The Association Between Delay Discounting and Weight Gain in First-Year Students: The Moderating Role of Restrained Eating

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Abstract

Weight gain is a prevalent concern nowadays due to adverse health consequences. Delay discounting (DD) has been associated with weight gain in past research, however, there have been inconsistencies in findings pertaining to the direction of the relationship. Literature on the restraint theory suggests that restrained eating (RE) might also play a role in weight gain. The current study examined whether high DD is associated with BMI increase and whether RE moderates this relationship. A longitudinal study was conducted, using self-report measures including the Monetary Choice Questionnaire to measure DD, and the restraint scale to measure RE. The BMI of first-year female psychology students was measured four times over the course of 6 months. Results showed that DD was not significantly related to BMI increase. RE significantly moderated the relationship between DD and BMI increase, meaning that people with high DD and high RE showed greater weight gain. High DD reflects the tendency to prefer immediate over delayed rewards and was associated with BMI increase only at high levels of RE. Future research should replicate the study to confirm the robustness and generalizability of the moderation effect and consider a longer research design. Additional factors such as alcohol consumption due to its relationship to DD, weight gain, and first-year students should also be considered.

Keywords: delay discounting, weight gain, BMI increase, restrained eating, restraint theory, moderation

The Association Between Delay Discounting and Weight Gain in First Year Students: The Moderating Role of Restrained Eating

Weight gain is a prevalent concern because it can lead to health issues, especially in cases of obesity (Balvinder & Kumar, 2024; Zheng et al., 2017). Obesity is defined as abnormal or excessive fat accumulation that presents a risk to health (World Health Organization, n.d.). Obesity and excess body weight can be linked to cardiovascular disease, higher risk of cancer, and increased overall mortality (Bianchini et al., 2002; Gaal & Maggioni, 2014). Obesity develops as a result of weight gain, especially when there is an imbalance between energy intake and expenditure (Panuganti et al., 2023). Weight gain can therefore be seen as a precursor of obesity, leading to health issues.

For many young adults, attending their first year of university can be a critical time for weight changes and an increased autonomy for dietary choices (Anderson et al., 2003; Vella-Zarb et al., 2009; Deliens et al., 2014, 2015). The "freshman fifteen" is a common expression to describe the weight gain of 15 pounds in the first year of university. Even though it has been refuted that students gain the exact amount of 15 pounds, numerous studies show weight gain does occur during this time (Anderson et al., 2003; Baum, 2017; Holm-Deloma et al., 2008; Levitsky et al., 2004; Zagorsky & Smith, 2011). These changes are especially relevant for young women, since weight gain can negatively influence self-esteem, body image, and mental illnesses, including depression and anxiety (Abraham, 2003; Dijkstra et al., 2015; Kemp et al., 2023). Thus, weight gain may have physiological and psychological health consequences, especially for young women in their first year of university.

Delay discounting (DD) might be important in understanding the trajectory of weight gain in first-year students. Delay discounting (DD) refers to the decrease in a reward's perceived value the further this reward lies in the future. To put it differently, DD describes the tendency to devalue rewards as they get temporally distant (Bickel et al., 2018; Mazur et

al., 1987). Individuals who prefer immediate rewards and devalue long-term rewards are said to show steeper, higher DD (Kirby et al., 1999). Conversely, individuals with low DD are able to delay rewards and do not prefer the smaller immediate over the larger delayed reward. High DD has been previously linked to weight gain and obesity (Amlung et al., 2016; Epstein et al., 2010; Weller et al., 2008; Felton et al., 2020). Low DD, on the other hand, has been associated with weight loss or weight loss maintenance (Bickel et al., 2018). Bickel et al. (2021) suggest that DD might be a behavioral marker for obesity. DD has been shown to be related to unhealthy eating behaviors, such as poor dietary choices, which is a factor closely linked to weight gain (Bickel et al., 2021; Mozaffarian et al., 2011). Bickel et al. (2021) propose four key criteria to determine a behavioral marker, including differences between healthy and clinical groups, the relation to underlying biological mechanisms, stability over time, as well as the ability to respond to treatment outcomes. DD adheres to the criteria. Identifying behavioral markers like DD makes it easier to identify people at risk of weight gain before serious weight concerns like obesity might develop. In the context of the present study, this highlights the importance of researching the relationship between DD and weight gain, as DD might be an indicator for identifying individuals who are more likely to gain weight. Furthermore, it might help to understand why some people may be more vulnerable to weight gain than others. Therefore, the proposal of DD as a behavioral marker might be an important theoretical framework for understanding the relationship between DD and weight gain.

Dassen et al. (2015) found that unhealthy eating might be associated with DD. This could entail preferring to snack multiple times a day instead of waiting for the next meal. Snacking has been associated with weight gain (Skoczek-Rubińska & Bajerska, 2021; Nederkoorn et al., 2010). Therefore, high DD, meaning the preference for immediate food

rewards in comparison to long-term health goals, may be associated with an increase in weight.

There have been mixed findings on the relationship between DD and weight gain. A longitudinal study by Felton et al. (2020) found that there is a positive relationship between DD and weight gain. They found that if DD increases significantly over time, participants are more likely to show steeper increases in BMI later on. More specifically, adolescents who progressively chose smaller immediate rewards rather than larger delayed ones tended to gain more weight. Other studies found no association between DD and BMI increase (Veillard & Vincent, 2020; Bjorlie & Fazzino, 2020). Bjorlie & Fazzino (2020) investigated the relationship between DD and weight gain. Results showed that DD was not associated with increases in weight. Veillard and Vincent (2020) tested the moderating effect of DD on the rate of BMI increase with age, researching whether DD affects how quickly individuals gain weight. They found that DD is not associated with BMI increase. More specifically, individuals with high DD do not seem to gain more weight than those with low DD. Together, the lack of consistent findings across previous studies highlights the complexity of the association between DD and weight gain.

To better understand the relationship between DD and weight gain, the present study adds restrained eating (RE) as a potential moderator. DD can not only be linked to obesity and weight gain, but also to RE (Kuijer et al., 2008). While DD measures the decrease in value of a future reward, it does not account for other cognitive differences in eating behavior that could be associated with weight gain, such as RE. RE is defined as the intention to diet to control one's weight (Lowe et al., 1991). Specifically, it is a cognitive effort to restrict food intake (Lowe et al., 1991). This is especially relevant for young women, since they are more likely to show high RE, compared to men (Quick & Byrd-Bredbenner, 2012). Importantly, RE does not necessarily lead to weight loss, compared to caloric restriction (Schaumberg et al.,

2016). Conversely, RE might be associated with weight gain. This assumption is based on the restraint theory by Herman and Mack (1975). The theory states that RE can lead to overeating due to cycles of restriction and disinhibition due to the stressors of long-term dieting (Herman & Mack, 1975), which might eventually result in weight gain over time. Therefore, based on the restraint theory, it is assumed that high RE will be associated with weight gain.

Mixed findings in the literature on RE and weight gain show the existing inconsistencies regarding the topic at hand. Research has found that RE predicts future weight gain (Klesges et al., 1992; French et al., 1994; Stice et al., 1999). In contrast to this, Schaumberg et al. (2016) found that high RE has been associated with weight loss and weight maintenance. Among other factors, high RE was one factor associated with successful weight maintenance in normal-weight compared to obese individuals (Phelan et al., 2009). In connection with DD, a study by Dong et al. (2016) found RE scores to be positively correlated with higher DD scores. People with higher RE scores showed preferences for smaller immediate rewards compared to larger delayed rewards (Dong et al., 2016), which implies that people who restrain their eating may struggle with delaying rewards. Thus, the relationship between DD on weight gain might depend on how much a person intends to restrain their eating. More specifically, DD may be linked to weight gain only in individuals who strongly restrain their eating. If high RE might be associated with weight gain, or has an influence on the relationship between DD and weight gain, this is of value for prevention programs or weight management strategies. This could entail identifying people who are high in RE and consequently at risk of weight gain, and educating them about the effects RE might have on their health, especially in combination with DD, as examined in the current study.

Previous literature has mostly either focused on the relationship between DD and weight gain or on the relationship between RE and weight gain, and both areas of research have yielded lots of conflicting results. Additionally, there hasn’t been a moderation model in

which RE would change the relationship between DD and weight gain. Thus, this study aims to investigate whether DD is related to weight gain, and whether this relationship changes depending on a difference in high or low RE (see Appendix, Figure 1).

The aim of the current study was to examine the association between DD and weight gain in first-year psychology students, and whether this relationship is moderated by differences in RE. The central research question was whether individuals with higher DD show greater weight gain over time, and if this association depends on their level of RE.

Specifically, the study tests two hypotheses: H1: higher DD is associated with an increase in BMI, and H2: RE moderates the relationship between DD and BMI increase, such that higher DD is associated with greater BMI increase only at high levels of RE.

Method

Participants

Participants were first-year psychology students. The sample consisted of a group of 178 participants, and all participants were female. Their average age was 19.31 (*SD* = 1.79). 59% (*n* = 104) of participants were Dutch, 41% (*n* = 71) had a different nationality. Of this sample, 175 participants were included in the final analysis. Four were excluded because their data was incomplete. The average BMI of these participants at the first measurement was 21.90 (*SD* = 2.84).

Measures

Delay Discounting (DD) was measured using the Monetary Choice Questionnaire (Kirby et al., 1999). The MCQ is a self-report measure that presents individuals with a series of hypothetical choices between smaller immediate and larger delayed monetary rewards. This is done to assess their perceived value of rewards. It included 27 questions, such as "Would you prefer $25 today, or $60 in 14 days?". Each item reflects a different delay length and reward size, including small, medium, and large rewards. Scoring of the responses was

done using a SPSS syntax by Gray et al. (2016). The syntax compares the participants' choice patterns to a set of predefined discounting rates (k-value) for either small, medium, or large reward sizes. These k-values are assigned based on individual switch points. A switch point is the point at which an individual changes the preference from delayed to immediate. In other words, the delayed reward no longer feels worth waiting for. The earlier a participant reaches the switch point, the higher their k-value and the more they prefer the immediate reward, also called steep discounting. Overall, a higher k-value indicates higher DD, which means a stronger preference for immediate rewards. On the other hand, a lower k-value indicated lower DD, which indicates a preference for delayed rewards. The k-values were log-transformed since they are mostly positively skewed. The mean of these variables was calculated and was then used in the following analyses. Cronbach's alpha showed high reliability (Cronbach's $\alpha = .91$). This means that participants show a stable tendency to discount future rewards across different reward sizes.

Dietary restraint was assessed using the Restraint Scale (Herman & Polivy, 1975). The 10-item self-report questionnaire measures concerns with dieting and weight fluctuations. The items measuring concern with dieting are shown on a 5-point Likert scale (1 = never, 5 = always). Total scores were computed by summing the average of items. A higher score on these items shows a higher concern for dieting. Weight fluctuation is measured on a 5-point scale, in kilograms, ranging from "0-0.5 kilos" to 2.5 kilos or more". Internal consistency for both the items on weight fluctuation and concern for dieting were acceptable (Cronbach's $\alpha = .70$, $\alpha = .70$). The overall internal consistency was good (Cronbach's $\alpha = .80$). Most items were moderately correlated with each other (.04 to .56), which suggests that the items measure a common underlying concept without being repetitive. However, the item "How conscious are you of what you are eating?" showed relatively weak correlations with the other

items (r = .04-0.3) on the inter-item correlation matrix. Removing this item would not have improved the reliability of the scale, which is why it is kept in.

Weight gain was measured in BMI = weight (kilogram) / height (meters). Change in BMI was calculated by subtracting the last measurement point from the first point.

Procedure

This study was approved by the Ethics Committee of Psychology of the University of Groningen (PSY-2324-S-0363). The study was conducted at the Faculty of Behavioural and Social Sciences of the University of Groningen. The data reported in the present longitudinal study were part of a larger study, conducting research about DD, eating disorders, and emotion regulation strategies. First-year psychology students were recruited using the SONA platform, a participant recruitment tool used by academic institutions, where they could enroll themselves in the study "PSY-2324-S-0363 Emotion regulation and weight". The overarching study lasted for one year and consisted of five data collection points. However, this study only makes use of the data from the first four data collection points. Participants are asked to wear standard clothing (a T-shirt and leggings) that is kept constant through each collection point to make sure there are no confounding factors, like the weight of the clothes. For the first and last data point, they are required to complete a list of five questionnaires, accessible through the *Qualtrics* website, and are then measured for both their height in meters and weight in kilograms. For the three intermediate data points, participants are only required to complete the Eating Disorder Examination-Questionnaire, and their weight is measured at each point. All participants gave informed consent prior to participation. Each data collection point lasts three weeks, with five weeks between each point. Participants have the choice to complete the study in either Dutch or English. The students receive study credits for their participation. Additionally, participants who completed the entire study, meaning they attended every data collection session, were financially incentivized with five euros. They also received an

additional monetary reward of five euros after the final data collection point, as the study extended beyond the first academic year. This incentive was provided in recognition of the extra effort required to remain engaged in the study after the program had already ended.

Data Analysis

The data was analyzed using SPSS (IBM Corp, 2024). Descriptive statistics (mean, standard deviation, and range) of the main variables and demographics were computed. Assumptions of normality, homoscedasticity, and linearity were checked and not violated. To measure the correlation between DD and weight gain, a Pearson's correlation coefficient was used to measure the strength and direction of the relationship. A repeated measures ANOVA was conducted to test whether BMI significantly changes over time, and whether this change is associated with DD. To measure whether RE has an effect on the relationship between DD and BMI change, a moderation analysis was conducted via Process Macro for SPSS (Model 1) (Hayes, 2022). DD was the independent variable, BMI change score was the outcome variable, and RE was the moderator.

An a priori power analysis was conducted using G Power (Faul et al., 2009) to test whether the study's sample was large enough to detect significant effects. Since there is no previous literature similar enough to this study, a medium effect size is the standard (F = 0.15), with an expected power of 0.80. Statistical significance was set at an alpha of 0.05. A sample size of 68 was needed in order to conduct hierarchical regression analysis for the moderation analysis. A sample size of 55 was needed for the main analysis.

Results

Descriptive Statistics

From the initial 178 participants, 46 were removed due to one or more missing data BMI timepoints, resulting in a total of 132 participants. Assumptions of normality, linearity, and homoscedasticity were checked for in the final sample and not violated (Appendix, Figure

2-7). Normality was not violated shown by the histogram (Figure 2) in which the data is roughly bell-shaped, and in the p-p plot in which points are lying close to the line (Figure 3). Linearity was not violated, as shown by a scatter plot indicating a slightly upward trend (Figure 4-6). Homoscedasticity was also not violated since there is no clustering or strong pattern in the spread of dots (Figure 4-6). Furthermore, there is no multicollinearity shown by the VIF = 1. When including the moderator and interaction term, multicollinearity is still not present (VIF = 1.04).

Descriptive statistics of age and the main study variables, DD, BMI change, and RE, are shown in Table 1. Participants showed relatively small changes in BMI over time, including a range from a decrease of 3.07 to an increase of 2.80 on BMI.

Table 1

Descriptive Statistics

Variable	Minimum	Maximum	Mean	SD
Age	17.00	30.00	19.31	1.89
DD	.87	3.80	2.41	.59
BMI Change	-3.07	2.80	0.16	0.88
RE	2.00	29.00	13.29	5.49

Note. n = 175 for all variables except BMI change (n = 132); *DD* = Delay discounting; *RE* = Restraint eating; *SD* = Standard deviation.

A repeated measures ANOVA was used to analyze whether BMI changes across the different timepoints showed a significant effect of time on BMI (p = .031, $F(1.8,233.10)$ = 3.62, partial η^2 = .03). This indicates that BMI significantly changed over the course of the

measurement points independent of DD. Descriptive statistics showed that BMI increased slightly from the first measurement point to the last (Table 2).

Table 2

BMI change across four timepoints, Descriptive Statistics

Time Point	M	SD
BMI_1	21.82	2.63
BMI_2	21.81	2.62
BMI_3	21.90	2.69
BMI_4	21.98	2.62

Note. Greenhouse-Geisser correction was applied due to violation of the sphericity assumption (Mauchly's W = 0.39, $p < .001$)

Hypothesis Testing

To test H1, whether high DD is associated with BMI change, DD is added as a covariate to the repeated measures ANOVA. The results showed that BMI did not change significantly over time when DD is included in the model, F (1.69, 54.08) = 0.10, p = .869, partial η^2 = .00. The previous model without DD showed a significant main effect of time on BMI change (p = .031, F (1.87, 233.10) = 3.62, partial η^2 = .03). However, this changes to nonsignificant when DD is included in the model. There was no significant interaction between time and DD, F (3, 210) = 0.86, p = .85, partial η^2 = .53, indicating that BMI change over time did not depend on DD (Table 4).

Table 4

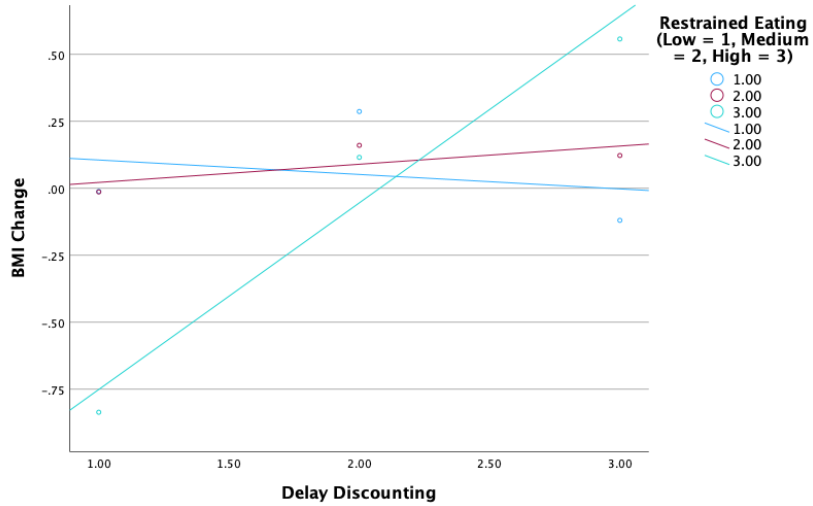
Repeated-Measures ANOVA, BMI Change by DD Group (Greenhouse–Geisser Correction)

Effect	df	F	p	Partial η^2
Time	1.69, 54.08	0.10	.869	.00
Time × DD	3.00, 210.00	0.86	.849	.01

To test H2, it was examined whether scores of the restraint scale moderate the relationship between DD and BMI increase. The Process Model 1 (Hayes, 2022) showed a significant effect (F (3, 127) = 3.35, p = .02, R^2 = .07). This indicates that 7.3% of the variance in BMI change was explained by the model. The main relationship between DD and BMI change, as well as the interaction between RE and BMI change, was nonsignificant. Additionally, regression coefficients of the moderation analysis can be found in Table 5. Furthermore, a simple slopes analysis showed that at high levels of RE, higher DD significantly predicted greater BMI increase (B = 0.65, p = .004), this relationship was not significant when RE scores were low. The 84th percentile was chosen for this since it represents approximately one SD above the mean, which indicates high levels of the moderator variable. These results suggest that DD is associated with BMI increase among individuals high in RE. High DD describes the tendency to choose smaller immediate rewards over larger delayed ones. The moderation analysis showed that DD and BMI change were only associated at high levels of RE. This suggests that people who restrain their eating and struggle to delay rewards show greater weight gain.

Figure 5

Changes in BMI dependent on DD and different levels of RE



Discussion

This study aimed to examine whether high DD is associated with an increase in BMI over time, and whether high RE moderates this relationship. First, it was found that there is a small, significant increase in BMI over time. However, DD did not significantly predict BMI change. The moderation analysis showed a significant effect of RE on the relationship between DD and BMI change. At high levels of RE, greater DD was associated with a significant increase in BMI. Thus, individuals who prefer immediate rewards and highly restrain their eating show the strongest BMI increases, even though DD alone was not associated with BMI change.

The first hypothesis investigating a positive association between DD and weight gain was not supported by the findings. This finding stands against some of what was found previously by other researchers. Earlier research has found a positive relationship between high DD and weight gain, indicating that people who prefer smaller immediate over larger delayed rewards tend to be heavier or gain more weight (Felton et al.,2020). The study by Felton et al. (2020) showed that a significant increase in DD over time is associated with rapid increases in BMI. The study examined adolescents over a six-year period. It is important to note that the mean age of participants was 13 at the start of the study. The age difference between this sample and the one of the current study may be crucial in interpreting the

conflicting results, since children generally tend to show higher DD than adults (Yu et al., 2021). Notably, the differences in results may be explained by the difference in samples, since some studies used groups of overweight individuals, and this study used one of normal-weight students. Kishinevsky et al. (2012), for example, found an effect of DD on weight gain in a sample of obese women. This leads to question whether DD might have a more direct connection to weight gain in overweight and obese women than to weight gain in normal weight women. It further suggests that the association between DD and weight gain may be limited to these specific groups. Overall, the inconsistent findings may be due to variation in samples, in particular due to differences in age and weight group. There have been some studies that found no significant association between DD and weight gain, in line with results. These studies used samples of normal-weight individuals (Veillard & Vincent, 2020; Bjorlie & Fazzino, 2020). More specifically, Veillard & Vincent (2020) found no evidence that high DD of monetary rewards is associated with BMI or the rate of BMI gain over time. They conducted an online study with a large sample of 381 adults. The study by Veillard & Vincent (2020) and the present study show multiple similarities, such as a longitudinal design, as well as a sample of young and healthy-weight adults. This suggests that the findings might be internally consistent within a shared population but may not be generalizable to others. In further support of this, Bjorlie & Fazzino (2020) also found that DD was not significantly associated with weight gain. They also used a similar sample, including first-year university students, with similar age (M=18.2) and mean BMI (M=24.9). Therefore, the absence of a significant effect may be specific to the sample of young healthy-weight individuals.

In addition, the meta-analysis by Tang et al. (2019) further highlights that the mixed results on studies of DD and weight gain might be due to methodological heterogeneity. Specifically, the authors present factors explaining the differences in results across literatures. They propose that studies that make use of real monetary rewards in comparison to

hypothetical rewards show more consistent positive associations between DD and obesity and weight gain. This could explain why the study at hand found different results, since it measured DD using a hypothetical, monetary reward questionnaire instead of real rewards. Taken together, methodological differences, including different sample composition and the use of different rewards, may help to explain why there have been conflicting results in studies.

The initial motivation for researching RE as a moderator was that previous studies showed inconsistencies in findings on the relationship between DD and weight gain, which may be due to disregarding the role of differences in behaviors like RE. Previous research has found positive associations between RE and DD (Dong et al., 2016), as well as between RE and weight gain (French et al., 1994; Klesges et al., 1992; Schur et al., 2010). The second hypothesis explored whether high RE would moderate the relationship between DD and BMI change, which was supported by the findings. The interaction between DD and RE was associated with a BMI increase over time. In this case, this means that the relationship between DD and weight gain is dependent on the level of RE. Only people high in RE show an association between DD and BMI. This suggests that the preference for immediate rewards (high DD) only contributes to weight gain when individuals also show a strong intention to restrict food intake (high RE). This finding partially aligns with the restraint theory that proposes that the stress of high RE, caused by the alternating cycles of restriction and disinhibition that many people experience while dieting, may lead to weight gain (Herman & Polivy, 1975). While RE did not relate to weight gain, contrary to one of the core assumptions of the theory, its moderating effect suggests that people who prefer immediate rewards and highly restrain their eating might be especially at risk for weight gain, which might offer an expanded understanding of the theory. Overall, the results suggest that the interaction between

DD and RE might be critical in researching weight gain. Especially because high DD alone did not predict weight gain, but became a significant predictor when RE was included.

One of the key strengths of this study is its longitudinal design, which allows to measure actual weight trajectory over multiple measurement points. The use of validated questionnaires (RS, MCQ) and the relatively large sample size (N=175) also enhances the reliability of findings. The study was conducted in a controlled laboratory setting, which ensures that there are no external distractions. Furthermore, it is generalizable to a population of first-year psychology students.

However, there are some limitations in this study that should be considered in the interpretation of results. First, there could be confounding variables. Specifically, these may include, e.g., psychological stress or poor sleep quality. Both are associated with weight gain (Dakanalis et al., 2024; Geiker et al., 2018; Mouchacca et al., 2013; Jang et al., 2020). Stress is shown to be associated with higher DD, particularly because people under stress tend to choose more immediate rewards than delayed ones (Bird et al., 2023; Kimura et al., 2013). Thus, stress and alcohol use seem to be associated with the main variables of the current study, DD and weight gain, and might therefore be important third variables to be researched. Second, the reliance on self-report measures poses the risk for response biases. Third, the moderation model accounted for only some variance in BMI change, and leaves a large portion of variance unexplained. Therefore, it is important to further research additional factors. Despite limitations, this study adds new, valuable findings by showing that DD alone does not predict weight gain but has an effect on weight gain when measured together with RE.

The findings of this study have multiple implications for future research on the impact of DD on weight gain and the moderating effect of RE. First, DD did not show a direct effect on weight gain. However, the significant moderation effect of RE on the relationship between

DD and weight gain implies that DD should rather be considered in the context of RE. This means that individuals who show higher preferences for immediate rewards and restrain their eating might be at more risk of weight gain. The role of RE is important in explaining the association of DD and weight gain. Individuals showing both high DD and RE may benefit from an approach where both are considered together. Further, this challenges the idea of DD as a single behavioral marker for obesity or weight gain. However, the moderation effect suggests that DD may still be a useful behavioral marker, but only in the context of other variables, like RE. An important next step could be to replicate the moderation model in a larger and diverse sample to determine whether the effects might also apply to other populations. Second, another implication might concern the length of the study. The findings suggest that the current study period may have been too short to detect long-term effects. Previous research by Felton et al. (2020) has found a significant effect when researching adolescents over the course of 6 years. This suggests that the effect of DD on weight gain might take several years to be identified. A shorter study, like the current one, may not be able to capture longer-term patterns, leading to insignificant results. Therefore, future research should use a longer study period to examine the relationship between DD and weight gain further. Third, the nonsignificant relationship between DD and weight gain suggests that there might be other predictors. There has been a lot of evidence for weight gain in the first year of university overall (Anderson et al., 2003; Baum, 2017; Holm-Deloma et al., 2008; Levitsky et al., 2004; Zagorsky & Smith, 2011). Factors influencing this could be stress, unhealthy food consumption, and lifestyle habits, as well as heightened alcohol consumption (Choi et al., 2020; De Vos et al., 2015; Wilson et al., 2021). Other research has also shown an association between alcohol dependence and DD (Bobova et al., 2009). Especially when transitioning to university, alcohol consumption increases, putting first-year students at risk for problematic alcohol use (Ghrekin & Sher, 2006; Weitzman et al., 2003). Since alcohol use increases,

especially in the first year of university, and is related to DD, this might be a relevant factor to consider in future research of DD on weight gain. High alcohol consumption might moderate the relationship between DD and weight gain.

Conclusion

To conclude, this study aimed to investigate whether there is a positive relation between DD and weight gain and whether this relationship is moderated by RE. The results found no association of DD on weight gain in first-year psychology students. Nevertheless, it found a slight positive increase in BMI over time, independent of DD. The effect of DD on weight gain was present at high levels of RE, meaning that participants with high DD and high RE experienced greater weight gain. The study highlights the importance of including RE in the research on DD and weight gain. Future research should focus on conducting longer studies and include more variables, especially those important to first-year students, e.g., alcohol consumption.

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Appendix

Figure 1

Research Model

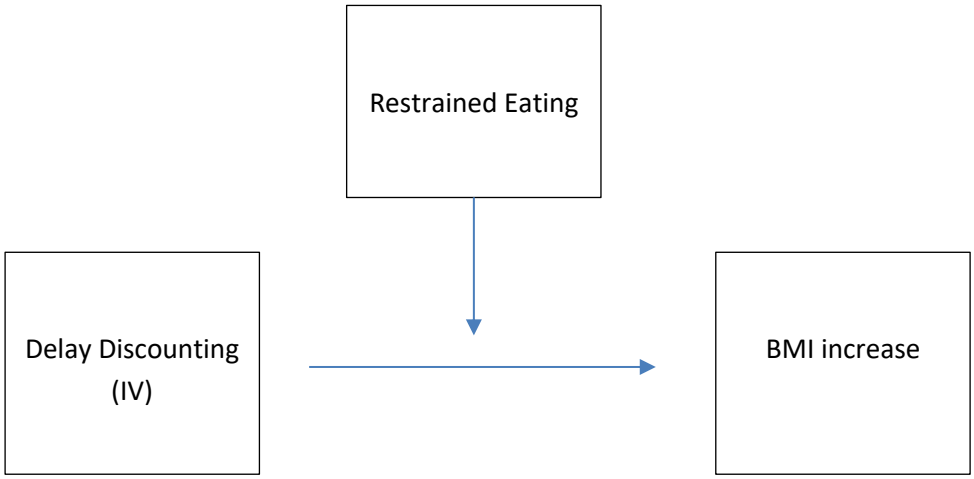

Figure 2

Normality of Residuals

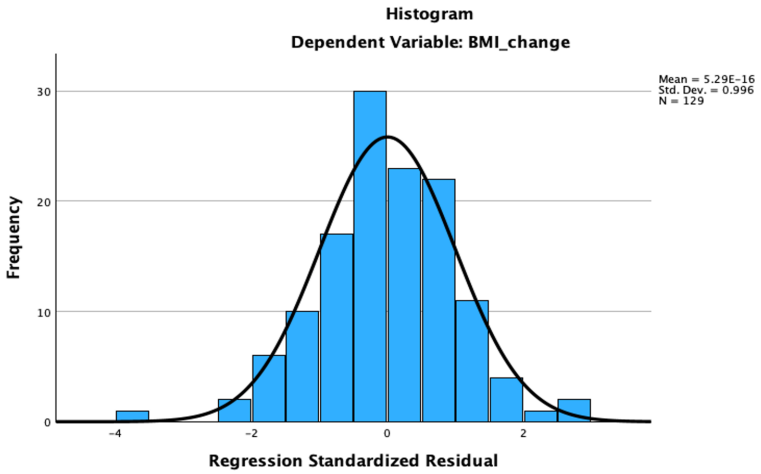

Figure 3

Normal P-P Plot of Regression Standardized Residuals

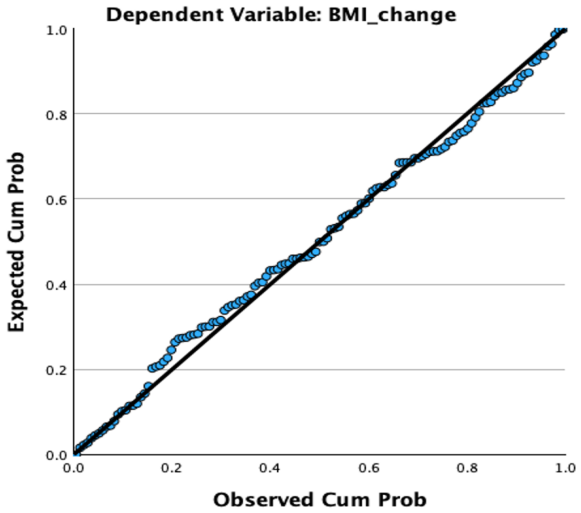

Figure 4

Scatterplot of Standardized Residuals for BMI change

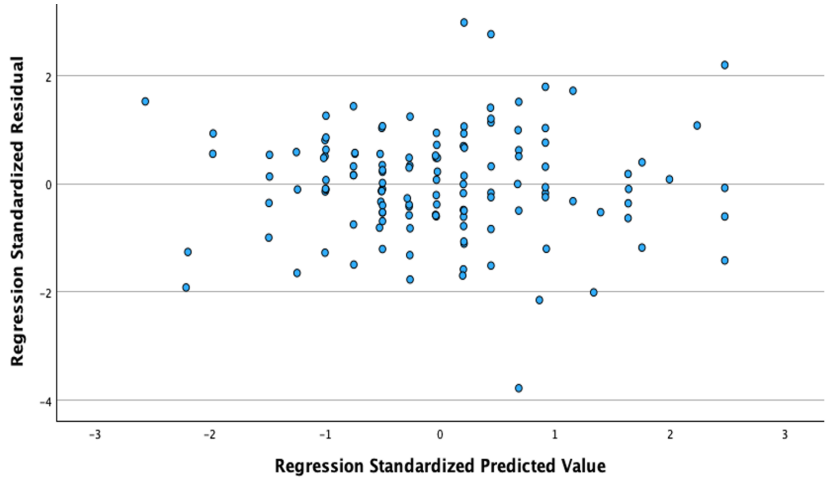

Figure 5

Scatterplot of Standardized Residuals for DD

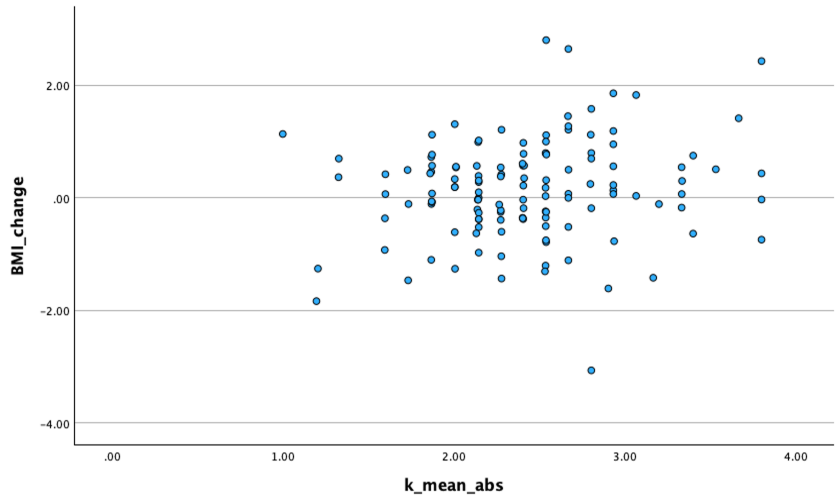

Figure 6

Scatterplot of Standardized Residuals for RE

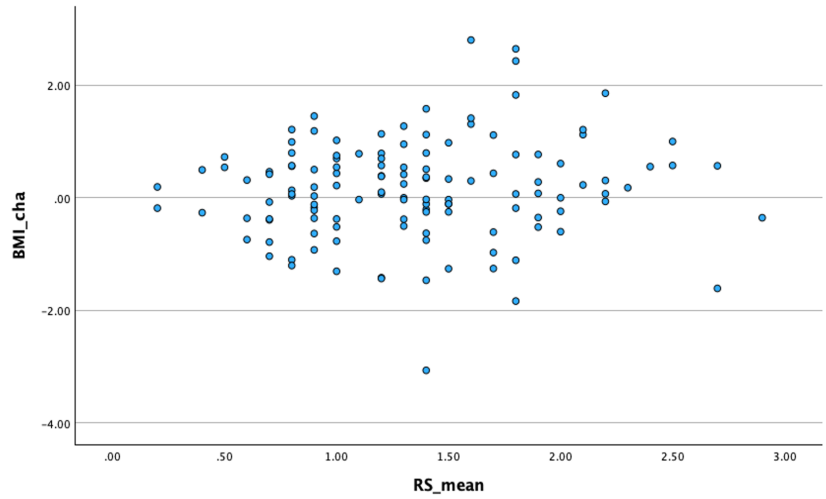

Table 5

Regression Coefficients Moderation Analysis

Predictor	B	SE	*t*	*p*	LLCI	ULCI
Constant	0.13	0.08	1.73	.086	-0.02	0.28
DD	0.12	0.13	0.93	.354	-0.14	0.38
RE	0.01	0.01	0.35	.729	-0.02	0.03
Interaction	0.08	0.03	3.08	.003	0.03	0.15