

Obesity Prevention and Management Among Adults

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Abstract

Objective. To provide a review of theory-driven constructs on obesity interventions among United States adults.

Methods. Fifteen articles were selected for this review. Articles were chosen that included theories/models to identify which interventions were most successful in combating adult obesity. The theories and constructs that were used for this review were self-efficacy theory, social cognitive theory, theory of planned behavior, health belief model, and social-ecological theory.

Theories and Constructs. Self-efficacy, behavioral beliefs and attitudes, social support, and knowledge were all impactful constructs in the interventions reviewed. These constructs proved to work best when paired with at least one other construct. Interventions focused on improving self-efficacy for engaging in physical activity and healthy eating were most successful.

Recommendations. It is recommended that public health professionals utilize a combination of theory-driven constructs when planning interventions. It is imperative to focus interventions on changing the participants' attitudes towards healthy eating and physical activity and increasing their confidence in participating in healthy behaviors. Positive attitudes and associations yield better outcomes. Using virtual or online components to increase knowledge and provide social support systems can be beneficial. Practitioners should spend time educating patients on the importance of healthy eating and physical activity. They should also advocate for the improved access to healthier food options and improved built environment for underserved communities.

Keywords. Obesity, BMI, theory, adults, interventions

Introduction

Obesity has become a pressing issue among adults in the United States, especially over the last decade. In 2017-2018, the age-adjusted prevalence of obesity in U.S. adults was approximately 43% (Hales et al., 2016). If this rate continues to increase, the U.S. will be moving even further from the Healthy People 2030 obesity prevalence goal of 36% (U.S. Department of Health and Human Services, 2021). Overweight and obesity are caused by the excessive accumulation of body fat and pose a serious threat to one's health (World Health Organization, 2021). Obesity in adults can cause serious medical complications including cardiovascular disease, high blood

pressure, metabolic syndrome, atherosclerosis, diabetes, high blood cholesterol, cancers, and sleep disorders (World Health Organization, 2021). Additionally, obesity in adults has been associated with poor mental health outcomes and decreased quality of life (Centers for Disease Control and Prevention, 2021).

The obesity epidemic has become a substantial public health issue for a variety of reasons. The U.S. healthcare system is significantly impacted by obesity and its associated comorbidities. In 2008, obesity-related medical expenses were estimated to be \$147 billion (Centers for Disease Control and Prevention, 2021). If current obesity trends continue, it has been estimated that by 2030, obesity-related medical costs could rise by \$48 to \$66 billion a year in the United States (Harvard School of Public Health, 2021). Obesity has also put a strain on work environments resulting in decreased productivity, absence from work, premature death, disability, and higher insurance premiums (Harvard School of Public Health, 2021).

There are a number of factors that contribute to the onset of this disease including genetics, physical inactivity, dietary patterns, environment, and education; however, obesity in adults can be prevented through a number of intervention approaches at the individual, community, and macro level (Centers for Disease Control and Prevention, 2021). The objective of this literature review was to assess the application of health promotion and behavior theories in various adult obesity intervention studies to determine which theory-based interventions are successful in combating obesity in adults.

Methods for Selecting Articles

This systematic review aimed to provide a summary of theory-driven studies for interventions to prevent and manage obesity in U.S. adults. A search strategy was developed to find scholarly articles that utilized theories/models to identify which interventions were most successful in combating adult obesity. In order to find articles for this systematic review, a few different searches were done on multiple search engines. First, the phrases “United States” AND “obesity in adults” AND “theory based” AND “interventions” were used on google scholar. This yielded 51,200 results. The articles were then condensed to articles that were from 2001 or later. Two articles were selected from this search. Next, the same phrases were searched on the University of Georgia library database. This yielded 457 results. Again, the articles were condensed so that the results only showed articles from 2001 or later. Seven articles were selected from this search. Next, the phrases “obesity OR overweight OR fat OR obese OR unhealthy weight OR high bmi” AND “adults” AND “interventions OR strategies OR best practices” AND “theory” were searched on the University of Georgia library database. This search yielded 5,138 results. The articles were condensed so that the results only displayed articles from 2001 or later. Eight articles were selected from this search.

The inclusion criteria for this review included that the articles were: (1) aiming to reduce, prevent, or manage obesity, (2) using theories or constructs of theories, (3) using adults as participants, and (4) were conducted in the United States. The exclusion criteria that were used were: (1) articles where constructs or theories were not defined, (2) articles that used children as participants, (3) articles that did not have an intervention, and (4) articles that were conducted outside the United States.

After completing searches on through multiple search engines, and utilizing the inclusion and exclusion criteria, 15 articles were retrieved for analysis. The full text of these articles was read to confirm that they met the criteria for this review. Table 1 details the theories examined in this report. Appendix A contains a complete description of these studies.

Table 1. Summary of articles reviewed by theory (Total unduplicated studies = 15)

Theory/Model	# of studies
Self-efficacy Theory	9
Social Cognitive Theory	4
Theory of Planned Behavior	3
Health Belief Model	2
Social-Ecological Theory	1

Note: A description of each study is in Appendix A.

Theories and Constructs

This section includes articles that used different theories and constructs to reduce or prevent obesity among U.S. adults. It is important to utilize theory-based studies and constructs to understand the strengths and barriers individuals face when striving to change health behaviors. As a result of examining theory-driven articles, various constructs can be considered and included when planning successful interventions relating to preventing and/or managing obesity in adults.

Self-efficacy

High levels of self-efficacy are important for individuals seeking to reduce their BMI or prevent obesity. There are positive, direct effects seen among individuals who have high self-efficacy when participating in weight loss interventions (Lee et al., 2021). Self-efficacy has been noted as an important predictor for physical activity change in overweight and obese individuals (Robertson, Green, Liao, Durand, & Basen-Engquist, 2020). Along with physical activity, self-efficacy has also been a predictor of positive healthy eating behaviors among participants (Anderson, Winett, & Wojcik, 2007). Self-efficacy helps individuals improve other skills as well. In interventions where self-efficacy was emphasized, self-regulatory skills were improved and helped participants to overcome obesity-related barriers (Annesi et al., 2015; Roberstson et.al, 2020). If participants do not have a high level of self-efficacy when beginning an intervention, it is beneficial to incorporate self-regulatory behaviors, such as goal-setting, in an intervention to help individuals increase their self-efficacy (Anderson et al., 2007; Petosa & Silfee, 2016). Self-efficacy also helped to successfully transition participants from the intervention context to the course of their normal lives (Voils et al., 2014). Participants were more likely to keep up with behaviors learned in the intervention, after the intervention ended, when they involved self-efficacy (Mason et al., 2016).

Cognitive belief

An individual's cognitive belief and awareness is another important aspect of weight loss and weight prevention. Having encouragement from others while attempting to lose weight helps increase an individual's cognitive belief about their ability to lose weight (Englund et al., 2021). A positive cognitive belief helps lead individuals to engage in health behaviors such as buying fruits and vegetables (Englund et al., 2021). Cognitive belief among individuals was increased by addressing factors such as self-monitoring, goal setting, self-reward, social support, and time management. As a result, this led individuals to a higher chance of overcoming barriers, eventually leading to better health outcomes (Petosa & Silfee, 2016).

Behavioral Beliefs and Attitudes

Behavioral beliefs and attitudes towards healthy eating and physical activity is important in regard to obesity prevention and management. Individuals with a positive attitude towards purchasing fruits and vegetables were more likely to increase their consumption and demonstrate improved health outcomes (Cheng et al., 2019). Educational components to interventions led to better attitudes towards weight loss (Estabrooks et al., 2017). Those with negative health outcome expectations were more likely to purchase and consume foods higher in fat and less in fiber; however, dispelling these negative expectations through interventions could result in healthier food choices (Anderson et al., 2007).

Social Support

Social support has been a reoccurring theme among many of the obesity-related interventions analyzed. The type of social support varied in different studies, and included family, friends, and peers to reduce unhealthy eating behaviors and increase physical activity (Anderson et al., 2007; Englund, et al., 2021; Petosa & Silfee, 2016). Social support was found to help increase the likelihood of eating healthy if the individual's social circle engaged in healthy eating (Sapp & Weng, 2007). Some studies emphasized the importance of technology to provide social support to individuals by creating mobile apps and online programs. These programs highlighted the versatility of using virtual support as a means for self-regulation, diet tracking, encouragement, and positive reinforcement (Estabrooks, et al., 2017; Hales, et al.; Lee et al., 2020).

Knowledge

Increasing knowledge is another important approach to help prevent and manage obesity during interventions. It is important for individuals to understand the negative health effects of obesity and to obtain knowledge about the skills to increase healthy behaviors. Individuals who learned more about the risks of obesity were more likely to engage in positive habits, eventually leading to diet-health awareness (Liou & Kulik, 2020). Additionally, knowledge on healthy behaviors led to higher levels of self-efficacy (Anderson et al., 2007; Liou & Kulik, 2020). Many patients lacked intrinsic motivation for physical activity prior to intervention. After gaining knowledge on the importance of physical activity in reducing obesity, they were more likely to engage in this behavior (Fisher & Kridli, 2014). Participants noted that components of the intervention that were knowledge based were more meaningful when they also involved a personal component such as an activity or feedback from the facilitators. (Suggs, McIntyre, & Cowdery, 2010).

The overall main findings of these theory-based articles conclude that a variety of constructs and factors impact individuals' BMI and weight status. Self-efficacy has been mentioned in the majority of articles reviewed and is a major predictor of obesity risk reduction. Self-efficacy as a construct in the social cognitive theory has also been relevant to promote behavior changes. Additionally, other constructs from the social cognitive theory such as behavioral beliefs, attitudes, and knowledge, were significant in many of the interventions analyzed.

Recommendations for Researchers

Utilize a combination of constructs from various theories to achieve the best results in weight loss and prevention behavior changes. Self-efficacy is an important construct that should be used in health promotion interventions to ensure individuals are confident in continuing healthy behaviors even after the intervention ends. Self-efficacy will help to ensure the behavior change is sustained long-term. Encouraging individuals to develop a positive attitude towards healthy eating and physical activity will help to ensure they continue these positive behaviors after the intervention to minimize the prevalence of obesity. Interventions should also emphasize the importance of having a support system, so they are encouraged by peers, family, and friends while they work to achieve healthier behaviors. Additionally, an individual's cognitive belief and attitude towards healthy behaviors will influence them towards obesity management and prevention.

Promote positive attitudes on healthy eating behaviors and physical activity benefits. Behavioral beliefs and attitudes among participants may differ depending on their current background on the health issue. It is important to focus interventions on increasing positive attitudes surrounding obesity risk reduction, focusing on factors such as goal setting, education, and trying new foods and exercises.

Incorporate an online or virtual component when creating an intervention. In today's virtual day and age, it is important to take advantage of educating and supporting others even when they are not physically present with each other. It is important to create some form of online intervention, such as online forums, module, or app, to allow participants to be fully engaged in their weight loss journey. This added virtual component could lead to higher confidence and increase social support.

Recommendations for Practitioners

- **Discuss and educate individuals on the importance of healthy eating behaviors and regular physical activity.** Practitioners are encouraged to inform individuals on the benefits of eating nutritious foods and avoiding highly processed foods and snacks. Additionally, they should urge the importance of daily exercise to reduce BMI. Practitioners should ensure they are using credible, science-based information when recommending diet changes and exercises. Communicating these healthy behaviors may help to encourage individuals on changing their habits.
- **Arrange for improved access to healthier food options.** Improving access to grocery stores can help eliminate many of the barriers individuals face when trying to build a healthy diet. Those who live in food deserts or areas where grocery stores are not as accessible leads to higher chances of the

individual eating fast food and other processed foods. Examples of improving access includes building more grocery stores, creating community gardens, and developing a reliable transportation system to grocery stores.

- **Advocate for built-environment changes on a local and state level.** Pushing policymakers and state departments to create a safer environment for individuals safely walk or exercise outside is essential in preventing and managing obesity among adults. Practitioners should take into account how built environment may impact obesity rates in the area and advocate for healthy communities.

The Big Picture: Macro-level Implications

Obesity is a public health issue not only local to the United States but across the globe. Individuals with lower socioeconomic status (SES) experience obesity and its comorbidities at a much higher rate than those with higher income levels. Individuals who live in food deserts are unable to access and/or afford healthy, nutritious foods. Therefore, it is important to not only make these foods affordable, but also accessible to those living in food deserts or underserved communities. Additionally, many communities also do not have access to safe spaces for physical activity. Every community should have sidewalks and recreational areas that individuals can use safely to walk, run, and bicycle. Oftentimes, these spaces are only created in high-income communities. Public health professionals should work to advocate for the expansion of these spaces on a local, state, and national level. Obesity can be prevented through a number of policies changes and advocating for these individuals is an important step in ending the obesity epidemic.

Appendix A. Summary of Theory-based Articles Reviewed

#	(Authors, Year)	Purpose	Sample	Design	Theory/ Constructs	Results/ Conclusions
1	(Anderson et. al., 2007)	Determine how social cognitive theory affects food purchases and consumption among churchgoing adults	714 churchgoers from 14 churches in southwestern Virginia	Cross-sectional study-- Data collected included psychosocial questionnaires, Block Food Frequency Questionnaires and family food shopping receipts	Self-efficacy, social support, and self-regulation components of the social cognitive theory	Self-efficacy is the most important determinant of nutrition behavior in relation to regulating calorie intake and food purchases. Individuals with higher self-efficacy and self-regulatory behaviors were able to set goals to plan and monitor their healthy eating behaviors.
2	(Annesi et al., 2015)	To increase self-efficacy for exercise and healthy eating habits among adults with obesity	274 participants Inclusion criteria for participants were: (a) at least 21 years or older (b) BMI between 35 and 50 (c) doesn't exercise regularly <2 sessions a week.	Experimental design with two treatment groups	Social cognitive theory; self-efficacy theory; utilizing constructs such as self-regulation and behavioral changes	Both treatment groups in the study displayed significant improvements in increased exercise and healthy eating behaviors. Results indicated that the self-regulation training applied to more controlled, healthy eating habits (Self-Regulation Group). Self-regulatory skills improved when self-efficacy was emphasized. Empowering participants with the needed self-regulatory skills helped overcome common obesity-related barriers.
3	(Cheng, et. al., 2019)	Evaluate an extended TPB model incorporating weight-related self-stigma	104 overweight university students	Observational study	Theory of planned behavior; subjective norms, attitudes, perceived behavioral control, behavioral intentions	Weight-related self-stigma was significantly and directly associated with physical activity and healthy eating. Perceived behavioral control was indirectly associated with physical activity. Behavioral intention was significantly associated with physical activity and healthy eating.

4	(Englund et al., 2021)	To assess brand awareness and fruit- and vegetable-related outcomes among FNV target audience	1604 moms in California and Virginia	Cross-sectional study	Awareness, cognitive belief, encouragement, behavioral intentions	Those who were aware of the campaign and had encouragement from friends and family were more likely to buy fruits and vegetables.
5	(Estabrooks, et. al., 2017)	To evaluate a scalable, community weight loss program using reach, effectiveness, and cost metrics.	40,308 participants	Quasi experimental design	Social Cognitive theory	The weight loss trial by Tate and colleagues reported that 22% of the participants who completed follow-up achieved a 5% weight loss with an internet-based educational program—which is similar to the WAW baseline-value-carried-forward proportion of 19%. However, when a doctoral-level therapist provided personalized behavioral therapy, the proportion of participants achieving 5% weight loss increased to 45%
6	(Fisher & Kridli, 2013)	Examine how self-efficacy and motivation affect the performance of health promotion behaviors in overweight or obese middle-aged American women.	Two groups of middle-aged women (30-65 yrs) where one group had a body mass index (BMI) range of 25–29, and the second group with a BMI of ≥ 30 (n=140)	Observational study	Self-efficacy, motivation	The results indicated that both overweight and obese participants had low levels of intrinsic motivation which indicated that they lacked the desire to complete health promotion behaviors. Both overweight and obese participants scored high in self-efficacy and obese participants demonstrated a positive relationship between increased education level and a greater level of self-efficacy.
7	(Hales, et. al., 2016)	Assess the effectiveness of a weight loss mobile app that targets social support and self-monitoring of diet, physical activity, and weight in	51 adults from South Carolina who identified as either overweight or obese	Randomized clinical trial	Social cognitive theory; self-efficacy, self-regulation, social support Ecological perspective (interpersonal level)	The weight loss, self-monitoring app that utilized theory-based constructs significantly decreased the weight of participants.

		improving healthy weight loss				
8	(Lee et. al., 2020)	To evaluate the effectiveness of the program, Fun For Wellness (FFW), which is an online intervention aimed to increase well-being actions in adults with obesity in the United States in relatively uncontrolled settings	667 participants (either overweight or obese adults recruited through an online panel recruitment company)	Large-scale, prospective, double-blind, parallel-group randomized controlled trial	Self-efficacy theory	There were positive direct effects on well-being in participants as a result of the theory-based intervention (FFW).
9	(Liou & Kulik, 2020)	Examine how self-efficacy and psychosocial determinants play a role in obesity risk reduction behaviors in young adults residing in New Jersey	174 participants (18 to 40 years)	cross-sectional survey	Theory of planned behavior; self-efficacy, behavioral intention, attitude, normative beliefs, motivation, perceived behavioral control	For obesity risk reduction behaviors, participants had the highest frequency of engaging in eating home-cooked meals instead of restaurant-prepared foods, eating healthy snacks, limiting their intake of high-calorie beverages, and following healthy food patterns. Additionally, respondents with higher levels of self-efficacy were more likely to practice obesity risk reduction behaviors and is the most prominent factor when considering nutrition interventions.
10	(Mason, et. al., 2016).	to evaluate changes in mindful eating as a potential mechanism underlying the effects of a mindfulness-based intervention for weight loss on eating of sweet foods and fasting glucose levels	194 obese individuals	Randomized control trial	Awareness, self-efficacy, mindfulness	Increases in mindful eating were associated with decreased eating of sweets and fasting glucose levels among mindfulness group participants, but this association was not statistically significant among active control group participants. Twelve-month increases in mindful eating partially mediated the effect of

						intervention arm on changes in fasting glucose levels from baseline to 12-month assessment
11	(Petosa, & Silfee, 2016)	Examine the impact of a 4-week behavioral intervention on the use of self-regulation skills for physical activity among overweight and obese adults with type 2 diabetes mellitus (T2DM)	23 participants	Randomized control group design with pre- and post-testing	Self-monitoring, goal setting, self-reward, social support, time management, overcoming barriers	Statistically significant increases in self-monitoring, goal setting, self-reward, social support, time management, and overcoming barriers which led to better health outcomes
12	(Robertson, et. al., 2020)	Examine how determinants such as self-efficacy predict physical activity patterns over time.	96 participants	Observational study	Self-efficacy	Self-efficacy is an important predictor for clinically relevant physical activity change in overweight and obese individuals.
13	(Sapp & Weng, 2007)	To examine the effectiveness of the health-belief model to predict individuals' dietary quality and body mass	1319 adults from a nationwide US sample	Observational study	Health-belief model	There was a statistical significance between healthy eating index and BMI. The health belief model helped predict the dietary quality and body mass of the sampled adults.
14	(Suggs, et.al., 2010)	To explore sedentary overweight and obese adults' communication practices and preferences related to physical activity	13 participants	Observational study	Utilized constructs from Health Belief Model, Theory of Planned Behavior, and Social Cognitive Theory	Results from the study indicated that participants did not know the daily PA recommendations, lacked motivation, had low perceived behavioral control, and preferred tailored interpersonal communication.
15	(Voils, et. al., 2014)	To generate Maintenance After Initiation of Nutrition TrAINing (MAINTAIN), an intervention to enhance weight loss maintenance following initiation. The effectiveness of MAINTAIN is being evaluated	230 participants	Randomized, parallel-design, two-arm trial	Self-efficacy	Help participants successfully transition from the intervention context to the course of their normal lives. MAINTAIN is designed to be lower in cost and dose than most previously tested behavioral weight loss maintenance programs

		in an ongoing trial				
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References

- Anderson, E. S., Winett, R. A., & Wojcik, J. R. (2007). Self-regulation, self-efficacy, outcome expectations, and social support: social cognitive theory and nutrition behavior. *Ann Behav Med*, 34(3), 304-312. doi:10.1007/bf02874555
- Annesi, J., Johnson, P., McEwen, K., Annesi, J. J., Johnson, P. H., & McEwen, K. L. (2015). Changes in self-efficacy for exercise and improved nutrition fostered by increased self-regulation among adults with obesity. *Journal of Primary Prevention*, 36(5), 311-321. doi:10.1007/s10935-015-0398-z
- Centers for Disease Control and Prevention. (2021). Adult Obesity Causes and Consequences Retrieved from <https://www.cdc.gov/obesity/adult/causes.html>
- Cheng, O. Y., Yam, C. L. Y., Cheung, N. S., Lee, P. L. P., Ngai, M. C., & Lin, C. Y. (2019). Extended Theory of Planned Behavior on Eating and Physical Activity. *Am J Health Behav*, 43(3), 569-581. doi:10.5993/ajhb.43.3.11
- Englund, R. T., Valisa, E. H., Sofía Rincón-Gallardo, P., Lauren, E. K., Kathryn, W. H., Elena, L. S., & Vivica, I. K. (2021). Awareness and outcomes of the fruits and veggies (FNV) campaign to promote fruit and vegetable consumption among targeted audiences in California and Virginia: a cross-sectional study. *BMC Public Health*, 21(1), 1-12. doi:10.1186/s12889-021-11055-6
- Estabrooks, P. A., Wilson, K. E., McGuire, T. J., Harden, S. M., Ramalingam, N., Schoepke, L., . . . Bayer, A. L. (2017). A Quasi-Experiment to Assess the Impact of a Scalable, Community-Based Weight Loss Program: Combining Reach, Effectiveness, and Cost(1), 24. Retrieved from <https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip.shib&db=edsbl&AN=RN383481774&site=eds-live&custid=uga1>
- Fisher, K., & Kridli, S. A. (2014). The role of motivation and self-efficacy on the practice of health promotion behaviours in the overweight and obese middle-aged American women. *Int J Nurs Pract*, 20(3), 327-335. doi:10.1111/ijn.12155
- Hales, S., Turner-McGrievy, G. M., Wilcox, S., Fahim, A., Davis, R. E., Huhns, M., & Valafar, H. (2016). Social networks for improving healthy weight loss behaviors for overweight and obese adults: A randomized clinical trial of the social pounds off digitally (Social POD) mobile app. *Int J Med Inform*, 94, 81-90. doi:10.1016/j.ijmedinf.2016.07.003
- Harvard School of Public Health. (2021). Obesity Prevention Source Retrieved from <https://www.hsph.harvard.edu/obesity-prevention-source/obesity-consequences/economic/>
- Lee, S., McMahon, A., Prilleltensky, I., Myers, N. D., Dietz, S., Prilleltensky, O., . . . Brincks, A. M. (2021). Effectiveness of the Fun for Wellness Online Behavioral Intervention to Promote Well-Being Actions in Adults With Obesity or Overweight: A Randomized Controlled Trial. *Journal of Sport & Exercise Psychology*, 43(1), 83-96. doi:10.1123/jsep.2020-0049
- Liou, D., & Kulik, L. (2020). Self-efficacy and psychosocial considerations of obesity risk reduction behaviors in young adult white Americans. *PLOS ONE*, 15(6), e0235219. doi:10.1371/journal.pone.0235219
- Mason, A., Epel, E., Kristeller, J., Moran, P., Dallman, M., Lustig, R., . . . Daubenmier, J. (2016). Effects of a mindfulness-based intervention on mindful eating, sweets consumption, and fasting glucose levels in obese adults: data from the SHINE

- randomized controlled trial. *Journal of Behavioral Medicine*, 39(2), 201-213.
doi:10.1007/s10865-015-9692-8
- Petosa, R. L., & Silfee, V. (2016). Construct Validation of a Program to Increase Use of Self-Regulation for Physical Activity among Overweight and Obese Adults with Type 2 Diabetes Mellitus. *American Journal of Health Education*, 47(6), 379-384. Retrieved from
<https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip.shib&db=eric&AN=EJ1117146&site=eds-live&custid=ugal>
- Robertson, M. C., Green, C. E., Liao, Y., Durand, C. P., & Basen-Engquist, K. M. (2020). Self-efficacy and physical activity in overweight and obese adults participating in a worksite weight loss intervention: multistate modeling of wearable device data. *Cancer Epidemiology, Biomarkers & Prevention*, 29(4), 769-776. doi:10.1158/1055-9965.EPI-19-0907
- Sapp, S. G., & Weng, C. Y. (2007). Examination of the health-belief model to predict the dietary quality and body mass of adults. *International Journal of Consumer Studies*, 31(3), 189-194. doi:10.1111/j.1470-6431.2006.00500.x
- Suggs, L. S., McIntyre, C., & Cowdery, J. E. (2010). OVERWEIGHT AND OBESE SEDENTARY ADULTS' PHYSICAL ACTIVITY BELIEFS AND PREFERENCES. *American Journal of Health Studies*, 25(2), 69-77. Retrieved from
<https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip.shib&db=s3h&AN=52741647&site=eds-live&custid=ugal>
- U.S. Department of Health and Human Services. (2021). Overweight and Obesity. Retrieved from <https://www.nhlbi.nih.gov/health-topics/overweight-and-obesity>
- Voils, C. I., Gierisch, J. M., Olsen, M. K., Maciejewski, M. L., Grubber, J., McVay, M. A., . . . Yancy, J. W. S. (2014). Study design and protocol for a theory-based behavioral intervention focusing on maintenance of weight loss: The Maintenance After Initiation of Nutrition TrAINing (MAINTAIN) study. *Contemporary Clinical Trials*, 39(1), 95-105. doi:10.1016/j.cct.2014.08.002
- World Health Organization. (2021). Obesity and overweight. Retrieved from <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>