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Behavioral Factors Related to Weight Change in a Health Promotion and Weight Control Intervention

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BEHAVIORAL FACTORS RELATED TO WEIGHT CHANGE IN A HEALTH PROMOTION AND WEIGHT CONTROL INTERVENTION

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Abstract

This study explored whether body weight was affected by certain lifestyle behaviors and if these behaviors were affected by a brief, self-directed weight control intervention. The behavioral factors assessed in this study included: meal regularity, fast-food eating, television viewing and eating/sedentary time, dietary modifications (e.g., portion control, reducing fat intake), self-monitoring (tracking diet and exercise), self-weighing, and physical activity. Participants were randomly assigned to intervention groups or a minimal contact control group. The intervention groups completed a 1-hour education session at baseline and received bi-weekly emails. Participants completed online questionnaires at baseline and 3 months, and body measurement sessions at baseline and 6 months. *T*-tests were used to determine whether the intervention had an effect on the lifestyle variables. Although there were trends in dietary modification and self-weighing, there was no significant difference. However, the weight control intervention did increase self-monitoring behaviors. A multiple regression model was used to determine whether changes in lifestyle variables predicted changes in weight. The overall model was significant, $F(9,50) = 2.34$, $p = 0.028$, $R^2 = .30$. Increases in meal regularity predicted decreases in weight, whereas increases in TV related eating/viewing and, unexpectedly, physical activity predicted increases in weight. No other behavioral factors significantly predicted changes in weight. Results suggest that the weight control intervention could be improved and that further research is needed to understand behavioral factors related to weight change.

Behavioral Factors Related to Weight Change in a Health Promotion and Weight Control Intervention

Obesity is a growing epidemic, and over the past few decades the prevalence of it has drastically increased. It has been projected that the utilization of healthcare services associated with obesity will continue to rise in the United States as its occurrence continues to surge, and by 2030, will account for 16-18% of total U.S. healthcare costs (Wang, Beydoun, Liang, Caballero, & Kumanyika, 2008). To be classified as obese, a person must have a body mass index (BMI) of 30 kg/m^2 or greater. The U.S. has the highest BMI average amongst all other countries, with 1 in 3 adults having an index of at least 30 kg/m^2 (Sturm & Hattori, 2013). In 2006, a study by Klein & Hensrud revealed that nearly 1 in 20 Americans had a BMI of 40 kg/m^2 or greater, which then led to a novel obesity classification: morbid obesity. For over 3 decades, the average global BMI has increased by nearly 0.5 kg/m^2 per decade (Finucane et al., 2011), leading to the formation of an even more recent obesity classification: super morbid obesity, where the BMI is that of 50 kg/m^2.

As the obesity rates continue to increase, various weight loss programs have been designed to help individuals who seek treatment. And while many programs have been highly successful for short-term weight loss, long-term weight loss still remains a challenge (Jeffery, Epstein, Wilson, Drewnowski, Stunkard, & Wing, 2000). Weight loss programs often include lifestyle, medical, surgical, and psychological interventions. Lifestyle interventions involve behavioral changes such as monitoring diet and exercise, and often account for a 10% loss of body weight (Lillis, Thomas, Niemeier, & Wing, 2017). However, Lillis et al. (2017) also reported that individuals who underwent these behavioral interventions had achieved a maximum weight loss at around 6-9 months, before slowly gaining the weight back.

Some of the lifestyle behaviors that may impact one's ability to lose weight are the number of meals eaten per day, along with where the meals come from (e.g., fast-food restaurant). Sedentary activities, such as watching television, can also have an effect on body weight. In a study involving 419 participants who had recently lost 10% of their body weight, Fuglestad, Jeffrey, and Sherwood (2012) discovered that meal regularity led to greater weight loss, along with a higher intake of fruits and vegetables. It was also found that people who ate out at restaurants more frequently, and those who ate while watching television, were less active and had a higher intake of fat and sugar. This led to the prediction that weight is affected by these lifestyle behaviors but questioned whether the behaviors are affected by weight loss treatments.

Diet modifications, such as portion size reduction, are other lifestyle behaviors that can have an impact on long-term weight loss and are often integrated into weight loss programs. Research shows that reducing the number of daily calories consumed can be highly effective for a short-term period (2-3 months), but weight is still easily regained after 1 year (Jeffrey et al., 2000). Reducing the number of calories is often done by utilizing smaller portion sizes during regular meals. Using a treatment plan for portion control, Rolls, Roe, James, & Sanchez (2017) discovered that by consuming a diet of pre-portioned foods, people are more likely to lose weight than those who are instructed to follow dietary guidelines, as well as those who are told to choose foods based on energy density. However, this was also only effective for a short time period.

Self-weighing is another factor that has evidence for impacting one's success for weight loss. A study by Linde, Jeffery, French, Pronk, & Boyle (2005) found that individuals who weighed themselves more frequently had a greater weight loss after a 24-month period than those

who weighed themselves less frequently. Wing et al. (2015) also discovered that people who reported more frequent self-weighing had higher weight loss control. Although it has been reported that daily self-weighing is beneficial to individuals trying to lose weight (Linde et al., 2005), it is important to note that successful weight loss is not as likely when it is the only intervention being utilized (Madigan, Daley, Lewis, Aveyard, & Jolly, 2015). Other self-monitoring techniques, such as diet tracking and exercise, would also need to be applied. Additional research has shown that self-weighing is an intentional behavioral factor that has been affected by weight-loss interventions (Fuglestad, Rothman, Jeffery, & Sherwood, 2013).

Physical exercise has been one of the most imperative factors known to have an effect on a person's weight. Many lifestyle interventions have also revealed that exercise has been affected by weight loss treatments. Studies indicate that engaging in regular physical activity is crucial not only for losing weight, but also for preventing weight regain (Swift, Johannsen, Lavie, Earnest, & Church, 2014). People with higher levels of physical activity have also been found to have greater success with dietary restraints, in addition to more weight loss than those with lower levels of physical activity (Ogden et al., 2014).

With each of these findings in consideration, this study aimed to investigate 1) how weight was affected by changes in certain lifestyle behaviors and 2) if a brief, self-directed intervention could promote changes in these behaviors. The variables of interest included meal regularity, fast-food eating, television viewing and eating, diet modifications, self-weighing, and physical activity. It was hypothesized that increases in meal regularity, self-monitoring of diet and physical activity, self-weighing, physical activity, and healthy dietary modifications would lead to decreases in weight over six months. Conversely, it was hypothesized that increases in fast food consumption and television related eating and viewing would lead to increases in

weight over six months. It was expected that the brief, self-directed weight control intervention would lead to increases in meal regularity, self-monitoring of diet and physical activity, self-weighing, physical activity and healthy dietary modifications, and decreases in fast food consumption and television related eating and viewing.

Method

Participants

Participants in this study included 202 individuals (44 males and 158 females) who completed the initial online questionnaire and were either trying to lose weight or prevent weight gain. All participants were recruited through email and were either students or staff members at the University of North Florida with no physical or psychiatric issues preventing participation in the intervention. The race/ethnicity of the individuals included 160 Caucasian, 30 Black, 11 Asian, 4 Native American, and 32 Hispanic (participants may have selected more than one ethnicity). The mean age of the participants was 25 ($SD = 9$). Of the 202 participants, 153 completed the initial body measurement session, 108 completed an online 3-month assessment, and 74 completed the 6-month body measurement session. All participants were volunteers and were compensated by receiving a $15 Publix gift card at each session.

Measures

Meal Regularity

Participants were asked about the number of times in a typical week they 1) ate breakfast, 2) ate lunch, and 3) ate dinner. Each participant responded on a 5-point scale: 0 times, 1-2 time, 3-4 times, 5-6 times, or 7+ times. Mean scores were then created for the baseline measurement session ($M = 4.00$, $SD = .73$) and again for the 3-month measurement session ($M = 4.17$, $SD =$

.72). Change scores were created by subtracting time 1 scores from time 2 (positive numbers indicate higher values at time 2 compared to time1).

Fast food

Participants were asked about the number of times in a typical week they 1) ate food prepared at a fast-food restaurant, and 2) purchased food at a convenience store/ gas station. Each participant responded on a 5-point scale: 0 times, 1-2 time, 3-4 times, 5-6 times, or 7+ times. Mean scores were then created for the baseline measurement session ($M = 1.74$, $SD = .66$) and again for the 3-month measurement session ($M = 1.63$, $SD = .53$). Change scores were created by subtracting time 1 scores from time 2 (positive numbers indicate higher values at time 2 compared to time 1).

TV Viewing and Eating/Sedentary time

Participants indicated the frequency per week that they 1) ate after 8 pm, 2) ate a snack while watching TV, and 3) ate a meal while watching TV. The participants responded by using a 5-point scale: 0 times, 1-2 time, 3-4 times, 5-6 times, or 7+ times. They were then asked about the number of hours on an average day that they 4) watched TV, and 5) sat or reclined (not including sleeping). Their responses were recorded on a 7-point scale: 0, <1 hour, 1 hour, 2 hours, 3 hours, 4 hours, or 5+ hours. Mean scores were then created for the baseline measurement session ($M = 3.44$, $SD = .90$) and again for the 3-month measurement session ($M = 3.34$, $SD = .90$). Change scores were created by subtracting time 1 scores from time 2 (positive numbers indicate higher values at time 2 compared to time 1).

Self-Weighing

For self-weighing, participants were asked on the initial questionnaire and then again at the body measurement session how often they weighed themselves. For time 1, individuals were

asked "How often do you weigh yourself?" and responded on a 7-point scale: never, about once a year or less, every couple of months, every month, every week, every day, or more than once a day. For time 2, they were asked "In the past week, how many times did you weigh yourself?" and responded on a 5-point scale: never, 1-2 times, 3-4 times, 5-6 times, or 7 or more times. To address the different response scales, *z*-scores were computed at each time point. Change scores were created by subtracting time 1 scores from time 2 (positive numbers indicate higher values at time 2 compared to time 1).

Self-Monitoring (Diet & Exercise)

For self-monitoring, participants were asked how often they wrote down the calorie content of the foods they ate and the amount and types of exercise they did. Participants responded on a 5-point scale: never, rarely, sometimes, often, or very often. Mean scores were then calculated for the baseline measurement session ($M = 1.86$, $SD = 1.03$) and again for the 3-month measurement session ($M = 2.85$, $SD = 1.26$). Change scores were created by subtracting time 1 scores from time 2 (positive numbers indicate higher values at time 2 compared to time 1).

Dietary Modifications

Dietary modification was measured by asking participants how often they 1) reduced their portions, 2) decreased snacks, 3) decreased sweets, 4) decreased fried food, 5) decreased carbs, 6) decreased fat, 7) increased fruits and vegetables, and 8) planned meals. Participants responded on a 5-point scale: never, rarely, sometimes, often, or very often. Mean scores were then calculated for the baseline measurement session ($M = 2.96$, $SD = .74$) and again for the 3-month measurement session ($M = 3.32$, $SD = .73$). Change scores were created by subtracting

time 1 scores from time 2 (positive numbers indicate higher values at time 2 compared to time 1).

Physical Activity

To measure physical activity, participants were asked how often they 1) planned their exercise, 2) walked for at least 30 minutes at a time, and 3) engaged in other moderate to vigorous exercise. Participants responded on a 5-point scale: never, rarely, sometimes, often, or very often. Mean scores were then calculated for the baseline measurement session ($M = 3.31$, $SD = .94$) and again after 3 months ($M = 3.55$, $SD = 1.08$). Change score were created by subtracting time 1 scores from time 2 (positive numbers indicate higher values at time 2 compared to time 1).

Procedure

Participants completed an initial survey online through Qualtrics which consisted of demographic questions (age, gender, ethnicity, year in school) and health behavior questions. They were also weighed by study staff during a baseline body measurement session ($M = 153.7$ lb, $SD = 31.6$) and then again after 6 months ($M = 149.9$ lb, $SD = 28.9$). Participants were randomly assigned to either a promotion-focused intervention, a prevention-focused intervention, or a minimal contact control group. Because they are not the focus of the present analysis, the two intervention groups were combined to examine the effects of intervention versus control. For the intervention groups, participants completed a 1-hour educational information session and received a packet which contained information about healthy food choices, exercise recommendations, strategies for weight control, and goal setting. Participants were asked to keep a daily log of their food intake and exercise. They also received email messages every 2 to 3 weeks to reinforce the study messages about health promotion and weight control. Participants

who were in the control group received a pamphlet about general dietary and physical activity guidelines.

Results

As shown in Table 1, *t*-tests were used to determine whether the intervention had an effect on the lifestyle variables. There were trends in dietary modification and self-weighing but nothing was statistically significant. The intervention led to an increase in self-monitoring of diet and exercise behaviors relative to control (intervention change $M = 1.10$ versus control change $M = 0.35$, $p = .03$).

A multiple regression was used to determine whether changes in lifestyle variables predicted changes in weight. The overall model was significant, $F(9,50) = 2.34$, $p = 0.028$, $R^2 = .30$. As shown in Table 2, an increase in meal regularity was associated with a decrease in weight ($\beta = -.35$, $p = .014$), an increase in TV related eating and viewing was associated with an increase in weight ($\beta = .38$, $p = .003$), and an increase in physical activity was associated with an increase in weight ($\beta = .37$, $p = .013$). No other behavioral changes were associated with changes in weight.

Discussion

Lifestyle interventions used to combat the current obesity epidemic tend to be generally both costly and time consuming. The current study implemented a lifestyle intervention in a brief, self-directed manner as a way to promote weight loss and prevent weight gain. The study examined which behavioral factors would be affected by the intervention and ultimately revealed that self-monitoring of diet and exercise behaviors were significantly impacted. Although not statistically significant, there were trends consistent with expectations that the intervention would lead to increases in self-weighing and healthy dietary modifications. Surprisingly, no other

behavioral factors were affected by the intervention, although all of the behavioral changes were in the predicted direction (e.g., non-significant increases in meal regularity). This is likely due to the limited scope of the intervention. With a 1-hour baseline educational session, participants may not have been fully aware of the magnitude of changes that truly needed to be implemented. Additional sessions may be needed to fully educate and support the participants on these difficult and complex lifestyle changes. It also appears as though the intervention should focus more on lifestyle behaviors such as, reducing fast food and TV viewing/eating and sedentary time.

The current study also examined which behaviors would be related to weight change and found that increases in meal regularity and decreases in TV related eating and viewing predicted decreases in weight over the 6-month period. This supported the hypotheses that individuals who ate 3 meals a day and watched less TV would be more successful in controlling their weight. This also further supported the findings of Fuglestad et al. (2012) which discovered that meal regularity led to greater weight loss, and that individuals who ate while watching TV were less active and had a higher intake of fat and sugar. Contrary to expectation, increases in physical activity predicted increases in weight. This surprising finding could be due to participants' increasing muscle mass, compensating for poor dietary choices with increased exercise, or increasing dietary intake in response to increased exercise (King et al., 2007). Another surprising factor is the lack of results regarding self-monitoring, self-weighing, eating fast food, and dietary modifications, which contradicted prior findings (e.g., Burke, Wang, & Sevick, 2011; Fuglestad et al., 2012). As shown in Figure 1, on average, participants did not show a great deal of change regardless of intervention group (standard deviations were generally small as well), which could account for the lack of prediction. Furthermore, the self-report nature of the behavioral measures may be subject to self-presentational bias and/or accuracy issues.

. One of the limitations of this study was participant dropout. After beginning the study with 202 participants, only 74 remained at the 6-month weight measurement session. The time frame for the final weigh-in could potentially yield differences in findings if it were to be expanded upon. Unfortunately, this was not feasible with such a high dropout rate. The representation of males in the study sample was also a limitation as it was only 22% at the baseline survey. With the sample being heavily weighted towards females, it is difficult to associate the study population with the general population. Future research should include a larger sample size with a longer follow-up period.

Other factors to consider for future research include more nuanced and/or objective measures of behaviors. This would be beneficial for behavioral variables such as physical activity, as the current study did not differentiate between diverse types of activity (e.g., daily walking to and from destinations, sports/recreational engagement, cardio, weight training). The current measure was also self-reported by the participants rather than measured by activity level. Future research should implement the use of a Fit-bit or other mobile tracking device that accurately measures the level of physical activity. Analyzing specific behaviors of diet modification (e.g., portion control, reducing deserts) should also be employed in future analysis. Employing a more sophisticated assessment of dietary intake would also be beneficial. Using a 24-hour dietary recall or even a validated dietary history measure to record the participants' food intake are potential methods to gain more reliable data. The overall intervention used for this study could additionally be improved for future research by specifically targeting lifestyle factors, such as TV related eating and sedentary time, which were unaffected in the present study.

Conclusion

In general, the findings of this study indicated that the brief, self-directed intervention significantly impacted individuals' self-monitoring of their diet and exercise. With regards to weight change, the findings signified that individuals who regularly eat three meals a day and those who limit TV related eating and viewing weigh significantly less after a period of 6 months. In addition to an enhancement of the overall intervention, more research is needed to determine which behavioral factors can be affected by brief, self-directed lifestyle interventions that will ultimately lead to weight loss and improved health.

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Table 1

Mean Changes in Lifestyle Variables by Intervention Condition

	Control Group	Intervention Group	*t*-value	*df*	*p*-value
Meal Regularity	-.09	.15	-1.18	87	.24
TV eating/viewing	-.04	-.21	.79	87	.43
Fast Food	.02	-.05	.37	87	.71
Dietary Modifications	.08	.33	-1.5	86	.15
Exercise	.02	.07	-.16	86	.87
Self-monitoring	.35	1.10	-2.2	86	.03
Self-weighing	-.31	.12	-1.6	86	.12

Table 2

Predicted Weight Change from Baseline to 6 Months by Changes in Lifestyle Variables

	β	*t*-value	*p*-value
Meal Regularity	-.35	-2.56	.014
TV eating/viewing	.38	3.12	.003
Fast Food	.12	.93	.356
Dietary Modifications	-.04	-.23	.821
Exercise	.37	2.56	.013
Self-monitoring	-.002	-.02	.986
Self-weighing	-.08	-.56	.578

Note. Age and sex were entered as covariates. Degrees of freedom are 1 and 50.

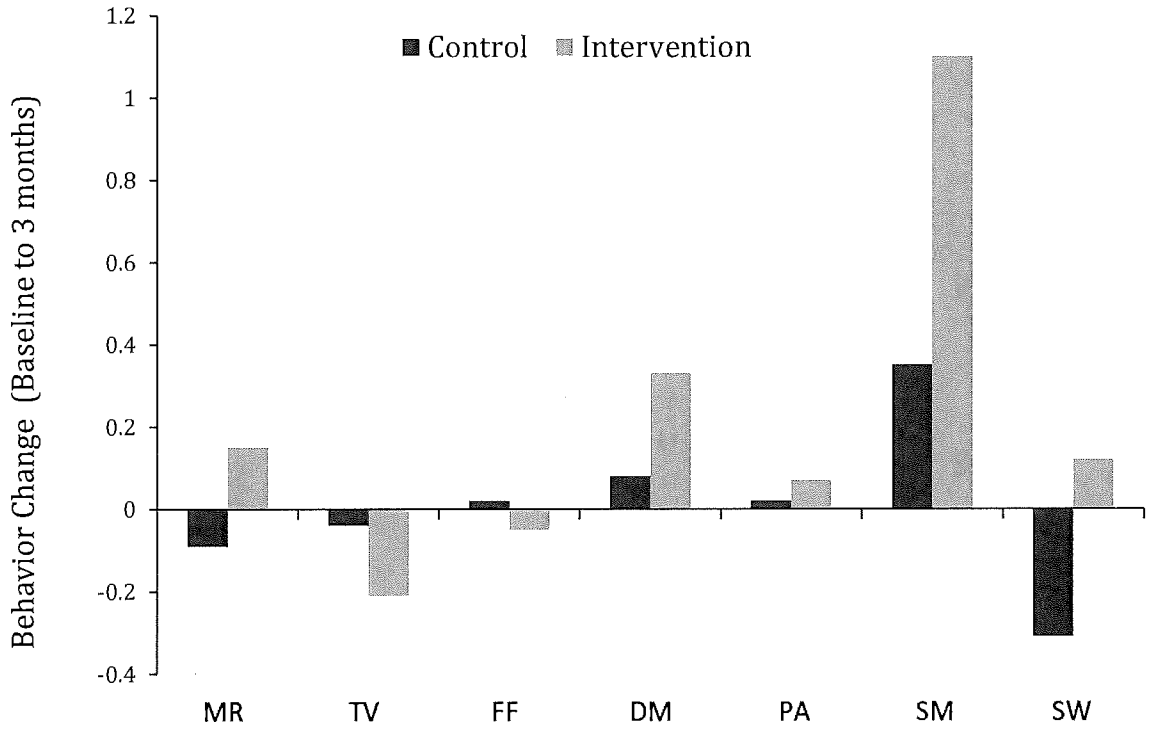

Figure 1. Behavioral factor change by condition. MR = meal regularity; TV = TV related eating and viewing; FF = fast food consumption; DM = dietary modifications; PA = physical activity; SM = self-monitoring; SW = self-weighing.