi.org/10.1016/j.appet.2022.106311>

Adams, K., Sargent, R. G., Thompson, S. H., Richter, D., J. Corwin, S., & J. Rogan, T. (2000). A study of body weight concerns and weight control practices of 4th and 7th grade adolescents. *Ethnicity & Health*, 5(1), 79-94.

<https://doi.org/10.1080/13557850050007374>

Almenara, C. A., Fauquet, J., López-Guimerà, G., Pàmias-Massana, M., & Sánchez-Carracedo, D. (2014). Sociocultural influences and body change strategies in Spanish adolescent boys of different weight status. *Eat Behav*, 15(4), 654-657.

<https://doi.org/10.1016/j.eatbeh.2014.09.001>

- American Psychiatric Association. (2022). *What is gender dysphoria?* Retrieved November 1 from <https://www.psychiatry.org/patients-families/gender-dysphoria/what-is-gender-dysphoria>
- Anastasiou, K., Miller, M., & Dickinson, K. (2019). The relationship between food label use and dietary intake in adults: A systematic review. *Appetite*, 138, 280-291. <https://doi.org/10.1016/j.appet.2019.03.025>
- Anderson, D. M., & Holt, J. K. (2017). *Do high school students know their parents' income?* (Illinois Education Research Council Research Brief No. 2017-3). <https://eric.ed.gov/?id=ED574698>
- Anderson, M., & Jiang, J. (2018). *Teens, social media and technology 2018*. Pew Research Center. Retrieved May 3, 2022 from <https://www.pewresearch.org/internet/2018/05/31/teens-social-media-technology-2018/>
- Andrew, G. (2007). Struggles with survey weighting and regression modeling. *Statistical Science*, 22(2), 153-164. <https://doi.org/10.1214/088342306000000691>
- Annesi, J. J. (2018). Effects of self-regulatory skill usage on weight management behaviours: Mediating effects of induced self-efficacy changes in non-obese through morbidly obese women. *British Journal of Health Psychology*, 23(4), 1066-1083. <https://doi.org/10.1111/bjhp.12338>
- Appleton, K. M., & Pidgeon, H. J. (2018). 5-a-day fruit and vegetable food product labels: Reduced fruit and vegetable consumption following an exaggerated compared to a modest label. *BMC Public Health*, 18(1), 624. <https://doi.org/10.1186/s12889-018-5528-0>

- Arnett, M. J., Thorpe, R. J., Jr., Gaskin, D. J., Bowie, J. V., & LaVeist, T. A. (2016). Race, medical mistrust, and segregation in primary care as usual source of care: Findings from the Exploring Health Disparities in Integrated Communities Study. *Journal of Urban Health*, 93(3), 456-467. <https://doi.org/10.1007/s11524-016-0054-9>
- Arrúa, A., Curutchet, M. R., Rey, N., Barreto, P., Golovchenko, N., Sellanes, A., Velazco, G., Winokur, M., Giménez, A., & Ares, G. (2017). Impact of front-of-pack nutrition information and label design on children's choice of two snack foods: Comparison of warnings and the traffic-light system. *Appetite*, 116, 139-146. <https://doi.org/10.1016/j.appet.2017.04.012>
- Atske, S. & Perrin, A. (2021). *Home broadband adoption, computer ownership vary by race, ethnicity in the U.S.* Pew Research Center. Retrieved October 20 from <https://www.pewresearch.org/fact-tank/2021/07/16/home-broadband-adoption-computer-ownership-vary-by-race-ethnicity-in-the-u-s/>
- Auchincloss, A. H., Young, C., Davis, A. L., Wasson, S., Chilton, M., & Karamanian, V. (2013). Barriers and facilitators of consumer use of nutrition labels at sit-down restaurant chains. *Public Health Nutrition*, 16(12), 2138-2145. <https://doi.org/10.1017/s1368980013000104>
- Austin, S. B., Haines, J., & Veugelers, P. J. (2009). Body satisfaction and body weight: Gender differences and sociodemographic determinants. *BMC Public Health*, 9(1), 313. <https://doi.org/10.1186/1471-2458-9-313>

- Baker, J. H., Higgins Neyland, M. K., Thornton, L. M., Runfola, C. D., Larsson, H., Lichtenstein, P., & Bulik, C. (2019). Body dissatisfaction in adolescent boys. *Dev Psychol*, 55(7), 1566-1578. <https://doi.org/10.1037/dev0000724>
- Baixaui, R., Salvador, A., Hough, G., & Fiszman, S. M. (2008). How information about fibre (traditional and resistant starch) influences consumer acceptance of muffins. *Food Quality and Preference*, 19(7), 628-635. <https://doi.org/10.1016/j.foodqual.2008.05.002>
- Balasubramanian, S., & Cole, C. (2002). Consumers' search and use of nutrition information: The challenge and promise of the Nutrition Labeling and Education Act. *Journal of Marketing*, 66, 112-127. <https://doi.org/10.1509/jmkg.66.3.112.18502>
- Barker, M., Lawrence, W., Robinson, S., & Baird, J. (2012). Food labelling and dietary behaviour: Bridging the gap. *Public Health Nutrition*, 15(5), 758-759. <https://doi.org/10.1017/s136898001200081x>
- Bell, B. T., Deighton-Smith, N., & Hurst, M. (2019). 'When you think of exercising, you don't really want to think of puking, tears, and pain': Young adolescents' understanding of fitness and #fitspiration. *Journal of Health Psychology*, 26(7), 1046-1060. <https://doi.org/10.1177/1359105319869798>
- Bhawra, J., Kirkpatrick, S. I., Hall, M. G., Vanderlee, L., Thrasher, J. F., & Hammond, D. (2022). Correlates of self-reported and functional understanding of nutrition labels across 5 countries in the 2018 International Food Policy Study. *Journal of Nutrition*, 152(Supplement_1), 13s-24s. <https://doi.org/10.1093/jn/nxac018>

- Bibiloni, M. d. M., Coll, J. L., Pich, J., Pons, A., & Tur, J. A. (2017). Body image satisfaction and weight concerns among a Mediterranean adult population. *BMC Public Health*, 17(1), 39. <https://doi.org/10.1186/s12889-016-3919-7>
- Bleich, S. N., & Wolfson, J. A. (2015). Differences in consumer use of food labels by weight loss strategies and demographic characteristics. *BMC Public Health*, 15, 1275-1275. <https://doi.org/10.1186/s12889-015-2651-z>
- Blitstein, J. L., & Evans, W. D. (2006). Use of Nutrition Facts panels among adults who make household food purchasing decisions. *Journal of Nutrition Education and Behavior*, 38(6), 360-364. <https://doi.org/10.1016/j.jneb.2006.02.009>
- Bloom, B., Jones, L. I., & Freeman, G. (2013). Summary health statistics for U.S. children: National Health Interview Survey, 2012. *Vital Health Stat 10*(258), 1-81.
- Bornioli, A., Lewis-Smith, H., Slater, A., & Bray, I. (2021). Body dissatisfaction predicts the onset of depression among adolescent females and males: A prospective study. *Journal of Epidemiology and Community Health*, 75(4), 343. <https://doi.org/10.1136/jech-2019-213033>
- Bould, H., Carnegie, R., Allward, H., Bacon, E., Lambe, E., Sapseid, M., Button, K. S., Lewis, G., Skinner, A., Broome, M. R., Park, R., Harmer, C. J., Penton-Voak, I. S., & Munafò, M. R. (2018). Effects of exposure to bodies of different sizes on perception of and satisfaction with own body size: two randomized studies. *R Soc Open Sci*, 5(5), 171387. <https://doi.org/10.1098/rsos.171387>
- Bouzas, C., Bibiloni, M. D. M., & Tur, J. A. (2019). Relationship between body image and body weight control in overweight ≥ 55 -year-old adults: A systematic review.

- International Journal of Environmental Research and Public Health*, 16(9), 1622.
<https://doi.org/10.3390/ijerph16091622>
- Brechan, I., & Kvalem, I. L. (2015). Relationship between body dissatisfaction and disordered eating: Mediating role of self-esteem and depression. *Eating Behaviors*, 17, 49-58. <https://doi.org/10.1016/j.eatbeh.2014.12.008>
- Bridger, T. (2009). Childhood obesity and cardiovascular disease. *Paediatrics & Child Health*, 14(3), 177-182. <https://doi.org/10.1093/pch/14.3.177>
- Brown, R., Seabrook, J. A., Stranges, S., Clark, A. F., Haines, J., O'Connor, C., Doherty, S., & Gilliland, J. A. (2021). Examining the correlates of adolescent food and nutrition knowledge. *Nutrients*, 13(6). <https://doi.org/10.3390/nu13062044>
- Bryła, P. (2020). Who reads food labels? Selected predictors of consumer interest in front-of-package and back-of-package labels during and after the purchase. *Nutrients*, 12(9). <https://doi.org/10.3390/nu12092605>
- Bucchianeri, M. M., Arikian, A. J., Hannan, P. J., Eisenberg, M. E., & Neumark-Sztainer, D. (2013). Body dissatisfaction from adolescence to young adulthood: findings from a 10-year longitudinal study. *Body Image*, 10(1), 1-7.
<https://doi.org/10.1016/j.bodyim.2012.09.001>
- Campbell, M. K. (2016). Biological, environmental, and social influences on childhood obesity. *Pediatric Research*, 79(1), 205-211. <https://doi.org/10.1038/pr.2015.208>
- Bopape, M., Taillie, L. S., & Swart, R. (2022). Perceived effect of warning label on parental food purchasing and drivers of food selection among South African parents-an exploratory study. *Frontiers in Public Health*, 10, 939937.
<https://doi.org/10.3389/fpubh.2022.939937>

- Buote, V. M., Wilson, A. E., Strahan, E. J., Gazzola, S. B., & Papps, F. (2011). Setting the bar: Divergent sociocultural norms for women's and men's ideal appearance in real-world contexts. *Body Image*, 8(4), 322-334.
<https://doi.org/10.1016/j.bodyim.2011.06.002>
- Burton, S., Garretson, J. A., & Velliquette, A. M. (1999). Implications of accurate usage of nutrition facts panel information for food product evaluations and purchase intentions. *Journal of the Academy of Marketing Science*, 27(4), 470-480.
<https://doi.org/10.1177/0092070399274006>
- Buyuktuncer, Z., Ayaz, A., Dedebyraktar, D., Inan-Eroglu, E., Ellahi, B., & Besler, H. T. (2018). Promoting a healthy diet in young adults: The role of nutrition labelling. *Nutrients*, 10(10), 1335. <https://doi.org/10.3390/nu10101335>
- Calogero, R. M., Davis, W. N., & Thompson, J. K. (2005). The role of self-objectification in the experience of women with eating disorders. *Sex Roles*, 52(1), 43-50. <https://doi.org/10.1007/s11199-005-1192-9>
- Calzo, J. P., Sonnevile, K. R., Haines, J., Blood, E. A., Field, A. E., & Austin, S. B. (2012). The development of associations among body mass index, body dissatisfaction, and weight and shape concern in adolescent boys and girls. *Journal of Adolescent Health*, 51(5), 517-523.
<https://doi.org/10.1016/j.jadohealth.2012.02.021>
- Campos, S., Doxey, J., & Hammond, D. (2011). Nutrition labels on pre-packaged foods: a systematic review. *Public Health Nutrition*, 14(8), 1496-1506.
<http://dx.doi.org/10.1017/S1368980010003290>

- Cauberghe, V., Van Wesenbeeck, I., De Jans, S., Hudders, L., & Ponnet, K. (2020). How adolescents use social media to cope with feelings of loneliness and anxiety during COVID-19 lockdown. *Cyberpsychology, Behavior, and Social Networking*, 24(4), 250-257. <https://doi.org/10.1089/cyber.2020.0478>
- Centers for Disease Control and Prevention. (2018). *Defining childhood obesity: BMI for children and teens*. Retrieved June 17, 2021 from <https://www.cdc.gov/obesity/childhood/defining.html>
- Cha, E. M., Hoelscher, D. M., Ranjit, N., Chen, B., Gabriel, K. P., Kelder, S., & Saxton, D. L. (2018). Effect of media use on adolescent body weight. *Preventing Chronic Disease*, 15, E141-E141. <https://doi.org/10.5888/pcd15.180206>
- Channing Division of Network Medicine. (2020). *Growing Up Today Study (GUTS)*. Retrieved August 26, 2021 from <http://www.gutsweb.org/>
- Chapman, J., Armitage, C. J., & Norman, P. (2009). Comparing implementation intention interventions in relation to young adults' intake of fruit and vegetables. *Psychology & Health*, 24(3), 317-332. <https://doi.org/10.1080/08870440701864538>
- Chau, M. M., Burgermaster, M., & Mamykina, L. (2018). The use of social media in nutrition interventions for adolescents and young adults-A systematic review. *International Journal of Medical Informatics*, 120, 77-91. <https://doi.org/10.1016/j.ijmedinf.2018.10.001>
- Choukas-Bradley, S., Nesi, J., Widman, L., & Galla, B. M. (2020). The Appearance-Related Social Media Consciousness Scale: Development and validation with

- adolescents. *Body Image*, 33, 164-174.
<https://doi.org/10.1016/j.bodyim.2020.02.017>
- Christoph, M. J., An, R., & Ellison, B. (2016). Correlates of nutrition label use among college students and young adults: A review. *Public Health Nutrition*, 19(12), 2135-2148. <https://doi.org/10.1017/s1368980015003183>
- Christoph, M. J., Larson, N., Laska, M. N., & Neumark-Sztainer, D. (2018). Nutrition facts panels: Who uses them, what do they use, and how does use relate to dietary intake? *Journal of the Academy of Nutrition and Dietetics*, 118(2), 217-228.
<https://doi.org/10.1016/j.jand.2017.10.014>
- Christoph, M. J., Loth, K. A., Eisenberg, M. E., Haynos, A. F., Larson, N., & Neumark-Sztainer, D. (2018). Nutrition facts use in relation to eating behaviors and healthy and unhealthy weight control behaviors. *Journal of Nutrition Education and Behavior*, 50(3), 267-274.e261. <https://doi.org/10.1016/j.jneb.2017.11.001>
- Cowburn, G., & Stockley, L. (2005). Consumer understanding and use of nutrition labelling: A systematic review. *Public Health Nutrition*, 8(1), 21-28.
<https://doi.org/10.1079/PHN2004666>
- Cramer, P., & Steinwert, T. (1998). Thin is good, fat is bad: how early does it begin? *Journal of Applied Developmental Psychology*, 19(3), 429-451.
[https://doi.org/10.1016/S0193-3973\(99\)80049-5](https://doi.org/10.1016/S0193-3973(99)80049-5)
- Crane, M. M., Jeffery, R. W., & Sherwood, N. E. (2017). Exploring Gender Differences in a Randomized Trial of Weight Loss Maintenance. *Am J Mens Health*, 11(2), 369-375. <https://doi.org/10.1177/1557988316681221>

- Crane, M. M., Tangney, C. C., French, S. A., Wang, Y., & Appelhans, B. M. (2019). Gender comparison of the diet quality and sources of food purchases made by urban primary household food purchasers. *Journal of Nutrition Education and Behav*, 51(2), 199-204. <https://doi.org/10.1016/j.jneb.2018.07.016>
- Crosnoe, R., & Johnson, M. K. (2011). Research on adolescence in the twenty-first century. *Annual Review of Sociology*, 37, 439-460. <https://doi.org/10.1146/annurev-soc-081309-150008>
- Daniel, S., & Bridges, S. K. (2010). The drive for muscularity in men: Media influences and objectification theory. *Body Image*, 7(1), 32-38. <https://doi.org/10.1016/j.bodyim.2009.08.003>
- Daniels, S. R., Arnett, D. K., Eckel, R. H., Gidding, S. S., Hayman, L. L., Kumanyika, S., Robinson, T. N., Scott, B. J., St Jeor, S., & Williams, C. L. (2005). Overweight in children and adolescents: Pathophysiology, consequences, prevention, and treatment. *Circulation*, 111(15), 1999-2012. <https://doi.org/10.1161/01.Cir.0000161369.71722.10>
- de Guzman, N. S., & Nishina, A. (2014). A longitudinal study of body dissatisfaction and pubertal timing in an ethnically diverse adolescent sample. *Body Image*, 11(1), 68-71. <https://doi.org/10.1016/j.bodyim.2013.11.001>
- de Morais Sato, P., Mais, L. A., Khandpur, N., Ulian, M. D., Bortoletto Martins, A. P., Garcia, M. T., Spinillo, C. G., Urquizar Rojas, C. F., Jaime, P. C., & Scagliusi, F. B. (2019). Consumers' opinions on warning labels on food packages: A qualitative study in Brazil. *PLOS ONE*, 14(6), e0218813. <https://doi.org/10.1371/journal.pone.0218813>

- de-Magistris, T., Royo, A. G., & HurlÈ, J. B. (2010). Effects of the nutritional labels use on healthy eating habits in Spain. *Agricultural Economics*, 56(11), 540–55.
- de Onis, M., Onyango, A. W., Borghi, E., Siyam, A., Nishida, C., & Siekmann, J. (2007). Development of a WHO growth reference for school-aged children and adolescents. *Bulletin of the World Health Organization*, 85(9), 660-667.
doi:10.2471/blt.07.043497
- dell'Olio, L., Ibeas, A., Oña, J. d., & Oña, R. d. (2018). Chapter 4 - Designing a survey for public transport users. In L. dell'Olio, A. Ibeas, J. d. Oña, & R. d. Oña (Eds.), *Public transportation quality of service* (pp. 49-61). Elsevier.
<https://doi.org/10.1016/B978-0-08-102080-7.00004-5>
- Denny, K. N., Loth, K., Eisenberg, M. E., & Neumark-Sztainer, D. (2013). Intuitive eating in young adults. Who is doing it, and how is it related to disordered eating behaviors? *Appetite*, 60(1), 13-19. <https://doi.org/10.1016/j.appet.2012.09.029>
- do Carmo, A. S., Mendes, L. L., Pessoa, M. C., Meireles, A. L., da Silva, A. A. M., & Dos Santos, L. C. (2021). Family characteristics, perceived environment for physical activity, and childhood obesity: An approach with structural equation models. *American Journal of Human Biology*, 33(6), e23560.
<https://doi.org/10.1002/ajhb.23560>
- Doan, N., Olstad, D. L., Vanderlee, L., Hammond, D., Wallace, M., & Kirkpatrick, S. I. (2022). Investigating the intersections of racial identity and perceived income adequacy in relation to dietary quality among adults in Canada. *Journal of Nutrition*, 152(Suppl 1), 67s-75s. <https://doi.org/10.1093/jn/nxac076>

- Drichoutis, A. C., Lazaridis, P., Nayga, R. M., Jr., Kapsokefalou, M., & Chryssochoidis, G. (2008). A theoretical and empirical investigation of nutritional label use. *European Journal of Health Economics*, 9(3), 293-304.
<https://doi.org/10.1007/s10198-007-0077-y>
- Dues, K., Kandiah, J., Khubchandani, J., & Haroldson, A. (2019). Adolescent Body Weight Perception: Association With Diet and Physical Activity Behaviors. *The Journal of School Nursing*, 36(5), 339-347.
<https://doi.org/10.1177/1059840518824386>
- Dumoitier, A., Abbo, V., Neuhofer, Z. T., & McFadden, B. R. (2019). A review of nutrition labeling and food choice in the United States. *Obesity Science & Practice*, 5(6), 581-591. <https://doi.org/10.1002/osp4.374>
- Edgar, K. A., & Skinner, T. C. (2003). Illness representations and coping as predictors of emotional well-being in adolescents with type 1 diabetes. *Journal of Pediatric Psychology*, 28(7), 485-493. <https://doi.org/10.1093/jpepsy/jsg039>
- Eisenberg, M. E., Gower, A. L., McMorris, B. J., Rider, G. N., Shea, G., & Coleman, E. (2017). Risk and Protective Factors in the Lives of Transgender/Gender Nonconforming Adolescents. *J Adolesc Health*, 61(4), 521-526.
<https://doi.org/10.1016/j.jadohealth.2017.04.014>
- Eisenberg, M. E., Neumark-Sztainer, D., & Paxton, S. J. (2006). Five-year change in body satisfaction among adolescents. *Journal of Psychosomatic Research*, 61(4), 521-527. <https://doi.org/10.1016/j.jpsychores.2006.05.007>
- Elbon, S. M., Johnson, M. A., Fischer, J. G., & Searcy, C. A. (2000). Demographic factors, nutrition knowledge, and health-seeking behaviors influence nutrition

- label reading behaviors among older American adults. *Journal of Nutrition For the Elderly*, 19(3), 31-48. https://doi.org/10.1300/J052v19n03_03
- Fahlman, M. M., McCaughtry, N., Martin, J., & Shen, B. (2010). Racial and socioeconomic disparities in nutrition behaviors: targeted interventions needed. *Journal of Nutrition Education and Behavior*, 42(1), 10-16. <https://doi.org/10.1016/j.jneb.2008.11.003>
- Fanelli, S. M., Jonnalagadda, S. S., Pisegna, J. L., Kelly, O. J., Krok-Schoen, J. L., & Taylor, C. A. (2020). Poorer diet quality observed among US adults with a greater number of clinical chronic disease risk factors. *Journal of Primary Care & Community Health*, 11, 2150132720945898. <https://doi.org/10.1177/2150132720945898>
- Fang Zhang, F., Liu, J., Rehm, C. D., Wilde, P., Mande, J. R., & Mozaffarian, D. (2018). Trends and disparities in diet quality among US adults by Supplemental Nutrition Assistance Program participation status. *JAMA Network Open*, 1(2), e180237. <https://doi.org/10.1001/jamanetworkopen.2018.0237>
- Farhat, T. (2015). Stigma, obesity and adolescent risk behaviors: Current research and future directions. *Current Opinion in Psychology*, 5, 56-66. <https://doi.org/10.1016/j.copsyc.2015.03.021>
- Fernández-Bustos, J. G., Infantes-Paniagua, Á., Gonzalez-Martí, I., & Contreras-Jordán, O. R. (2019). Body dissatisfaction in adolescents: Differences by sex, BMI and type and organisation of physical activity. *International Journal of Environmental Research and Public Health*, 16(17), 3109. <https://doi.org/10.3390/ijerph16173109>

- Field, A. E., Javaras, K. M., Aneja, P., Kitos, N., Camargo, C. A., Jr., Taylor, C. B., & Laird, N. M. (2008). Family, peer, and media predictors of becoming eating disordered. *Archives of Pediatric & Adolescent Medicine*, 162(6), 574-579. <https://doi.org/10.1001/archpedi.162.6.574>
- Fitzgerald, N., Damio, G., Segura-Pérez, S., & Pérez-Escamilla, R. (2008). Nutrition knowledge, food label use, and food intake patterns among Latinas with and without type 2 diabetes. *Journal of the American Dietetic Association*, 108(6), 960-967. <https://doi.org/10.1016/j.jada.2008.03.016>
- Flodgren, G. M., Helleve, A., Lobstein, T., Rutter, H., & Klepp, K.-I. (2020). Primary prevention of overweight and obesity in adolescents: An overview of systematic reviews. *Obesity Reviews*, 21(11), e13102. <https://doi.org/10.1111/obr.13102>
- Franco-Arellano, B., Vanderlee, L., Ahmed, M., Oh, A., & L'Abbé, M. (2020). Influence of front-of-pack labelling and regulated nutrition claims on consumers' perceptions of product healthfulness and purchase intentions: A randomized controlled trial. *Appetite*, 149, 104629. <https://doi.org/10.1016/j.appet.2020.104629>
- Franco, D. L., & Striegel-Moore, R. H. (2002). The role of body dissatisfaction as a risk factor for depression in adolescent girls: Are the differences Black and white? *Journal of Psychosomatic Research*, 53(5), 975-983. [https://doi.org/10.1016/S0022-3999\(02\)00490-7](https://doi.org/10.1016/S0022-3999(02)00490-7)
- Fredrickson, B. L., & Roberts, T.-A. (1997). Objectification theory: Toward understanding women's lived experiences and mental health risks. *Psychology of*

- Women Quarterly*, 21(2), 173-206. <https://doi.org/10.1111/j.1471-6402.1997.tb00108.x>
- Freire, W. B., Waters, W. F., Rivas-Mariño, G., Nguyen, T., & Rivas, P. (2017). A qualitative study of consumer perceptions and use of traffic light food labelling in Ecuador. *Public Health Nutrition*, 20(5), 805-813. <https://doi.org/10.1017/s1368980016002457>
- Frie, K., Hartmann-Boyce, J., Jebb, S. A., & Aveyard, P. (2020). Effectiveness of a self-regulation intervention for weight loss: A randomized controlled trial. *British Journal of Health Psychology*, 25(3), 652-676. <https://doi.org/10.1111/bjhp.12436>
- Fyler, M., Schumacher, J., Banning, J., & Gam, H. J. (2014). Influence of body satisfaction, body mass index, and diet quality on healthy eating attitudes among college students. *Family and Consumer Sciences Research Journal*, 42(4), 330-340. <https://doi.org/10.1111/fcsr.12067>
- Galioto, R., & Crowther, J. H. (2013). The effects of exposure to slender and muscular images on male body dissatisfaction. *Body Image*, 10(4), 566-573. <https://doi.org/10.1016/j.bodyim.2013.07.009>
- Gans, K. M., Burkholder, G. J., Risica, P. M., & Lasater, T. M. (2003). Baseline fat-related dietary behaviors of white, Hispanic, and Black participants in a cholesterol screening and education project in New England. *Journal of the American Dietetic Association*, 103(6), 699-706. <https://doi.org/10.1053/jada.2003.50135>
- Gans, K. M., Lovell, H. J., Fortunet, R., Mc mahon, C., Carton-Lopez, S., & Lasater, T. M. (1999). Implications of qualitative research for nutrition education geared to

- selected Hispanic audiences. *Journal of Nutrition Education*, 31(6), 331-338.
[https://doi.org/10.1016/S0022-3182\(99\)70486-3](https://doi.org/10.1016/S0022-3182(99)70486-3)
- Gaylis, J. B., Levy, S. S., & Hong, M. Y. (2020). Relationships between body weight perception, body mass index, physical activity, and food choices in Southern California male and female adolescents. *International Journal of Adolescence and Youth*, 25(1), 264-275. <https://doi.org/10.1080/02673843.2019.1614465>
- Gillett, T. J. (2011). Lessons from nutritional labeling on the 20th anniversary of the NLEA: Applying the history of food labeling to the future of household chemical labeling. *Washington University Journal of Law and Policy*, 37.
- Goldfield, G., Moore, C., Henderson, K., Buchholz, A., Obeid, N., & Flament, M. (2010). The relation between weight-based teasing and psychological adjustment in adolescents. *Paediatrics & Child Health*, 15(5), 283-288.
<https://doi.org/10.1093/pch/15.5.283>
- Goldschmidt, A. B., Wall, M. M., Choo, T.-H. J., Evans, E. W., Jelalian, E., Larson, N., & Neumark-Sztainer, D. (2018). Fifteen-year weight and disordered eating patterns among community-based adolescents. *American Journal of Preventive Medicine*, 54(1), e21-e29. <https://doi.org/10.1016/j.amepre.2017.09.005>
- Goodman, S., Hammond, D., Pillo-Blocka, F., Glanville, T., & Jenkins, R. (2011). Use of nutritional information in Canada: National trends between 2004 and 2008. *Journal of Nutrition Education and Behavior*, 43(5), 356-365.
<https://doi.org/10.1016/j.jneb.2011.02.008>
- Gordon, C. S., Jarman, H. K., Rodgers, R. F., McLean, S. A., Slater, A., Fuller-Tyszkiewicz, M., & Paxton, S. J. (2021). Outcomes of a cluster randomized

- controlled trial of the SoMe social media literacy program for improving body image-related outcomes in adolescent boys and girls. *Nutrients*, 13(11).
<https://doi.org/10.3390/nu13113825>
- Gordon-Larsen, P., The, N. S., & Adair, L. S. (2010). Longitudinal trends in obesity in the United States from adolescence to the third decade of life. *Obesity*, 18(9), 1801-1804. <https://doi.org/10.1038/oby.2009.451>
- Government of Canada Health and Nutrition Surveys. (2021). *Canadian Community Health Survey*. Retrieved September 5, 2021 from
<https://www.canada.ca/en/health-canada/services/food-nutrition/food-nutrition-surveillance/health-nutrition-surveys/canadian-community-health-survey-cchs.html>
- Greenberg, E. F. (1990). The changing food label: The Nutrition Labeling and Education Act of 1990. *Loyola Consumer Law Review*, 3(1).
- Grunert, K. G., Wills, J. M., & Fernández-Celemín, L. (2010). Nutrition knowledge, and use and understanding of nutrition information on food labels among consumers in the UK. *Appetite*, 55(2), 177-189. <https://doi.org/10.1016/j.appet.2010.05.045>
- Guthrie, J. F., Fox, J. J., Cleveland, L. E., & Welsh, S. (1995). Who uses nutrition labeling, and what effects does label use have on diet quality? *Journal of Nutrition Education*, 27(4), 163-172. [https://doi.org/10.1016/S0022-3182\(12\)80422-5](https://doi.org/10.1016/S0022-3182(12)80422-5)
- Haidar, A., Carey, F. R., Ranjit, N., Archer, N., & Hoelscher, D. (2017). Self-reported use of nutrition labels to make food choices is associated with healthier dietary

- behaviours in adolescents. *Public Health Nutrition*, 20(13), 2329-2339.
<https://doi.org/10.1017/s1368980017001252>
- Haines, J., Neumark-Sztainer, D., Eisenberg, M. E., & Hannan, P. J. (2006). Weight teasing and disordered eating behaviors in adolescents: longitudinal findings from Project EAT (Eating Among Teens). *Pediatrics*, 117(2), e209-215.
<https://doi.org/10.1542/peds.2005-1242>
- Hamlin, R., & Hamlin, B. (2020). An experimental comparison of the impact of ‘warning’ and ‘health star rating’ FoP labels on adolescents’ choice of breakfast cereals in New Zealand. *Nutrients*, 12(6). <https://doi.org/10.3390/nu12061545>
- Hammond D. *International Food Policy Study: 2019 youth survey – United States*. 2021. Retrieved June 17, 2021 from http://foodpolicystudy.com/wp-content/uploads/2021/02/2019-IFPS-Youth-Survey-USA_20210225.pdf
- Hammond, D., Vanderlee, L., White, C. M., Acton, R. B., White, M., Roberto, C. A., Cameron, A., Sacks, G., Kirkpatrick, S., Dubin, J., Adams, J., Jauregui, A., & Thrasher, J. F. (2022). The conceptual framework for the International Food Policy Study: Evaluating the population-level impact of food policy. *The Journal of Nutrition*, 152(Supplement_1), 1S-12S. <https://doi.org/10.1093/jn/nxac042>
- Hammond, D., White, C. M., & Reid, J. L. (2017). *2016 Canada Food Study: Technical report – Wave 2*. Retrieved June 17, 2021 from <http://www.canadafoodstudy.ca/studydocs>
- Hammond, D., White, C. M., Rynard, V. L., & Vanderlee, L. (2021). *International Food Policy Study: Technical report – 2019 youth survey*. Retrieved Retrieved June 17, 2021 from <http://foodpolicystudy.com/methods/>

- Hartman-Munick, S. M., Gordon, A. R., & Guss, C. (2020). Adolescent body image: Influencing factors and the clinician's role. *Current Opinion in Pediatrics*, 32(4).
<https://doi.org/10.1097/MOP.0000000000000910>
- Hawthorne, K. M., Moreland, K., Griffin, I. J., & Abrams, S. A. (2006). An educational program enhances food label understanding of young adolescents. *Journal of the American Dietetic Association*, 106(6), 913-916.
<https://doi.org/10.1016/j.jada.2006.03.004>
- Hayman, L. L. (2016). Reducing racial and ethnic disparities in childhood and adolescent obesity: Behavior matters. *The Journal of Pediatrics*, 175, 9-10.
<https://doi.org/10.1016/j.jpeds.2016.05.002>
- Hermans, R. C. J., Smit, K., van den Broek, N., Evenhuis, I. J., & Veldhuis, L. (2020). Adolescents' food purchasing patterns in the school food environment: Examining the role of perceived relationship support and maternal monitoring. *Nutrients*, 12(3). <https://doi.org/10.3390/nu12030733>
- Heymsfield, S. B., Aronne, L. J., Eneli, I., Kumar, R. B., Michalsky, M., Walker, E., Wolfe, B. M., Woolford, S. J., & Yanovski, S. (2018). Clinical perspectives on obesity treatment: Challenges, gaps, and promising opportunities. *NAM Perspectives. Discussion Paper, National Academy of Medicine, Washington, DC*.
<https://doi.org/10.31478/201809b>
- Heywood, S., & McCabe, M. P. (2006). Negative affect as a mediator between body dissatisfaction and extreme weight loss and muscle gain behaviors. *Journal of Health Psychology*, 11(6), 833-844. <https://doi.org/10.1177/1359105306069077>

- Hieke, S., & Taylor, C. R. (2012). A critical review of the literature on nutritional labeling. *Journal of Consumer Affairs*, 46(1), 120-156.
<https://doi.org/10.1111/j.1745-6606.2011.01219.x>
- Higgins, E. T. (1998). Promotion and prevention: Regulatory focus as a motivational principle. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 30, pp. 1-46). Academic Press. [https://doi.org/10.1016/S0065-2601\(08\)60381-0](https://doi.org/10.1016/S0065-2601(08)60381-0)
- Hobin, E., Shen-Tu, G., Sacco, J., White, C., Bowman, C., Sheeshka, J., McVey, G., O'Brien, M. F., Vanderlee, L., & Hammond, D. (2016). Comprehension and use of Nutrition Facts tables among adolescents and young adults in Canada. *Canadian Journal of Dietetic Practics and Research*, 77(2), 59-65.
<https://doi.org/10.3148/cjdpr-2015-042>
- Holsen, I., Jones, D. C., & Birkeland, M. S. (2012). Body image satisfaction among Norwegian adolescents and young adults: A longitudinal study of the influence of interpersonal relationships and BMI. *Body Image*, 9(2), 201-208.
<https://doi.org/10.1016/j.bodyim.2012.01.006>
- Hooper, L., Puhl, R., Eisenberg, M. E., Crow, S., & Neumark-Sztainer, D. (2021). Weight teasing experienced during adolescence and young adulthood: Cross-sectional and longitudinal associations with disordered eating behaviors in an ethnically/racially and socioeconomically diverse sample. *International Journal of Eating Disorders*, 54(8), 1449-1462. <https://doi.org/10.1002/eat.23534>
- Houle-Johnson, S. A., & Kakinami, L. (2018). Do sex differences in reported weight loss intentions and behaviours persist across demographic characteristics and weight

- status in youth? A systematic review. *BMC Public Health*, 18(1), 1343.
<https://doi.org/10.1186/s12889-018-6179-x>
- Hu, T., Jacobs, D. R., Jr., Larson, N. I., Cutler, G. J., Laska, M. N., & Neumark-Sztainer, D. (2016). Higher diet quality in adolescence and dietary improvements are related to less weight gain during the transition from adolescence to adulthood. *The Journal of Pediatrics*, 178, 188-193.e183.
<https://doi.org/10.1016/j.jpeds.2016.08.026>
- Huang, T. T., Kaur, H., McCarter, K. S., Nazir, N., Choi, W. S., & Ahluwalia, J. S. (2004). Reading nutrition labels and fat consumption in adolescents. *Journal of Adolescent Health*, 35(5), 399-401.
<https://doi.org/10.1016/j.jadohealth.2004.02.005>
- Hunger, J. M., Major, B., Blodorn, A., & Miller, C. T. (2015). Weighed down by stigma: How weight-based social identity threat contributes to weight gain and poor health. *Social and Personality Psychology Compass*, 9(6), 255-268.
<https://doi.org/10.1111/spc3.12172>
- International Food Policy Study (2022). Retrieved September 5, 2022 from
<https://foodpolicystudy.com>
- Jakobsen, J. C., Gluud, C., Wetterslev, J., & Winkel, P. (2017). When and how should multiple imputation be used for handling missing data in randomised clinical trials – A practical guide with flowcharts. *BMC Medical Research Methodology*, 17(1), 162. <https://doi.org/10.1186/s12874-017-0442-1>
- Jarman, H. K., Marques, M. D., McLean, S. A., Slater, A., & Paxton, S. J. (2021). Motivations for social media use: Associations with social media engagement and

- body satisfaction and well-being among adolescents. *Journal of Youth and Adolescence*, 50(12), 2279-2293. <https://doi.org/10.1007/s10964-020-01390-z>
- Jarman, H. K., McLean, S. A., Slater, A., Marques, M. D., & Paxton, S. J. (2021). Direct and indirect relationships between social media use and body satisfaction: A prospective study among adolescent boys and girls. *New Media & Society*. <https://doi.org/10.1177/14614448211058468>
- Jasti, S., & Kovacs, S. (2010). Use of trans fat information on food labels and its determinants in a multiethnic college student population. *Journal of Nutrition Education and Behavior*, 42(5), 307-314. <https://doi.org/10.1016/j.jneb.2009.06.004>
- Jaworska, N., & MacQueen, G. (2015). Adolescence as a unique developmental period. *Journal of Psychiatry & Neuroscience*, 40(5), 291-293. <https://doi.org/10.1503/jpn.150268>
- Jay, M., Adams, J., Herring, S. J., Gillespie, C., Ark, T., Feldman, H., Jones, V., Zabar, S., Stevens, D., & Kalet, A. (2009). A randomized trial of a brief multimedia intervention to improve comprehension of food labels. *Preventive Medicine*, 48(1), 25-31. <https://doi.org/10.1016/j.ypmed.2008.10.011>
- Jebeile, H., Partridge, S. R., Gow, M. L., Baur, L. A., & Lister, N. B. (2021). Adolescent exposure to weight loss imagery on Instagram: A content analysis of “top” images. *Childhood Obesity*, 17(4), 241-248. <https://doi.org/10.1089/chi.2020.0351>
- Jia, P., Xue, H., Cheng, X., Wang, Y., & Wang, Y. (2019). Association of neighborhood built environments with childhood obesity: Evidence from a 9-year longitudinal,

- nationally representative survey in the US. *Environment International*, 128, 158-164. <https://doi.org/10.1016/j.envint.2019.03.067>
- Johnson, F., Pratt, M., & Wardle, J. (2012). Dietary restraint and self-regulation in eating behavior. *International Journal of Obesity*, 36(5), 665-674. <https://doi.org/10.1038/ijo.2011.156>
- Johnson, F., & Wardle, J. (2005). Dietary restraint, body dissatisfaction, and psychological distress: A prospective analysis. *Journal of Abnormal Psychology*, 114(1), 119-125. <https://doi.org/10.1037/0021-843x.114.1.119>
- Jones, T. L., Baxter, M. A., & Khanduja, V. (2013). A quick guide to survey research. *Annals of The Royal College of Surgeons of England*, 95(1), 5-7. <https://doi.org/10.1308/003588413x13511609956372>
- Jordan Lin, C.-T., Zhang, Y., Carlton, E. D., & Lo, S. C. (2016). 2014 FDA Health and Diet Survey. Retrieved August 1, 2021 from <https://www.fda.gov/media/96883/download>
- Jung, F., Spahlholz, J., Hilbert, A., Riedel-Heller, S. G., & Luck-Sikorski, C. (2017). Impact of weight-related discrimination, body dissatisfaction and self-stigma on the desire to weigh less. *Obesity Facts*, 10(2), 139-151. <https://doi.org/10.1159/000468154>
- Kansra, A. R., Lakkunarajah, S., & Jay, M. S. (2021). Childhood and adolescent obesity: A review. *Frontiers in Pediatrics*, 8. <https://doi.org/10.3389/fped.2020.581461>
- Kant, A. K., & Graubard, B. I. (2010). Contributors of water intake in US children and adolescents: associations with dietary and meal characteristics—National Health

- and Nutrition Examination Survey 2005–2006. *The American Journal of Clinical Nutrition*, 92(4), 887-896. <https://doi.org/10.3945/ajcn.2010.29708>
- Kim, E., Ellison, B., McFadden, B., & Prescott, M. (2021). Consumers' decisions to access or avoid added sugars information on the updated Nutrition Facts label. *PLOS ONE*, 16, e0249355. <https://doi.org/10.1371/journal.pone.0249355>
- Kim, E. J., Ellison, B., Prescott, M. P., & Nayga, R. M. (2020). Consumer comprehension of the Nutrition Facts label: A comparison of the original and updated labels. *American Journal of Health Promotion*, 35(5), 648-657. <https://doi.org/10.1177/0890117120983128>
- Kim, S.-Y., Nayga, R. M., & Capps, O. (2000). The effect of food label use on nutrient intakes: An endogenous switching regression analysis. *Journal of Agricultural and Resource Economics*, 25(1), 215-231. <https://doi.org/10.22004/AG.ECON.3083>
- Kleemans, M., Daalmans, S., Carbaat, I., & Anschütz, D. (2018). Picture perfect: The direct effect of manipulated Instagram photos on body image in adolescent girls. *Media Psychology*, 21(1), 93-110. <https://doi.org/10.1080/15213269.2016.1257392>
- Kneavel, M. (2021). Relationship Between Gender, Stress, and Quality of Social Support. *Psychol Rep*, 124(4), 1481-1501. <https://doi.org/10.1177/0033294120939844>
- Kostanski, M., Fisher, A., & Gullone, E. (2004). Current conceptualisation of body image dissatisfaction: Have we got it wrong? *Journal of Child Psychology and Psychiatry*, 45(7), 1317-1325. <https://doi.org/10.1111/j.1469-7610.2004.00315.x>

- Kral, T. V., Roe, L. S., & Rolls, B. J. (2002). Does nutrition information about the energy density of meals affect food intake in normal-weight women? *Appetite*, 39(2), 137-145. <https://doi.org/10.1006/appe.2002.0498>
- Krayer, A., Ingledew, D. K., & Iphofen, R. (2007). Social comparison and body image in adolescence: A grounded theory approach. *Health Education Research*, 23(5), 892-903. <https://doi.org/10.1093/her/cym076>
- Kris-Etherton, P. M., Petersen, K. S., Velarde, G., Barnard, N. D., Miller, M., Ros, E., O'Keefe, J. H., Williams, K., Sr., Horn, L. V., Na, M., Shay, C., Douglass, P., Katz, D. L., & Freeman, A. M. (2020). Barriers, opportunities, and challenges in addressing disparities in diet-related cardiovascular disease in the United States. *Journal of the American Heart Association*, 9(7), e014433. <https://doi.org/10.1161/jaha.119.014433>
- Kruger, J., Galuska, D. A., Serdula, M. K., & Jones, D. A. (2004). Attempting to lose weight: Specific practices among U.S. adults. *American Journal of Preventive Medicine*, 26(5), 402-406. <https://doi.org/10.1016/j.amepre.2004.02.001>
- Kucharczuk, A. J., Oliver, T. L., & Dowdell, E. B. (2022). Social media's influence on adolescents' food choices: A mixed studies systematic literature review. *Appetite*, 168, 105765. <https://doi.org/10.1016/j.appet.2021.105765>
- Kvaavik, E., Andersen, L. F., & Klepp, K. I. (2005). The stability of soft drinks intake from adolescence to adult age and the association between long-term consumption of soft drinks and lifestyle factors and body weight. *Public Health Nutrition*, 8(2), 149-157. <https://doi.org/10.1079/phn2004669>

- Lake, A. A., Mathers, J. C., Rugg-Gunn, A. J., & Adamson, A. J. (2006). Longitudinal change in food habits between adolescence (11-12 years) and adulthood (32-33 years): the ASH30 Study. *Journal of Public Health*, 28(1), 10-16.
<https://doi.org/10.1093/pubmed/fdi082>
- Lampard, A. M., Macle hose, R. F., Eisenberg, M. E., Larson, N. I., Davison, K. K., & Neumark-Sztainer, D. (2016). Adolescents who engage exclusively in healthy weight control behaviors: Who are they? *International Journal of Behavioral Nutrition and Physical Activity*, 13(1), 5. <https://doi.org/10.1186/s12966-016-0328-3>
- Lando, A., Verrill, L., & Wu, F. (2021). *FSANS: FDA's Food Safety and Nutrition Survey*. Retrieved August 14, 2021 from
<https://www.fda.gov/media/146532/download>
- Langellier, B. A., & Massey, P. M. (2016). Nutrition activation and dietary intake disparities among US adults. *Public Health Nutrition*, 19(17), 3123-3134.
<https://doi.org/10.1017/s1368980016001464>
- Larson, N. I., Story, M., Eisenberg, M. E., & Neumark-Sztainer, D. (2006). Food preparation and purchasing roles among adolescents: Associations with sociodemographic characteristics and diet quality. *Journal of the American Dietetic Association*, 106(2), 211-218. <https://doi.org/10.1016/j.jada.2005.10.029>
- Larson, N. I., Story, M. T., & Nelson, M. C. (2009). Neighborhood environments: Disparities in access to healthy foods in the U.S. *American Journal of Preventive Medicine*, 36(1), 74-81. <https://doi.org/10.1016/j.amepre.2008.09.025>

- Laz, T. H., Rahman, M., & Berenson, A. B. (2015). Association of frequent use of food labels with weight loss behaviors among low-income reproductive-age women. *Journal of the American College of Nutrition*, 34(1), 73-79.
<https://doi.org/10.1080/07315724.2014.891957>
- Lebow, J., Narr, C., Mattke, A., Gewirtz O'Brien, J. R., Billings, M., Hathaway, J., Vickers, K., Jacobson, R., & Sim, L. (2021). Engaging primary care providers in managing pediatric eating disorders: A mixed methods study. *Journal of Eating Disorders*, 9(1), 11. <https://doi.org/10.1186/s40337-020-00363-8>
- Lee-Kwan, S. H., Moore, L. V., Blanck, H. M., Harris, D. M., & Galuska, D. (2017). Disparities in state-specific adult fruit and vegetable consumption - United States, 2015. *MMWR. Morbidity and Mortality Weekly Report*, 66(45), 1241-1247.
<https://doi.org/10.15585/mmwr.mm6645a1>
- Leme, A. C., & Philippi, S. T. (2013). Teasing and weight-control behaviors in adolescent girls. *Revista Paulista de Pediatria*, 31(4), 431-436.
<https://doi.org/10.1590/s0103-05822013000400003>
- Lemon, S. C., Rosal, M. C, Zapka, J., Borg, A., & Andersen, V. (2009). Contributions of weight perceptions to weight loss attempts: Differences by body mass index and gender. *Body Image*, 6(2), 90-96. <https://doi.org/10.1016/j.bodyim.2008.11.004>
- Lessard, L. M., & Puhl, R. M. (2021). Adolescent academic worries amid COVID-19 and perspectives on pandemic-related changes in teacher and peer relations. *School Psychology*, 36(5), 285-292. <https://doi.org/10.1037/spq0000443>

- Lessard, L. M., & Puhl, R. M. (2021). Adolescents' exposure to and experiences of weight stigma during the COVID-19 pandemic. *Journal of Pediatric Psychology*, 46(8), 950-959. <https://doi.org/10.1093/jpepsy/jsab071>
- Leventhal, H., Meyer, D., & Nerenz, D. (1980). The common-sense representation of illness danger. In S. Rachman (Ed.), *Contributions to medical psychology* (Vol. 2, pp. 7-30). Pergamon Press.
- Lewis, J. E., Arheart, K. L., LeBlanc, W. G., Fleming, L. E., Lee, D. J., Davila, E. P., Cabán-Martinez, A. J., Dietz, N. A., McCollister, K. E., Bandiera, F. C., & Clark, J. D., Jr. (2009). Food label use and awareness of nutritional information and recommendations among persons with chronic disease. *The American Journal of Clinical Nutrition*, 90(5), 1351-1357. <https://doi.org/10.3945/ajcn.2009.27684>
- Liechty, J. M. (2010). Body image distortion and three types of weight loss behaviors among nonoverweight girls in the United States. *Journal of Adolescent Health*, 47(2), 176-182. <https://doi.org/10.1016/j.jadohealth.2010.01.004>
- Lin, B.-H., & Yen, S. T. (2008). Consumer knowledge, food label use and grain consumption in the US. *Applied Economics*, 40(4), 437-448. <https://doi.org/10.1080/00036840600690298>
- Lipsky, L. M., Haynie, D. L., Liu, D., Chaurasia, A., Gee, B., Li, K., Iannotti, R. J., & Simons-Morton, B. (2015). Trajectories of eating behaviors in a nationally representative cohort of U.S. adolescents during the transition to young adulthood. *The International Journal of Behavioral Nutrition and Physical Activity*, 12, 138-138. <https://doi.org/10.1186/s12966-015-0298-x>

- Litwin, H., & Sapir, E. V. (2009). Perceived income adequacy among older adults in 12 countries: findings from the survey of health, ageing, and retirement in Europe. *Gerontologist*, 49(3), 397-406. <https://doi.org/10.1093/geront/gnp036>
- Lopez Khoury, E. N., Litvin, E. B., & Brandon, T. H. (2009). The effect of body image threat on smoking motivation among college women: Mediation by negative affect. *Psychology of Addictive Behaviors*, 23(2), 279-286. <https://doi.org/10.1037/a0014291>
- Lowry, R., Galuska, D. A., Fulton, J. E., Wechsler, H., & Kann, L. (2002). Weight management goals and practices among U.S. high school students: Associations with physical activity, diet, and smoking. *Journal of Adolescent Health*, 31(2), 133-144. [https://doi.org/10.1016/s1054-139x\(01\)00408-6](https://doi.org/10.1016/s1054-139x(01)00408-6)
- Lubman, N., Doak, C., & Jasti, S. (2012). Food label use and food label skills among immigrants from the former Soviet Union. *Journal of Nutrition Education and Behavior*, 44(5), 398-406. <https://doi.org/10.1016/j.jneb.2011.08.009>
- Ma, G., & Zhuang, X. (2021). Nutrition label processing in the past 10 years: Contributions from eye tracking approach. *Appetite*, 156, 104859. <https://doi.org/10.1016/j.appet.2020.104859>
- Mahon, C., & Hevey, D. (2021). Processing body image on social media: Gender differences in adolescent boys' and girls' agency and active coping. *Frontiers in Psychology*, 12(1703). <https://doi.org/10.3389/fpsyg.2021.626763>
- Mäkinen, M., Puukko-Viertomies, L. R., Lindberg, N., Siimes, M. A., & Aalberg, V. (2012). Body dissatisfaction and body mass in girls and boys transitioning from

- early to mid-adolescence: Additional role of self-esteem and eating habits. *BMC Psychiatry*, 12, 35. <https://doi.org/10.1186/1471-244x-12-35>
- Malloy-Weir, L., & Cooper, M. (2017). Health literacy, literacy, numeracy and nutrition label understanding and use: a scoping review of the literature. *Journal of Human Nutrition and Dietetics*, 30(3), 309-325. <https://doi.org/10.1111/jhn.12428>
- Mandelbaum, J., Davis, R. E., Frongillo, E., Thrasher, J. F., Vanderlee, L., & Hammond, D. (N.D.). Nutrition Facts label use, healthy eating efforts, and sociodemographic characteristics among U.S. adolescents.
- Mandelbaum, J., & Harrison, S. E. (2022). Perceived challenges to implementing childhood obesity prevention strategies in pediatric primary care. *SSM - Qualitative Research in Health*, 2, 100185. <https://doi.org/10.1016/j.ssmqr.2022.100185>
- Marciano, L., Ostroumova, M., Schulz, P. J., & Camerini, A.-L. (2022). Digital media use and adolescents' mental health during the Covid-19 pandemic: A systematic review and meta-analysis. *Frontiers in Public Health*, 9. <https://doi.org/10.3389/fpubh.2021.793868>
- Markey, C. N. (2010). Invited commentary: Why body image is important to adolescent development. *Journal of Youth and Adolescence*, 39(12), 1387-1391. <https://doi.org/10.1007/s10964-010-9510-0>
- McClain, A. D., Chappuis, C., Nguyen-Rodriguez, S. T., Yaroch, A. L., & Spruijt-Metz, D. (2009). Psychosocial correlates of eating behavior in children and adolescents: a review. *International Journal of Behavioral Nutrition and Physical Activity*, 6, 54. <https://doi.org/10.1186/1479-5868-6-54>

- McCormack, L. A., Laska, M. N., Gray, C., Veblen-Mortenson, S., Barr-Anderson, D., & Story, M. (2011). Weight-related teasing in a racially diverse sample of sixth-grade children. *Journal of the American Dietetic Association, 111*(3), 431-436. <https://doi.org/10.1016/j.jada.2010.11.021>
- McCreary, D. R., & Sasse, D. K. (2000). An exploration of the drive for muscularity in adolescent boys and girls. *Journal of American College Health, 48*(6), 297-304. <https://doi.org/10.1080/07448480009596271>
- McDool, E., Powell, P., Roberts, J., & Taylor, K. (2020). The internet and children's psychological wellbeing. *Journal of Health Economics, 69*, 102274. <https://doi.org/10.1016/j.jhealeco.2019.102274>
- McDow, K. B., Nguyen, D. T., Herrick, K. A., & Akinbami, L. J. (2019). Attempts to lose weight among adolescents aged 16-19 in the United States, 2013-2016. *NCHS Data Brief*(340), 1-8.
- McLean, R., & Hoek, J. (2014). Sodium and nutrition labelling: A qualitative study exploring New Zealand consumers' food purchasing behaviours. *Public Health Nutrition, 17*(5), 1138-1146. <https://doi.org/10.1017/S1368980013001079>
- Menzel, J. E., Schaefer, L. M., Burke, N. L., Mayhew, L. L., Brannick, M. T., & Thompson, J. K. (2010). Appearance-related teasing, body dissatisfaction, and disordered eating: A meta-analysis. *Body Image, 7*(4), 261-270. <https://doi.org/10.1016/j.bodyim.2010.05.004>
- Mikolajczyk, R. T., Iannotti, R. J., Farhat, T., & Thomas, V. (2012). Ethnic differences in perceptions of body satisfaction and body appearance among U.S. schoolchildren:

- A cross-sectional study. *BMC Public Health*, 12, 425.
<https://doi.org/10.1186/1471-2458-12-425>
- Miller, D. L., Bell, E. A., Pelkman, C. L., Peters, J. C., & Rolls, B. J. (2000). Effects of dietary fat, nutrition labels, and repeated consumption on sensory-specific satiety. *Physiology & Behavior*, 71(1-2), 153-158. [https://doi.org/10.1016/s0031-9384\(00\)00319-x](https://doi.org/10.1016/s0031-9384(00)00319-x)
- Miller, D. L., Castellanos, V. H., Shide, D. J., Peters, J. C., & Rolls, B. J. (1998). Effect of fat-free potato chips with and without nutrition labels on fat and energy intakes. *American Journal of Clinical Nutrition*, 68(2), 282-290.
<https://doi.org/10.1093/ajcn/68.2.282>
- Miller, L. M., Applegate, E., Beckett, L. A., Wilson, M. D., & Gibson, T. N. (2017). Age differences in the use of serving size information on food labels: Numeracy or attention? *Public Health Nutrition*, 20(5), 786-796.
<https://doi.org/10.1017/s1368980016003219>
- Miller, L. M. S., Beckett, L. A., Bergman, J. J., Wilson, M. D., Applegate, E. A., & Gibson, T. N. (2017). Developing nutrition label reading skills: A web-based practice approach. *Journal of Medical Internet Research*, 19(1), e16-e16.
<https://doi.org/10.2196/jmir.6583>
- Miller, L. M. S., & Cassady, D. L. (2015). The effects of nutrition knowledge on food label use. A review of the literature. *Appetite*, 92, 207-216.
<https://doi.org/10.1016/j.appet.2015.05.029>

- Miller, L. M. S., Cassady, D. L., Applegate, E. A., Beckett, L. A., Wilson, M. D., Gibson, T. N., & Ellwood, K. (2015). Relationships among food label use, motivation, and dietary quality. *Nutrients*, 7(2), 1068-1080. <https://doi.org/10.3390/nu7021068>
- Millstein, R. A., Carlson, S. A., Fulton, J. E., Galuska, D. A., Zhang, J., Blanck, H. M., & Ainsworth, B. E. (2008). Relationships between body size satisfaction and weight control practices among US adults. *Medscape Journal of Medicine*, 10(5), 119-119.
- Misra, R. (2007). Knowledge, attitudes, and label use among college students. *Journal of the American Dietetic Association*, 107(12), 2130-2134. <https://doi.org/10.1016/j.jada.2007.09.001>
- Moore, S. G., Donnelly, J. K., Jones, S., & Cade, J. E. (2018). Effect of educational interventions on understanding and use of nutrition labels: A systematic review. *Nutrients*, 10(10). <https://doi.org/10.3390/nu10101432>
- Movassagh, E. Z., Baxter-Jones, A. D. G., Kontulainen, S., Whiting, S. J., & Vatanparast, H. (2017). Tracking dietary patterns over 20 years from childhood through adolescence into young adulthood: The Saskatchewan Pediatric Bone Mineral Accrual Study. *Nutrients*, 9(9). <https://doi.org/10.3390/nu9090990>
- Mozaffarian, D., Angell, S. Y., Lang, T., & Rivera, J. A. (2018). Role of government policy in nutrition—Barriers to and opportunities for healthier eating. *BMJ*, 361, k2426. <https://doi.org/10.1136/bmj.k2426>
- Munro, S., Lewin, S., Swart, T., & Volmink, J. (2007). A review of health behaviour theories: How useful are these for developing interventions to promote long-term

- medication adherence for TB and HIV/AIDS? *BMC Public Health*, 7(1), 104.
<https://doi.org/10.1186/1471-2458-7-104>
- Murray, S. B., Rieger, E., Karlov, L., & Touyz, S. W. (2013). Masculinity and femininity in the divergence of male body image concerns. *Journal of Eating Disorders*, 1, 11. <https://doi.org/10.1186/2050-2974-1-11>
- Murtagh, J., Dixey, R., & Rudolf, M. (2006). A qualitative investigation into the levers and barriers to weight loss in children: opinions of obese children. *Archives of Disease in Childhood*, 91(11), 920-923. <https://doi.org/10.1136/ad.2005.085712>
- Nagata, J. M., Ganson, K. T., & Austin, S. B. (2020). Emerging trends in eating disorders among sexual and gender minorities. *Current Opinion in Psychiatry*, 33(6), 562-567. <https://doi.org/10.1097/yc.0000000000000645>
- National Center for Health Statistics. (2021). *National Health and Nutrition Examination Survey*. Centers for Disease Control and Prevention. Retrieved September 5, 2021 from <https://www.cdc.gov/nchs/nhanes/index.htm>
- Nayga Jr, R. M. (2000). Nutrition knowledge, gender, and food label use. *Journal of Consumer Affairs*, 34(1), 97-112. <https://doi.org/10.1111/j.1745-6606.2000.tb00086.x>
- Nelson, M. C., Story, M., Larson, N. I., Neumark-Sztainer, D., & Lytle, L. A. (2008). Emerging adulthood and college-aged youth: An overlooked age for weight-related behavior change. *Obesity*, 16(10), 2205-2211.
<https://doi.org/10.1038/oby.2008.365>
- Neufeld, L. M., Andrade, E. B., Ballonoff Suleiman, A., Barker, M., Beal, T., Blum, L. S., Demmler, K. M., Dogra, S., Hardy-Johnson, P., Lahiri, A., Larson, N.,

- Roberto, C. A., Rodríguez-Ramírez, S., Sethi, V., Shamah-Levy, T., Strömmer, S., Tumilowicz, A., Weller, S., & Zou, Z. (2022). Food choice in transition: Adolescent autonomy, agency, and the food environment. *Lancet*, 399(10320), 185-197. [https://doi.org/10.1016/s0140-6736\(21\)01687-1](https://doi.org/10.1016/s0140-6736(21)01687-1)
- Neuhofer, Z., McFadden, B. R., Rihn, A., Wei, X., Khachatryan, H., & House, L. (2020). Can the updated nutrition facts label decrease sugar-sweetened beverage consumption? *Economics & Human Biology*, 37, 100867. <https://doi.org/10.1016/j.ehb.2020.100867>
- Neumark-Sztainer, D., Bauer, K. W., Friend, S., Hannan, P. J., Story, M., & Berge, J. M. (2010). Family weight talk and dieting: How much do they matter for body dissatisfaction and disordered eating behaviors in adolescent girls? *Journal of Adolescent Health*, 47(3), 270-276. <https://doi.org/10.1016/j.jadohealth.2010.02.001>
- Neumark-Sztainer, D., Falkner, N., Story, M., Perry, C., Hannan, P. J., & Mulert, S. (2002). Weight-teasing among adolescents: correlations with weight status and disordered eating behaviors. *International Journal of Obesity*, 26(1), 123-131. <https://doi.org/10.1038/sj.ijo.0801853>
- Neumark-Sztainer, D., Levine, M. P., Paxton, S. J., Smolak, L., Piran, N., & Wertheim, E. H. (2006). Prevention of body dissatisfaction and disordered eating: What next? *Eating Disorders*, 14(4), 265-285. <https://doi.org/10.1080/10640260600796184>
- Neumark-Sztainer, D., Paxton, S. J., Hannan, P. J., Haines, J., & Story, M. (2006). Does body satisfaction matter? Five-year longitudinal associations between body

- satisfaction and health behaviors in adolescent females and males. *Journal of Adolescent Health*, 39(2), 244-251.
<https://doi.org/10.1016/j.jadohealth.2005.12.001>
- Newsom, J. T. (2020). Missing data and missing data estimation in SEM. In *Psy 523/623 Structural Equation Modeling, Spring 2020*. Portland, OR: Portland State University.
- Ni Mhurchu, C., Eyles, H., Jiang, Y., & Blakely, T. (2018). Do nutrition labels influence healthier food choices? Analysis of label viewing behaviour and subsequent food purchases in a labelling intervention trial. *Appetite*, 121, 360-365.
<https://doi.org/10.1016/j.appet.2017.11.105>
- O'Dea, J. A. (2004). Evidence for a self-esteem approach in the prevention of body image and eating problems among children and adolescents. *Eating Disorders*, 12(3), 225-239. <https://doi.org/10.1080/10640260490481438>
- Ogden, C. L., Fryar, C. D., Hales, C. M., Carroll, M. D., Aoki, Y., & Freedman, D. S. (2018). Differences in obesity prevalence by demographics and urbanization in US children and adolescents, 2013-2016. *JAMA*, 319(23), 2410-2418.
<https://doi.org/10.1001/jama.2018.5158>
- Ojala, K., Vereecken, C., Välimaa, R., Currie, C., Villberg, J., Tynjälä, J., & Kannas, L. (2007). Attempts to lose weight among overweight and non-overweight adolescents: A cross-national survey. *International Journal of Behavioral Nutrition and Physical Activity*, 4(1), 50. <https://doi.org/10.1186/1479-5868-4-50>

- Ollberding, N. J., Wolf, R. L., & Contento, I. (2010). Food label use and its relation to dietary intake among US adults. *Journal of the American Dietetic Association*, 110(8), 1233-1237. <https://doi.org/10.1016/j.jada.2010.05.007>
- Olstad, D. L., Nejatinamini, S., Kirkpatrick, S. I., Vanderlee, L., Livingstone, K. M., Campbell, D. J. T., Tang, K., Minaker, L. M., & Hammond, D. (2022). Stress-related poor diet quality does not explain socioeconomic inequities in health: A structural equation mediation analysis of gender-specific pathways. *Journal of the Academy of Nutrition and Dietetics*, 122(3), 541-554.e541. <https://doi.org/10.1016/j.jand.2021.09.018>
- Owens, T. E., Allen, M. D., & Spangler, D. L. (2010). An fMRI study of self-reflection about body image: Sex differences. *Personality and Individual Differences*, 48(7), 849-854. <https://doi.org/10.1016/j.paid.2010.02.012>
- Papas, M. A., Alberg, A. J., Ewing, R., Helzlsouer, K. J., Gary, T. L., & Klassen, A. C. (2007). The built environment and obesity. *Epidemiologic Reviews*, 29, 129-143. <https://doi.org/10.1093/epirev/mxm009>
- Persoskie, A., Hennessy, E., & Nelson, W. L. (2017). US consumers' understanding of nutrition labels in 2013: The importance of health literacy. *Preventing Chronic Disease*, 14, E86. <https://doi.org/10.5888/pcd14.170066>
- Pettigrew, S., & Pescud, M. (2013). The salience of food labeling among low-income families with overweight children. *Journal of Nutrition Education and Behavior*, 45(4), 332-339. <https://doi.org/10.1016/j.jneb.2013.01.025>

- Pfeiffer, J., Li, H., Martez, M., & Gillespie, T. (2018). The role of religious behavior in health self-management: A community-based participatory research study. *Religions*, 9(11). <https://doi.org/10.3390/rel9110357>
- Phillips, S. P. (2005). Defining and measuring gender: A social determinant of health whose time has come. *International Journal for Equity in Health*, 4(1), 11. <https://doi.org/10.1186/1475-9276-4-11>
- Pink, A. E., Lim, P. X. H., Sim, A. Y., & Cheon, B. K. (2022). The effects of acute social media exposure on body dissatisfaction and eating behavior of male and female students. *Journal of Social and Clinical Psychology*, 41(4), 365-397. <https://doi.org/10.1521/jscp.2022.41.4.365>
- Pont, S. J., Puhl, R., Cook, S. R., & Slusser, W. (2017). Stigma experienced by children and adolescents with obesity. *Pediatrics*, 140(6). <https://doi.org/10.1542/peds.2017-3034>
- Prentice-Dunn, H., & Prentice-Dunn, S. (2012). Physical activity, sedentary behavior, and childhood obesity: A review of cross-sectional studies. *Psychology, Health & Medicine*, 17(3), 255-273. <https://doi.org/10.1080/13548506.2011.608806>
- Pringle, J., Mills, K., McAteer, J., Jepson, R., Hogg, E., Anand, N., & Blakemore, S.-J. (2016). A systematic review of adolescent physiological development and its relationship with health-related behaviour: A protocol. *Systematic Reviews*, 5(1), 3. <https://doi.org/10.1186/s13643-015-0173-5>
- Puhl, R. M., & Heuer, C. A. (2010). Obesity stigma: Important considerations for public health. *American Journal of Public Health*, 100(6), 1019-1028. <https://doi.org/10.2105/AJPH.2009.159491>

- Puhl, R. M., Peterson, J. L., & Luedicke, J. (2013). Strategies to address weight-based victimization: youths' preferred support interventions from classmates, teachers, and parents. *Journal of Youth and Adolescence*, 42(3), 315-327.
<https://doi.org/10.1007/s10964-012-9849-5>
- Puhl, R. M., Wall, M. M., Chen, C., Bryn Austin, S., Eisenberg, M. E., & Neumark-Sztainer, D. (2017). Experiences of weight teasing in adolescence and weight-related outcomes in adulthood: A 15-year longitudinal study. *Preventive Medicine*, 100, 173-179. <https://doi.org/10.1016/j.ypmed.2017.04.023>
- Pulgaron, E. R. (2013). Childhood obesity: A review of increased risk for physical and psychological comorbidities. *Clinical Therapeutics*, 35(1), A18-32.
<https://doi.org/10.1016/j.clinthera.2012.12.014>
- Quittkat, H. L., Hartmann, A. S., Düsing, R., Buhlmann, U., & Vocks, S. (2019). Body dissatisfaction, importance of appearance, and body appreciation in men and women over the lifespan. *Frontiers in Psychiatry*, 10, 864-864.
<https://doi.org/10.3389/fpsy.2019.00864>
- Ramos, P., Moreno-Maldonado, C., Moreno, C., & Rivera, F. (2019). The role of body image in internalizing mental health problems in Spanish adolescents: An analysis according to sex, age, and socioeconomic status. *Frontiers in Psychology*, 10.
<https://doi.org/10.3389/fpsyg.2019.01952>
- Rana, L., & Alvaro, R. (2010). Applying a health promoting schools approach to nutrition interventions in schools: Key factors for success. *Health Promotion Journal of Australia*, 21(2), 106-113. <https://doi.org/10.1071/he10106>

- Rand, K., Vallis, M., Aston, M., Price, S., Piccinini-Vallis, H., Rehman, L., & Kirk, S. F. L. (2017). "It is not the diet; it is the mental part we need help with." A multilevel analysis of psychological, emotional, and social well-being in obesity. *International Journal of Qualitative Studies on Health and Well-being*, 12(1), 1306421-1306421. <https://doi.org/10.1080/17482631.2017.1306421>
- Rasberry, C. N., Chaney, B. H., Housman, J. M., Misra, R., & Miller, P. J. (2007). Determinants of nutrition label use among college students. *American Journal of Health Education*, 38(2), 76-82. <https://doi.org/10.1080/19325037.2007.10598947>
- Rasmussen, M., Krølner, R., Klepp, K. I., Lytle, L., Brug, J., Bere, E., & Due, P. (2006). Determinants of fruit and vegetable consumption among children and adolescents: a review of the literature. Part I: Quantitative studies. *International Journal of Behavioral Nutrition and Physical Activity*, 3, 22. <https://doi.org/10.1186/1479-5868-3-22>
- Riehm, K. E., Feder, K. A., Tormohlen, K. N., Crum, R. M., Young, A. S., Green, K. M., Pacek, L. R., La Flair, L. N., & Mojtabai, R. (2019). Associations Between Time Spent Using Social Media and Internalizing and Externalizing Problems Among US Youth. *JAMA Psychiatry*, 76(12), 1266-1273. <https://doi.org/10.1001/jamapsychiatry.2019.2325>
- Rippe, J. M., & Angelopoulos, T. J. (2015). Sugars and health controversies: What does the science say? *Advances in nutrition (Bethesda, Md.)*, 6(4), 493S-503S. <https://doi.org/10.3945/an.114.007195>

- Risica, P. M., Weinstock, M. A., Rakowski, W., Kirtania, U., Martin, R. A., & Smith, K. J. (2008). Body satisfaction effect on thorough skin self-examination. *American Journal of Preventive Medicine*, 35(1), 68-72.
<https://doi.org/10.1016/j.amepre.2008.03.017>
- Robert Wood Johnson Foundation. (2020). *National Obesity Monitor*. Retrieved March 16, 2022 from <https://stateofchildhoodobesity.org/monitor/>
- Roberto, C. A., & Khandpur, N. (2014). Improving the design of nutrition labels to promote healthier food choices and reasonable portion sizes. *International Journal of Obesity*, 38(1), S25-S33. <https://doi.org/10.1038/ijo.2014.86>
- Roberto, C. A., Ng, S. W., Ganderats-Fuentes, M., Hammond, D., Barquera, S., Jauregui, A., & Taillie, L. S. (2021). The influence of front-of-package nutrition labeling on consumer behavior and product reformulation. *Annual Review of Nutrition*, 41, 529-550. <https://doi.org/10.1146/annurev-nutr-111120-094932>
- Rodgers, R., Chabrol, H., & Paxton, S. J. (2011). An exploration of the tripartite influence model of body dissatisfaction and disordered eating among Australian and French college women. *Body Image*, 8(3), 208-215.
<https://doi.org/10.1016/j.bodyim.2011.04.009>
- Rodgers, R. F., Simone, M., Franko, D. L., Eisenberg, M. E., Loth, K., & Neumark-Sztainer, D. (2021). The longitudinal relationship between family and peer teasing in young adulthood and later unhealthy weight control behaviors: The mediating role of body image. *The International Journal of Eating Disorders*, 54(5), 831-840. <https://doi.org/10.1002/eat.23492>

- Romano, E., Haynes, A., & Robinson, E. (2018). Weight perception, weight stigma concerns, and overeating. *Obesity (Silver Spring, Md.)*, 26(8), 1365-1371. <https://doi.org/10.1002/oby.22224>
- Romieu, I., Dossus, L., Barquera, S., Blotière, H. M., Franks, P. W., Gunter, M., Hwalla, N., Hursting, S. D., Leitzmann, M., Margetts, B., Nishida, C., Potischman, N., Seidell, J., Stepien, M., Wang, Y., Westerterp, K., Winichagoon, P., Wiseman, M., Willett, W. C., & IARC working group on Energy Balance and Obesity. (2017). Energy balance and obesity: What are the main drivers? *Cancer Causes & Control*, 28(3), 247-258. <https://doi.org/10.1007/s10552-017-0869-z>
- Rønnow, H. N. (2020). The effect of front-of-pack nutritional labels and back-of-pack tables on dietary quality. *Nutrients*, 12(6). <https://doi.org/10.3390/nu12061704>
- Rosenkranz, R. R., & Dziewaltowski, D. A. (2008). Model of the home food environment pertaining to childhood obesity. *Nutrition Reviews*, 66(3), 123-140. <https://doi.org/10.1111/j.1753-4887.2008.00017.x>
- Ryan, P. (2009). Integrated theory of health behavior change: Background and intervention development. *Clinical Nurse Specialist*, 23(3), 161-170; quiz 171-162. <https://doi.org/10.1097/NUR.0b013e3181a42373>
- Saiphoo, A. N., & Vahedi, Z. (2019). A meta-analytic review of the relationship between social media use and body image disturbance. *Computers in Human Behavior*, 101, 259-275. <https://doi.org/10.1016/j.chb.2019.07.028>
- Sanyaolu, A., Okorie, C., Qi, X., Locke, J., & Rehman, S. (2019). Childhood and adolescent obesity in the United States: A public health concern. *Global Pediatric Health*, 6, 2333794X19891305. <https://doi.org/10.1177/2333794X19891305>

- Satia, J. A. (2009). Diet-related disparities: Understanding the problem and accelerating solutions. *Journal of the American Dietetic Association*, 109(4), 610-615.
<https://doi.org/10.1016/j.jada.2008.12.019>
- Satia, J. A., Galanko, J. A., & Neuhouser, M. L. (2005). Food nutrition label use is associated with demographic, behavioral, and psychosocial factors and dietary intake among African Americans in North Carolina. *Journal of the American Dietetic Association*, 105(3), 392-402. <https://doi.org/10.1016/j.jada.2004.12.006>
- Sattler, K. M., Deane, F. P., Tapsell, L., & Kelly, P. J. (2018). Gender differences in the relationship of weight-based stigmatisation with motivation to exercise and physical activity in overweight individuals. *Health psychology open*, 5(1).
<https://doi.org/10.1177/2055102918759691>
- Schaefer, M. K., & Blodgett Salafia, E. H. (2014). The connection of teasing by parents, siblings, and peers with girls' body dissatisfaction and boys' drive for muscularity: The role of social comparison as a mediator. *Eating Behaviors*, 15(4), 599-608.
<https://doi.org/10.1016/j.eatbeh.2014.08.018>
- Schvey, N. A., Marwitz, S. E., Mi, S. J., Galescu, O. A., Broadney, M. M., Young-Hyman, D., Brady, S. M., Reynolds, J. C., Tanofsky-Kraff, M., Yanovski, S. Z., & Yanovski, J. A. (2019). Weight-based teasing is associated with gain in BMI and fat mass among children and adolescents at-risk for obesity: A longitudinal study. *Pediatric Obesity*, 14(10), e12538. <https://doi.org/10.1111/ijpo.12538>
- Shah, B., Tombeau Cost, K., Fuller, A., Birken, C. S., & Anderson, L. N. (2020). Sex and gender differences in childhood obesity: Contributing to the research agenda.

- BMJ Nutrition, Prevention & Health*, 3(2), 387. <https://doi.org/10.1136/bmjnp-2020-000074>
- Shangguan, S., Afshin, A., Shulkin, M., Ma, W., Marsden, D., Smith, J., Saheb-Kashaf, M., Shi, P., Micha, R., Imamura, F., Mozaffarian, D., & Food, P. P. (2019). A meta-analysis of food labeling effects on consumer diet behaviors and industry practices. *American Journal of Preventive Medicine*, 56(2), 300-314. <https://doi.org/10.1016/j.amepre.2018.09.024>
- Sharif, M. Z., Rizzo, S., Prelip, M. L., Glik, D. C., Belin, T. R., Langellier, B. A., Kuo, A. A., Garza, J. R., & Ortega, A. N. (2014). The association between Nutrition Facts label utilization and comprehension among Latinos in two east Los Angeles neighborhoods. *Journal of the Academy of Nutrition and Dietetics*, 114(12), 1915-1922. <https://doi.org/10.1016/j.jand.2014.05.004>
- Sichert-Hellert, W., Kersting, M., & Manz, F. (2001). Fifteen year trends in water intake in German children and adolescents: Results of the DONALD Study. *Acta Paediatrica*, 90(7), 732-737. <https://doi.org/10.1111/j.1651-2227.2001.tb02797.x>
- Siervo, M., Montagnese, C., Muscariello, E., Evans, E., Stephan, B. C., Nasti, G., Papa, A., Iannetti, E., & Colantuoni, A. (2014). Weight loss expectations and body dissatisfaction in young women attempting to lose weight. *Journal of Human Nutrition and Dietetics*, 27 Suppl 2, 84-89. <https://doi.org/10.1111/jhn.12078>
- Sijtsma, F. P. C., Meyer, K. A., Steffen, L. M., Shikany, J. M., Van Horn, L., Harnack, L., Kromhout, D., & Jacobs, D. R., Jr. (2012). Longitudinal trends in diet and effects of sex, race, and education on dietary quality score change: The Coronary

- Artery Risk Development in Young Adults study. *The American Journal of Clinical Nutrition*, 95(3), 580-586. <https://doi.org/10.3945/ajcn.111.020719>
- Silverglade, B. A. (1996). The Nutrition Labeling and Education Act—Progress to date and challenges for the future. *Journal of Public Policy & Marketing*, 15(1), 148-150. <https://doi.org/10.1177/074391569601500115>
- SNAP4CT. (2018). *A new nutrition facts label for 2020*. Retrieved August 14, 2021 from <https://www.snap4ct.org/understanding-the-nutrition-label.html>
- Sonneville, K. R., Calzo, J. P., Horton, N. J., Haines, J., Austin, S. B., & Field, A. E. (2012). Body satisfaction, weight gain and binge eating among overweight adolescent girls. *International Journal of Obesity (2005)*, 36(7), 944-949. <https://doi.org/10.1038/ijo.2012.68>
- Spettigue, W., Obeid, N., Erbach, M., Feder, S., Finner, N., Harrison, M. E., Isserlin, L., Robinson, A., & Norris, M. L. (2021). The impact of COVID-19 on adolescents with eating disorders: A cohort study. *Journal of Eating Disorders*, 9(1), 65. <https://doi.org/10.1186/s40337-021-00419-3>
- StataCorp. (2021). *Stata Statistical Software: Release 15.1*. In StataCorp LLC.
- Steinberg, L. (2008). A social neuroscience perspective on adolescent risk-taking. *Developmental Review*, 28(1), 78-106. <https://doi.org/10.1016/j.dr.2007.08.002>
- Stice, E., & Shaw, H. E. (2002). Role of body dissatisfaction in the onset and maintenance of eating pathology: A synthesis of research findings. *Journal of Psychosomatic Research*, 53(5), 985-993. [https://doi.org/10.1016/S0022-3999\(02\)00488-9](https://doi.org/10.1016/S0022-3999(02)00488-9)

- Stockton, M. B., Lanctot, J. Q., McClanahan, B. S., Klesges, L. M., Klesges, R. C., Kumanyika, S., & Sherrill-Mittleman, D. (2009). Self-perception and body image associations with body mass index among 8-10-year-old African American girls. *Journal of Pediatric Psychology*, 34(10), 1144-1154.
<https://doi.org/10.1093/jpepsy/jsp023>
- Stran, K. A., & Knol, L. L. (2013). Determinants of food label use differ by sex. *Journal of the Academy of Nutrition and Dietetics*, 113(5), 673-679.
<https://doi.org/10.1016/j.jand.2012.12.014>
- Strelan, P., & Hargreaves, D. (2005). Reasons for exercise and body esteem: Men's responses to self-objectification. *Sex Roles*, 53(7), 495-503.
<https://doi.org/10.1007/s11199-005-7137-5>
- Stuthridge, L., Alexander, D., Stubbe, M., Eme, P., & Smith, C. (2022). "It's all just marketing", a qualitative analysis of consumer perceptions and understandings of nutrition content and health claims in New Zealand. *International Journal of Environmental Research and Public Health*, 19(6).
<https://doi.org/10.3390/ijerph19063510>
- Su, D., Zhou, J., Jackson, H. L., Soliman, G. A., Huang, T. T. K., & Yaroch, A. L. (2015). A sex-specific analysis of nutrition label use and health, Douglas County, Nebraska, 2013. *Preventing Chronic Disease*, 12, E158-E158.
<https://doi.org/10.5888/pcd12.150167>
- Suelter, C. S., Schvey, N., Kelly, N. R., Shanks, M., Thompson, K. A., Mehari, R., Brady, S., Yanovski, S. Z., Melby, C. L., Tanofsky-Kraff, M., Yanovski, J. A., & Shomaker, L. B. (2018). Relationship of pressure to be thin with gains in body

- weight and fat mass in adolescents. *Pediatric Obesity*, 13(1), 14-22.
<https://doi.org/10.1111/ijpo.12179>
- Surén, P., Skirbekk, A. B., Torgersen, L., Bang, L., Godøy, A., & Hart, R. K. (2022).
 Eating disorder diagnoses in children and adolescents in Norway before vs during
 the COVID-19 pandemic. *JAMA Network Open*, 5(7), e2222079-e2222079.
<https://doi.org/10.1001/jamanetworkopen.2022.22079>
- Svensson, R., Johnson, B., & Olsson, A. (2022). Does gender matter? The association
 between different digital media activities and adolescent well-being. *BMC Public
 Health*, 22(1), 273. <https://doi.org/10.1186/s12889-022-12670-7>
- Taillie, L. S. (2018). Who's cooking? Trends in US home food preparation by gender,
 education, and race/ethnicity from 2003 to 2016. *Nutrition Journal*, 17(1), 41.
<https://doi.org/10.1186/s12937-018-0347-9>
- Talagala, I. A., & Arambepola, C. (2016). Use of food labels by adolescents to make
 healthier choices on snacks: A cross-sectional study from Sri Lanka. *BMC Public
 Health*, 16(1), 739. <https://doi.org/10.1186/s12889-016-3422-1>
- The White House. (2022). *Biden-Harris Administration National Strategy on Hunger,
 Nutrition, and Health*.
- Thompson, J. K., van den Berg, P., Roehrig, M., Guarda, A. S., & Heinberg, L. J. (2004).
 The sociocultural attitudes towards appearance scale-3 (SATAQ-3): Development
 and validation. *International Journal of Eating Disorders*, 35(3), 293-304.
<https://doi.org/10.1002/eat.10257>

- Todd, M., Guetterman, T., Sigge, G., & Joubert, E. (2021). Multi-stakeholder perspectives on food labeling and health claims: Qualitative insights from South Africa. *Appetite*, 167, 105606. <https://doi.org/10.1016/j.appet.2021.105606>
- Tomiyama, A. J., Carr, D., Granberg, E. M., Major, B., Robinson, E., Sutin, A. R., & Brewis, A. (2018). How and why weight stigma drives the obesity ‘epidemic’ and harms health. *BMC Medicine*, 16(1), 123. <https://doi.org/10.1186/s12916-018-1116-5>
- Tsai, S. A., Lv, N., Xiao, L., & Ma, J. (2015). Gender differences in weight-related attitudes and behaviors among overweight and obese adults in the United States. *American Journal of Men’s Health*, 10(5), 389-398. <https://doi.org/10.1177/1557988314567223>
- Tyler, C., Johnston, C. A., Dalton, W. T., & Foreyt, J. P. (2008). Relationships between weight and body dissatisfaction, body esteem, and teasing in African American girls. *Journal of Black Psychology*, 35(1), 125-132. <https://doi.org/10.1177/0095798408323388>
- U.S. Census Bureau. (2021). *Measuring racial and ethnic diversity for the 2020 Census*. Retrieved October 20 from <https://www.census.gov/newsroom/blogs/random-samplings/2021/08/measuring-racial-ethnic-diversity-2020-census.html>
- U.S. Centers for Medicare & Medicaid Services. *The Children's Health Insurance Program (CHIP)*. Retrieved October 20 from <https://www.healthcare.gov/medicaid-chip/childrens-health-insurance-program/>
- U.S. Department of Health and Human Services. *StopBullying.gov*. Retrieved October 29 from <https://www.stopbullying.gov/>

- U.S. Food and Drug Administration. (2018). *Changes to the Nutrition Facts label*. Retrieved August 14, 2021 from <https://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/LabelingNutrition/ucm385663.htm>
- United Nations Population Fund. (2012). *Adolescent and youth demographics: A brief overview*. Retrieved June 17, 2021 from <https://www.unfpa.org/resources/adolescent-and-youth-demographics-a-brief-overview>
- University of Minnesota School of Public Health. (2021). *Project EAT*. Retrieved September 5, 2021 from <https://www.sph.umn.edu/research/projects/project-eat/>
- Valois, D. D., Davis, C. G., Buchholz, A., Obeid, N., Henderson, K., Flament, M., & Goldfield, G. S. (2019). Effects of weight teasing and gender on body esteem in youth: A longitudinal analysis from the REAL study. *Body Image*, 29, 65-73. <https://doi.org/10.1016/j.bodyim.2019.02.009>
- van den Berg, P., Neumark-Sztainer, D., Eisenberg, M. E., & Haines, J. (2008). Racial/ethnic differences in weight-related teasing in adolescents. *Obesity (Silver Spring)*, 16 Suppl 2, S3-10. <https://doi.org/10.1038/oby.2008.445>
- Van Dyke, N., & Drinkwater, E. J. (2014). Relationships between intuitive eating and health indicators: Literature review. *Public Health Nutrition*, 17(8), 1757-1766. <https://doi.org/10.1017/s1368980013002139>
- Variyam, J., & Cawley, J. (2006). *Nutrition labels and obesity* (NBER Working Paper No. 11956). <https://doi.org/10.3386/w11956>

- Velardo, S. (2015). The nuances of health literacy, nutrition literacy, and food literacy. *Journal of Nutrition Education and Behavior*, 47(4), 385-389.e381.
<https://doi.org/10.1016/j.jneb.2015.04.328>
- Viswanath, K. (2006). Public communications and its role in reducing and eliminating health disparities. In G. E. Thomson, F. Mitchell, & M. B. Williams (Eds.), *Examining the health disparities research plan of the National Institutes of Health: Unfinished business*. (pp. 215 –253). Institute of Medicine.
- Voelker, D. K., Reel, J. J., & Greenleaf, C. (2015). Weight status and body image perceptions in adolescents: Current perspectives. *Adolescent Health, Medicine and Therapeutics*, 6, 149-158. <https://doi.org/10.2147/AHMT.S68344>
- Voges, M. M., Giabbiconi, C. M., Schöne, B., Waldorf, M., Hartmann, A. S., & Vocks, S. (2019). Gender Differences in Body Evaluation: Do Men Show More Self-Serving Double Standards Than Women? *Front Psychol*, 10, 544.
<https://doi.org/10.3389/fpsyg.2019.00544>
- Wahlich, C., Gardner, B., & McGowan, L. (2013). How, when and why do young women use nutrition information on food labels? A qualitative analysis. *Psychol Health*, 28(2), 202-216. <https://doi.org/10.1080/08870446.2012.716439>
- Wang, D. D., Leung, C. W., Li, Y., Ding, E. L., Chiuve, S. E., Hu, F. B., & Willett, W. C. (2014). Trends in dietary quality among adults in the United States, 1999 through 2010. *JAMA Internal Medicine*, 174(10), 1587-1595.
<https://doi.org/10.1001/jamainternmed.2014.3422>
- Wang, S. B., Haynos, A. F., Wall, M. M., Chen, C., Eisenberg, M. E., & Neumark-Sztainer, D. (2019). Fifteen-year prevalence, trajectories, and predictors of body

- dissatisfaction from adolescence to middle adulthood. *Clinical Psychological Science*, 7(6), 1403-1415. <https://doi.org/10.1177/2167702619859331>
- Wang, Y., Liang, H., & Chen, X. (2009). Measured body mass index, body weight perception, dissatisfaction and control practices in urban, low-income African American adolescents. *BMC Public Health*, 9(1), 183. <https://doi.org/10.1186/1471-2458-9-183>
- Watson, W. L., Kelly, B., Hector, D., Hughes, C., King, L., Crawford, J., Sergeant, J., & Chapman, K. (2014). Can front-of-pack labelling schemes guide healthier food choices? Australian shoppers' responses to seven labelling formats. *Appetite*, 72, 90-97. <https://doi.org/10.1016/j.appet.2013.09.027>
- Weaver, R. G., Brazendale, K., Hunt, E., Sarzynski, M. A., Beets, M. W., & White, K. (2019). Disparities in childhood overweight and obesity by income in the United States: An epidemiological examination using three nationally representative datasets. *International Journal of Obesity*, 43(6), 1210-1222. <https://doi.org/10.1038/s41366-019-0331-2>
- Weihrauch-Blüher, S., Schwarz, P., & Klusmann, J. H. (2019). Childhood obesity: Increased risk for cardiometabolic disease and cancer in adulthood. *Metabolism*, 92, 147-152. <https://doi.org/10.1016/j.metabol.2018.12.001>
- Wilcox, S., Sharpe, P. A., Liese, A. D., Dunn, C. G., & Hutto, B. (2020). Socioeconomic factors associated with diet quality and meeting dietary guidelines in disadvantaged neighborhoods in the Southeast United States. *Ethnicity & Health*, 25(8), 1115-1131. <https://doi.org/10.1080/13557858.2018.1493434>

- Wilson, M. D., Ramírez, A. S., Arsenault, J. E., & Miller, L. M. S. (2018). Nutrition label use and its association with dietary quality among Latinos: The roles of poverty and acculturation. *Journal of Nutrition Education and Behavior*, 50(9), 876-887. <https://doi.org/10.1016/j.jneb.2018.05.019>
- Winpenny, E. M., Penney, T. L., Corder, K., White, M., & van Sluijs, E. M. F. (2017). Change in diet in the period from adolescence to early adulthood: A systematic scoping review of longitudinal studies. *The international journal of behavioral nutrition and physical activity*, 14(1), 60-60. <https://doi.org/10.1186/s12966-017-0518-7>
- Winpenny, E. M., van Sluijs, E. M. F., White, M., Klepp, K.-I., Wold, B., & Lien, N. (2018). Changes in diet through adolescence and early adulthood: Longitudinal trajectories and association with key life transitions. *The International Journal of Behavioral Nutrition and Physical Activity*, 15(1), 86-86. <https://doi.org/10.1186/s12966-018-0719-8>
- Woelders, L. C. S., Larsen, J. K., Scholte, R. H. J., Cillessen, A. H. N., & Engels, R. C. M. E. (2010). Friendship Group Influences on Body Dissatisfaction and Dieting Among Adolescent Girls: A Prospective Study. *Journal of Adolescent Health*, 47(5), 456-462. <https://doi.org/10.1016/j.jadohealth.2010.03.006>
- Wojcicki, J. M., & Heyman, M. B. (2012). Adolescent nutritional awareness and use of food labels: Results from the National Nutrition Health and Examination Survey. *BMC Pediatrics*, 12, 55-55. <https://doi.org/10.1186/1471-2431-12-55>
- World Health Organization. (2021). *Obesity and overweight*. Retrieved June 17, 2021 from <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>

- Wright, J. D., & Wang, C. Y. (2011). Awareness of Federal Dietary Guidance in persons aged 16 years and older: Results from the National Health and Nutrition Examination Survey 2005-2006. *Journal of the American Dietetic Association*, 111(2), 295-300. <https://doi.org/10.1016/j.jada.2010.10.049>
- Yang, K., Turk, M. T., Allison, V. L., James, K. A., & Chasens, E. (2014). Body mass index self-perception and weight management behaviors during late adolescence. *Journal of School Health*, 84(10), 654-660. <https://doi.org/10.1111/josh.12195>
- Yang, Y. C., Walsh, C. E., Johnson, M. P., Belsky, D. W., Reason, M., Curran, P., Aiello, A. E., Chanti-Ketterl, M., & Harris, K. M. (2021). Life-course trajectories of body mass index from adolescence to old age: Racial and educational disparities. *Proceedings of the National Academy of Sciences*, 118(17), e2020167118. <https://doi.org/10.1073/pnas.2020167118>
- Yarborough, B. J., DeBar, L. L., Wu, P., Pearson, J., & Stevens, V. J. (2012). Responding to pediatric providers' perceived barriers to adolescent weight management. *Clinical Pediatrics*, 51(11), 1063-1070. <https://doi.org/10.1177/0009922812459269>
- Yost, J., Krainovich-Miller, B., Budin, W., & Norman, R. (2010). Assessing weight perception accuracy to promote weight loss among U.S. female adolescents: A secondary analysis. *BMC Public Health*, 10(1), 465. <https://doi.org/10.1186/1471-2458-10-465>
- Zarychta, K., Chan, C. K. Y., Kruk, M., & Luszczynska, A. (2020). Body satisfaction and body weight in under- and healthy-weight adolescents: Mediating effects of restrictive dieting, healthy and unhealthy food intake. *Eating and Weight*

- Disorders - Studies on Anorexia, Bulimia and Obesity*, 25(1), 41-50.
<https://doi.org/10.1007/s40519-018-0496-z>
- Zarychta, K., Mullan, B., & Luszczynska, A. (2016). Am I Overweight? A Longitudinal Study on Parental and Peers Weight-Related Perceptions on Dietary Behaviors and Weight Status Among Adolescents. *Front Psychol*, 7, 83.
<https://doi.org/10.3389/fpsyg.2016.00083>
- Zhang, D., Li, Y., Wang, G., Moran, A. E., & Pagán, J. A. (2017). Nutrition label use and sodium intake in the U.S. *American Journal of Preventive Medicine*, 53(6, Supplement 2), S220-S227. <https://doi.org/10.1016/j.amepre.2017.06.007>
- Ziegler, A. M., Kasprzak, C. M., Mansouri, T. H., Gregory, A. M., Barich, R. A., Hatzinger, L. A., Leone, L. A., & Temple, J. L. (2021). An ecological perspective of food choice and eating autonomy among adolescents. *Frontiers in Psychology*, 12, 1098. <https://doi.org/10.3389/fpsyg.2021.654139>
- Zoellner, J., You, W., Connell, C., Smith-Ray, R. L., Allen, K., Tucker, K. L., Davy, B. M., & Estabrooks, P. (2011). Health literacy is associated with healthy eating index scores and sugar-sweetened beverage intake: Findings from the rural Lower Mississippi Delta. *Journal of the American Dietetic Association*, 111(7), 1012-1020. <https://doi.org/10.1016/j.jada.2011.04.010>

APPENDIX A

SUPPLEMENTARY METHODS TABLES

Table A.1 Question wording for variables included in Studies 1-2⁹

Variables	IFPS Variable Name	Question Wording	Values
Age	age	How old are you?	10=10 years 11=11 years 12=12 years 13=13 years 14=14 years 15=15 years 16=16 years 17=17 years
BMI	BMI_DV	How tall are you without shoes? How much do you weigh without clothes or shoes? Calculated BMI=weight/squared(height) from WHO macro (DV)	[numeric]
Body size ideal	wt_ideal_DV	Which picture looks most like how you want your body to look?	1=A [far left image] 2=B 3=C 4=D 5=E 6=F 7=G 8=H [far right image]

⁹ Table adapted from the IFPS Technical Report – 2019 Youth Survey, available at http://foodpolicystudy.com/wp-content/uploads/2021/03/2019-IFPS-Youth-Technical-Report_202100301.pdf.

Body size perception	wt_body_DV	Which picture looks most like your body shape?	1=A [far left image] 2=B 3=C 4=D 5=E 6=F 7=G 8=H [far right image]
Eating efforts – eat protein	effort_protein	Do you make a special effort to eat protein?	1=Yes 2=No
Eating efforts – eat less sugar or drink fewer sugary drinks	effort_sugar	Do you make a special effort to eat less sugar or drink fewer sugary drinks?	1=Yes 2=No
Eating efforts – eat fewer calories	effort_cal	Do you make a special effort to eat [fewer] calories?	1=Yes 2=No
Eating efforts – eat less salt	effort_salt	Do you make a special effort to eat less salt?	1=Yes 2=No
Eating efforts – eat vegetables and fruits	effort_fv	Do you make a special effort to eat vegetables and fruits?	1=Yes 2=No
Eating efforts – drink lots of water	effort_water	Do you make a special effort to drink lots of water?	1=Yes 2=No
Eating efforts – eat whole grains	effort_grain	Do you make a special effort to eat whole grains?	1=Yes 2=No

Eating efforts – eat less low-calorie sweeteners	effort_swtmr	Do you make a special effort to eat less low-calorie sweeteners?	1=Yes 2=No
Eating efforts – eat less processed foods	effort_process	Do you make a special effort to eat less processed foods?	1=Yes 2=No
Food guide awareness	fg_aware	Have you ever heard of MyPlate or the Food Guide Pyramid?	1=Yes 2=No
Gender	sex	Are you...?	1=Male 2=Female
Nutrition knowledge	nut_know_DV	How much do you know about healthy eating and nutrition? Please answer on a scale from 0 to 10, where 0 = Nothing, and 10 = A lot.	0=0 – Nothing 1=1 2=2 3=3 4=4 5=5 6=6 7=7 8=8 9=9 10=10 – A lot
Nutrition facts label understanding	nft_understand_USA	Do you find this information... [show NFT image]	1=Very hard to understand 2=Hard to understand 3=In the middle 4=Easy to understand 5=Very easy to understand
Nutrition facts label use	nft_use_USA	Do you use this type of food label when deciding what to eat or buy? [show NFT image]	1=Never 2=Rarely 3=Sometimes 4=Often

			5=All the time
Perceived income adequacy	inc_adeq	Does your family have enough money to pay for things your family needs?	1=Not enough money 2=Barely enough money 3=Enough money 4=More than enough money
Race/ethnicity	eth_USA_5cat_DV	People living in the United States come from many different cultural and racial backgrounds. Are you... (Select all that apply) Derived from ETH_USA series variables	1=White only 2=Black or African American only 3=Hispanic or Latino only 4=Other race only (Asian/Pacific Islander or Native American Indian only) 5=Two or more races
Social media use	media_wd_soc	On a normal weekday, how much time do you spend: On social media (including messaging, posting, or liking posts)	1=0 hours (none) 2=Up to 15 minutes 3=Up to 30 minutes 4=Up to 1 hour 5=Up to 2 hours 6=Up to 3 hours 7=Up to 4 hours 8=More than 4 hours
Weight change efforts	wt_try	Which of the following are you trying to do about your weight?	1=Nothing 2=Stay the same weight 3=Gain weight 4=Lose weight
Weight teasing	wt_tease	Do you get teased or made fun of because of your weight?	1=All the time 2=A lot 3=Sometimes 4=Rarely 5=Never

Table A.2 Rotated factor loadings and unique variances for *healthy eating efforts* variables, one-factor solution

Variable	Factor 1	Uniqueness
Eat less processed foods	0.6863	0.5291
Eat less low-calorie sweeteners	0.6545	0.5716
Eat less salt	0.6154	0.6213
Eat fewer calories	0.6067	0.6319
Eat whole grains	0.6060	0.6328
Eat less sugar or drink fewer sugary drinks	0.6014	0.6383
Eat vegetables and fruits	0.5585	0.6881
Eat protein	0.5226	0.7269
Drink lots of water	0.4239	0.8203

Table A.3 Rotated factor loadings and unique variances for *healthy eating efforts* variables, two-factor solution

Variable	Factor 1	Factor 2	Uniqueness
Eat less processed foods	0.6699	0.2501	0.4887
Eat fewer calories	0.6687	0.1190	0.5387
Eat less low-calorie sweeteners	0.6660	0.2023	0.5155
Eat less salt	0.6042	0.2196	0.5867
Eat less sugar or drink fewer sugary drinks	0.5873	0.2190	0.6072
Eat whole grains	0.3356	0.5631	0.5703
Eat vegetables and fruits	0.2382	0.6141	0.5662
Eat protein	0.1877	0.6216	0.5784
Drink lots of water	0.1261	0.5391	0.6935

Table A.4 Missingness of variables for Study 1, N=784

IFPS Variable Name	Missingness, n (%)¹
nft_use_USA	14 (1.79)
sex	0 (0)
age	0 (0)
age_DV	0 (0)
eth_USA_5cat_DV	3 (0.38)
inc_adeq	2 (0.26)
effort_protein	17 (2.17)
effort_sugar	4 (0.51)
effort_cal	13 (1.49)
effort_salt	9 (1.15)
effort_fv	2 (0.26)
effort_water	2 (0.26)
effort_grain	19 (2.42)
effort_swtnr	18 (2.30)
effort_process	16 (2.04)
fg_aware	10 (1.28)
nut_know_DV	4 (0.51)
wt_try	2 (0.26)

¹Responses coded as don't know (-77), refuse to answer (-88), and not stated (-99)

Table A.5 Categories for weighting the U.S. IFPS Youth Survey data¹

Age groups	Gender	Regions	Race/Ethnicity
1) 10-13 years	1) Male	1) New England	1) White alone
2) 14-17 years	2) Female	2) Middle Atlantic	2) Other
		3) East North Central	
		4) West North Central	
		5) South Atlantic	
		6) East South Central	
		7) West South Central	
		8) Mountain	
		9) Pacific	

¹Table adapted from the IFPS Technical Report – 2019 Youth Survey

Table A.6 Missingness of variables for Study 2, N=1,603

Variable Name from the IFPS	Don't know, refuse to answer, or missing, n (%)
sex	0 (0)
wt_body_DV	16 (1.00)
wt_ideal_DV	60 (3.74)
wt_try	10 (0.62)
nft_use_USA	25 (1.56)
media_wd_soc	5 (0.31)
BMI_DV	233 (14.54)
wt_tease	9 (0.56)
inc_adeq	11 (0.69)
nft_understand_USA	19 (1.19)
fg_aware	30 (1.87)
nut_know_DV	11 (0.69)
eth_USA_5cat_DV	6 (0.37)
age	0 (0)

APPENDIX B

SUPPLEMENTARY MANUSCRIPT 1 TABLES

Table B.1 Correlation matrix for study variables

[illegible]

Two or more races/ethnicities	-0.08 (0.02)	-0.08 (0.03)	-0.03 (0.40)	-0.01 (0.79)	-0.13 (0.01)	-0.10 (0.01)	-0.06 (0.08)	1.00									
Age	-0.01 (0.93)	-0.03 (0.45)	0.08 (0.02)	0.07 (0.04)	-0.09 (0.01)	0.02 (0.66)	0.04 (0.27)	-0.02 (0.63)	1.00								
Gender	-0.01 (0.68)	0.01 (0.69)	0.02 (0.61)	0.02 (0.67)	0.07 (0.04)	-0.04 (0.29)	0.02 (0.64)	0.01 (0.89)	0.009 (0.78)	1.00							
Food guide awareness	0.10 (0.01)	0.09 (0.01)	0.11 (0.01)	0.19 (0.01)	-0.06 (0.12)	-0.14 (0.01)	-0.01 (0.75)	-0.01 (0.92)	0.04 (0.23)	0.02 (0.74)	1.00						
Stay the same weight	0.17 (0.01)	0.21 (0.01)	0.14 (0.01)	0.17 (0.01)	0.03 (0.48)	0.02 (0.53)	0.03 (0.46)	0.001 (0.97)	-0.02 (0.65)	-0.04 (0.28)	0.006 (0.87)	1.00					
Gain weight	-0.01 (0.74)	-0.01 (0.87)	-0.02 (0.51)	0.01 (0.87)	0.02 (0.51)	0.005 (0.89)	-0.04 (0.28)	0.04 (0.25)	0.03 (0.42)	-0.18 (0.01)	-0.05 (0.19)	-0.27 (0.01)	1.00				
Lose weight	0.07 (0.06)	-0.01 (0.73)	-0.10 (0.01)	-0.15 (0.01)	-0.01 (0.69)	0.04 (0.31)	-0.05 (0.32)	0.03 (0.40)	-0.01 (0.70)	0.16 (0.01)	4.10e-07 (1.00)	-0.39 (0.01)	-0.19 (0.01)	1.00			
Barely enough money	-0.04 (0.21)	0.003 (0.92)	-0.08 (0.03)	-0.07 (0.06)	-0.02 (0.60)	0.02 (0.63)	-0.04 (0.21)	0.09 (0.26)	0.03 (0.38)	-0.02 (0.58)	0.03 (0.35)	-0.03 (0.41)	0.08 (0.03)	0.04 (0.23)	1.00		
Not enough money	-0.06 (0.10)	-0.10 (0.01)	-0.10 (0.01)	-0.03 (0.37)	-0.04 (0.26)	-0.01 (0.75)	-0.04 (0.22)	0.07 (0.06)	-0.01 (0.83)	0.05 (0.19)	0.01 (0.77)	-0.08 (0.02)	-0.02 (0.59)	0.05 (0.14)	-0.14 (0.01)	1.00	
More than enough money	0.09 (0.01)	0.17 (0.01)	0.15 (0.01)	0.17 (0.01)	0.06 (0.08)	-0.02 (0.61)	0.05 (0.16)	-0.09 (0.02)	-0.08 (0.03)	-0.08 (0.02)	0.05 (0.16)	0.08 (0.02)	-0.03 (0.41)	-0.12 (0.01)	-0.24 (0.01)	-0.11 (0.01)	1.00

[illegible]

Girls	-0.11 (0.001)	-0.003 (0.94)	0.01 (0.77)	-0.02 (0.52)	-0.01 (0.78)	0.01 (0.80)	-0.04 (0.23)	-0.05 (0.12)	0.01 (0.74)
Food guide awareness	-0.01 (0.68)	0.01 (0.70)	-0.02 (0.59)	0.01 (0.79)	0.01 (0.79)	-0.01 (0.84)	-0.01 (0.80)	0.004 (0.92)	0.01 (0.84)
Perceived income adequacy^c									
Not enough money	-0.01 (0.71)	0.04 (0.23)	0.01 (0.87)	-0.004 (0.92)	-0.03 (0.39)	-0.05 (0.17)	-0.05 (0.17)	-0.01 (0.88)	0.002 (0.95)
Barely enough money	0.02 (0.59)	-0.03 (0.35)	-0.02 (0.63)	-0.05 (0.13)	-0.03 (0.45)	-0.02 (0.55)	-0.04 (0.24)	-0.03 (0.40)	-0.02 (0.52)
More than enough money	0.03 (0.49)	0.004 (0.92)	-0.02 (0.66)	-0.02 (0.65)	-0.01 (0.86)	-0.01 (0.86)	0.02 (0.61)	-0.01 (0.86)	-0.01 (0.77)
Weight change efforts^d									
Trying to stay the same weight	0.12 (0.004)	0.12 (0.002)	0.14 (<0.001)	0.09 (0.04)	0.10 (0.02)	0.07 (0.09)	0.05 (0.19)	0.06 (0.13)	0.07 (0.10)
Trying to lose weight	0.06 (0.12)	0.22 (<0.001)	0.30 (<0.001)	0.13 (0.001)	0.08 (0.04)	0.09 (0.03)	0.03 (0.40)	0.10 (0.01)	0.06 (0.12)
Trying to gain weight	0.07 (0.06)	0.06 (0.08)	0.06 (0.09)	0.04 (0.35)	0.05 (0.20)	0.02 (0.55)	0.02 (0.55)	0.02 (0.65)	-0.02 (0.56)

^aReferent group: White

^bReferent group: Boys

^cReferent group: Enough money

^dReferent group: Not trying to change or maintain their weight