

**Dieting, Alcohol Use, and Impulsivity in a Sample of Undergraduate Students**

by

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## Abstract

Dieting behavior is correlated with frequency and quantity of alcohol use and alcohol related problems. Research has also shown that dieting behaviors are correlated with impulsivity, as measured by self-report questionnaires. Alcohol use is also correlated with impulsivity, in both self-report measures and other measures of impulsive decision making. The present study examined the role of impulsivity in the relationship between dieting and alcohol use. It was hypothesized that impulsivity would moderate the relationship between dieting and alcohol use and dieting and alcohol related problems. Furthermore, it was hypothesized that individuals who report increased levels of dieting and increased alcohol use will score higher on measures of impulsivity than those who are not elevated on these variables and those who are only elevated on one variable. Participants (n = 416 undergraduate female students) were asked to complete online questionnaires inquiring about their frequency and quantity of alcohol use, alcohol related problems, eating behaviors, and impulsivity. Impulsivity was assessed via two measures, a self-report questionnaire and a questionnaire that assessed impulsive decision making. Results differed between the two measures of impulsivity, suggesting they may not be tapping into the same construct. Results suggested that the self-report measure of impulsivity was correlated with alcohol use and dieting behaviors. Impulsivity inconsistently moderated the relationship between dieting and alcohol-related problems. In addition, this study confirmed the relations between alcohol use and impulsivity and dieting and impulsivity, but did not support the additive effect for alcohol use and eating behaviors across various measures of impulsivity.

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## INTRODUCTION

Alcohol abuse is a significant public health problem across college campuses (Dams-O’Conner, Martens, & Anderson, 2006; Jennison, 2004). Research has shown that alcohol use typically increases from high school to college, and that alcohol use typically peaks around the age of 20 or 21 and then decreases thereafter (Gotham, Sher, & Wood, 1997). A recent study at Auburn University revealed that approximately 80% of college males and 75% of college females use alcohol on a weekly basis (Correia & Day, 2007). Alcohol use is associated with a variety of outcomes including student attrition, sexual aggression, sexually transmitted diseases, violence, destruction of property, and car accidents/fatalities (Jennison). Due to this high level of use and these associated outcomes, it is important to learn more about alcohol use and ways to reduce the associated negative consequences. There has been a plethora of research conducted on college student alcohol use to try to better understand the risk factors associated with elevated rates of harmful alcohol use and related negative outcomes. One of these lines of research has found a correlation between alcohol use and certain eating behaviors, typically those behaviors associated with bulimia nervosa (e.g., bingeing and purging) and unhealthy dieting behaviors.

### *Eating disorders*

The *Diagnostic and Statistical Manual of Mental Disorders, fourth edition, text revision* (DSM-IV-TR; American Psychiatric Association (APA), 2000) includes criteria for three eating disorders: anorexia nervosa (AN), bulimia nervosa (BN), and eating disorder not otherwise specified (EDNOS). The diagnostic criteria for AN are maintaining a body weight at least 15%



below the average body weight for a person's sex, age, height, and body structure; fear of weight gain/becoming fat (despite maintaining below a minimal normal weight); disturbance in the way that body weight, size, or shape is experienced; and amenorrhea in females (absence of three or more consecutive menstrual cycles). There are two subtypes of AN: restricting type and binge-eating/purging type (APA). It is a common misconception that the word *anorexia* refers only to the restricting subtype, which is characterized by self-starvation only. However, the binge-eating/purging subtype is diagnosed when an individual regularly binges or purges while meeting all other criteria of AN (APA).

The diagnostic criteria for bulimia nervosa, as outlined by the DSM-IV-TR (APA, 2000), are repeated episodes of binge eating characterized by eating more than is considered normal during a two-hour period of time and lack of control during the episode; engaging in compensatory behaviors to prevent gaining weight (e.g., vomiting, excessive exercise, use of laxatives/diuretics, etc.); body shape or weight largely impacts his/her self-evaluation; and the individual must not meet criteria for AN. The criteria specify that the binge eating and compensatory behaviors must occur an average of twice a week for three consecutive months to receive a diagnosis of BN. As with AN, there are two subtypes of BN: purging type and the nonpurging type (APA). The purging subtype is most common and includes vomiting and/or use of laxatives, diuretics, or enemas as the compensatory behaviors following a binge episode. The nonpurging subtype is applied when the compensatory behavior is excessive exercise

There are not specific criteria for eating disorder not otherwise specified; EDNOS refers to patterns of disordered eating that do not meet specific criteria for AN or BN. However, the DSM-IV-TR (APA, 2000) does list some examples of when a diagnosis of EDNOS would be appropriate. These instances include if a female meets all criteria for AN, but she has regular

menses, the criteria for BN are met except for the frequency/duration criterion, or an individual meets criteria for AN but is normal weight, just to name a few. A fourth eating disorder, known as Binge Eating Disorder is mentioned as a nonofficial diagnosis that is included in a DSM-IV-TR appendix of diagnoses requiring further study (APA). Since binge eating disorder is a newer area of research and it is not as common in college students, the current study is focusing on symptoms of AN and BN, and on dieting behaviors.

### *Prevalence of eating disorders*

There is much debate about the actual percentage of people with eating disorders. However, most research agrees that the prevalence of eating disorders in North America ranges from 0.1% to 2% in the general population, and even as high as 5% in high school and college populations (Garner & Desai, 2000; Polivy, Herman, & Boivin, 2005). Many speculate that these percentages are an underestimate, as many individuals go undiagnosed because of the social acceptability of dieting and fasting in the Western culture (Polivy et al.). The onset of eating disorders typically occurs between the ages of eighteen and twenty, and is most often preceded by some life stressor or change (e.g., leaving for college). Dunn, Larimer, and Neighbors (2002) suggest that stress and life transitions help explain why college aged individuals are at a higher risk for developing an eating disorder.

Research shows that there are gender differences in the clinical populations of eating disordered individuals, with males accounting for only 5% to 10% of those diagnosed (Garner & Desai, 2000). A possible explanation for the unequal representation of males in the eating disordered population is differential cultural pressures for males and females. While females feel pressure to be thin, males are pressured to conform to muscular builds. Of the men in the eating

disordered population, most are involved in activities that emphasize weight control (e.g., gymnastics, wrestling, dance, etc.; Garner & Desai).

### *Eating disorders and alcohol use*

As stated previously, alcohol use and eating disorders commonly co-occur. This comorbid relationship is more common with BN than AN. For example, in a review of over fifty studies reporting comorbidity between alcohol use and eating disorders, Lilenfeld and Kaye (1996) found that 0% to 6% of individuals with restricting AN reported comorbid alcohol use, while 14% to 49% of those with BN reported regular alcohol use. Furthermore, Krahn, Kurth, Gomberg, and Drownowski (2005) estimated that among treatment seekers with BN, 9% to 50% also met criteria for alcohol abuse or dependence. Even though this relationship has been well documented, research in this area has yielded conflicting results regarding what correlations actually exist (Anderson, Martens, & Cimini, 2005). Most research suggests that individuals with symptoms of BN (i.e., bingeing and purging) are more likely to experience negative consequences from alcohol use than those who do not exhibit such symptoms (Anderson et al.; Dunn et al., 2002; Ross & Ivis, 1999). Some of these studies also suggest that these individuals report increased alcohol consumption (i.e., frequency of use, quantity consumed, or both; Anderson et al.; Ross & Ivis), while other studies suggest their use is no different from non-eating-disordered participants (Dunn et al.).

### *Disordered eating*

Distinct from eating disorders, disordered eating refers to a pattern of eating behaviors that are abnormal, but not diagnosable disorders. These eating behaviors range from symptoms of eating disorders (e.g., bingeing, purging, etc.) to behaviors consistent with popular diets (liquid diets, restricted caloric intake, elimination of 'junk food' from diet, etc.). Some refer to this

spectrum of behaviors as subclinical eating disorders. These behaviors are also known as EDNOS, diets, atypical eating disorder, partial eating disorder, sub-threshold eating disorder, problematic eating behaviors, or disordered eating (Chamay-Weber, Narring, & Michaud, 2005). Which term is used greatly depends on the research question and how the term is defined.

There are mixed findings in the literature regarding prevalence rates of individuals who exhibit disordered eating behaviors (Chamay-Weber et al., 2005; Kurth, Krahn, Nairn, & Drewnowski, 1995; Striegel-Moore, Silberstein, Frensch, & Rodin, 1989). Kurth et al. reported that roughly 2% of freshman college females had diagnoses of BN, but another 16% met most of the criteria for BN (i.e., four out of the necessary five criteria). Striegel-Moore et al. assessed the eating behaviors of college freshmen at the beginning of the year and again at the end of their freshman year. They observed that though rates of BN did not change, there was an increase in rates of disordered eating (e.g., bingeing, purging, severe dieting, etc.). Chamay-Weber et al. reviewed the literature on subclinical eating disorders in adolescence (it should be noted that the ages of participants in these studies ranged from middle school to college-aged). They found that the reported prevalence of subclinical eating disorders varied across studies and ranged from 0.8% to 14% in adolescent girls (Chamay-Weber et al.). Rates of purging behaviors alone in adolescent populations ranged from 5% to 16%. Chamay-Weber et al. stated that the large discrepancy in rates of problematic eating behaviors is due to several factors, including location of the study, age of participants in the study, assessment method, and criteria used to define a subclinical eating disorder.

Much of the literature on dual diagnoses with eating problems focuses on individuals who report bingeing and/or purging to lose weight as opposed to using individuals with a diagnosis of an eating disorder. Bingeing and purging behaviors are typically used because these

behaviors are associated with alcohol related problems, regardless of a diagnosis. Whereas symptoms consistent with AN, such as restricting food intake, are typically associated with a decrease in alcohol use. As with eating disorders, research has identified a link among certain eating behaviors, alcohol use, and alcohol related consequences.

Similar to BN, some research suggests that individuals with disordered eating behaviors consume a higher quantity of alcohol than those without disordered eating patterns. However, other research suggests that individuals who exhibit disordered eating behaviors do not differ from controls regarding frequency and quantity of alcohol consumed, but that they exhibit more problems related to similar levels of alcohol use (Dunn et al., 2002).

Anderson et al. (2005) assessed for alcohol use and related consequences in a sample of students who positively endorsed an item indicating that they had vomited or used laxatives in the past 30 days as a means to lose weight. This group was compared to a control group that was matched by body mass index and age. The results indicated that participants who purged reported higher frequency and quantity of alcohol consumed. These individuals also reported experiencing more negative consequences related to their alcohol use (Anderson et al.). Adams and Araas (2006) extended the findings of Anderson et al. by examining relationships in a larger, national sample. They similarly reported that participants in their study who reported purging were also more likely to report increased frequency of alcohol consumption and an increase in binge drinking episodes.

### *Dieting*

Diets are very commonplace in Western cultures. Many dieters engage in unhealthy eating behaviors, and thus the relationships between disordered eating and alcohol use could manifest themselves in a large number of people. There is no single definition of dieting.

Subsequently, there is no agreed upon method of assessing for dieting behaviors (Timko, Perone, & Crossfield, 2006). Many researchers who study dieting develop questions to assess for the specific behaviors of interest, which causes difficulty in comparing and contrasting studies. Dieting can refer to a variety of behaviors ranging from eating healthy to more severe means such as liquid and fasting diets. Given this lack of an agreed upon definition, it is no surprise that prevalence rates of dieting behaviors are quite variable. For example, Tylka and Subich (2002) found that 60% of female college students had engaged in an abnormal eating behavior, such as chronic dieting, during their lifetime. Timko et al. reported that over half (51.3%) of the women in their study indicated that they were on a diet to lose or maintain weight. However, looking at results based on responses to forced-choice dichotomous questions alone do not allow for further investigation as to what behaviors these diets may include. Timko et al. asked participants to elaborate positive responses by stating what types of behaviors they were engaging in to lose weight or maintain weight. Their responses indicate that positive responses to dieting questions most likely refer to the following behaviors: eating healthy, exercising, reducing caloric intake, reducing or eliminating carbohydrates, and low fat diets, with some differences between dieters who are trying to lose weight and dieters who are trying to maintain weight. Celio et al. (2006) examined the use of diet aids (e.g. diet pills, diuretics, laxatives, fat blockers, etc.) among a sample of college students and found that 32% of college females reported recent use of at least one diet aid, usually diet pills; however, the rates varied by area and was as high as 44% in one geographical area.

It is evident that prevalence rates differ contingent upon how dieting is defined. In spite of this lack of agreement surrounding prevalence rates, these statistics suggest that dieting behaviors are common in Western cultures. Additionally, some diets require participants to

follow strict rules or abnormal eating regimens that can be detrimental to one's health. Dieting behaviors are correlated with a variety of negative behaviors, including smoking cigarettes, mood swings, low self-esteem, and weight gain and associated health problems (Lowe et al., 2006; Racette, Deusinger, Strube, Highstein, & Deusinger, 2005). At least one study has reported that dieting behaviors during freshman year of college are more predictive of weight gain than overeating and restraint (Lowe et al.).

Research has also shown that dieting behaviors are correlated with alcohol use. As the perceived severity of eating behaviors decreases, so does the amount of research dedicated to the relationships between these eating behaviors and alcohol use. Much of the research on eating disorders and disordered eating with regards to alcohol use assumes that due to the linear correlations of these variables that the relationships would remain constant even at less severe levels (Krahn et al., 2005). Of the research that is published on dieting and alcohol use, similar discrepancies remain among the alcohol use variables (as with eating disorders and disordered eating). For example, Bradstock et al. (1988) reported that binge drinking is more common in normal weight individuals who reported engaging in dieting behaviors than in normal weight individuals who did not indicate they were dieting. Similarly, Krahn et al. reported that dieters use alcohol more frequently than non-dieters. Krahn et al. concluded that "the relationship between dieting behaviors and alcohol use is not confined to the severe end of each continuum of behaviors (i.e., bulimia nervosa and alcoholism)..." (p. 48). Another recent study observed that dieting behaviors seemed to strengthen the relationship between alcohol use and alcohol related problems in a sample of undergraduate females; dieting was more strongly related to alcohol use than bulimic symptoms (Heidelberg & Correia, 2009). Dams-O'Conner et al. (2006), however, reported that individuals who are trying to lose weight (i.e., dieters) did not differ from non-

dieters in frequency of alcohol use in the past 30 days or episodes of binge drinking. Despite this similarity in alcohol use, Dams-O'Conner et al. observed that the dieters in their study were more likely to experience negative consequences from their alcohol use than controls. The present study hopes to add more depth to this research regarding dieting and alcohol use.

### *Impulsivity*

Though the comorbidity of disordered eating and alcohol use has been established, there are competing theories as to how to explain these relationships. The present study posits that this co-occurrence is moderated by impulsivity. Impulsivity has been defined as acting on a sudden urge, as opposed to careful deliberation or reason (Evenden, 1999). However, in his review of impulsivity research, Evenden goes on to argue that there is not one definition of impulsivity, because the literature on impulsivity encompasses a variety of conceptual issues, behaviors, and assessment strategies.

When assessing impulsivity, it is important to realize that the level of impulsivity is inextricably linked to how it was assessed. Most assessments fall into one of two categories: face valid self-report measures or tasks that assess impulsive decision making. As the name suggests, [face valid] self-report measures of impulsivity require participants to complete a series of questions that are thought to assess the personality characteristic. These measures typically use yes-no forced choice response format, or a Likert scale; an advantage to using self-report measures is that they are quick, easy, and inexpensive to administer (Kazdin, 2003). Examples of self-report measures include the Barratt Impulsivity Scale (Patton, Stanford, & Barratt, 1995) and the Eysenck Impulsivity Scale (Eysenck, Pearson, Easting, & Allsopp, 1985). Impulsive decision making, on the other hand, is assessed by requiring participants to complete a task that supposedly taps into the construct, as opposed to answering questions about the construct. There



are a variety of impulsive decision making tasks, including delay discounting tasks (Bickel, Green, & Vuchinich, 1995), Simple Reaction Time, Time Estimation, and Time Production (Gerbing, Ahadi, & Patton, 1987). Tasks that assess impulsive decision making are typically more time consuming and sometimes perceived as more difficult to interpret than self-report measures. However, some view these measures as advantageous because they are easier to administer, as most are computer-based tasks, and they are not as face valid as many self-report measures (Kazdin). Also, impulsivity is typically viewed in terms of decisions made/behaviors; thus, some feel this construct should be assessed as such. Several studies have found that self-report and impulsive decision making tasks yield similar results; others have not found such correlations, and use this lack of a connection as evidence that self-report measures and other tasks tap into different constructs (Reynolds, Ortengren, Richards, & de Wit, 2006).

Several studies have been conducted using a delay discounting task among individuals who use alcohol (Tucker, Vuchinich, & Gladsjo, 1994; Tucker, Vuchinich, & Pukish, 1995; Vuchinich & Simpson, 1998). Delay discounting refers to the idea that the value of a reward is perceived as less than the actual value because time must elapse before the reward can be obtained, or, stated a different way, people prefer a smaller, more immediate reinforcer versus a larger, delayed reinforcer (Bickel et al., 1995; Myerson & Green, 1995). Although everyone discounts delayed rewards to some extent, individuals who are typically more impulsive are likely to allow the delay time to affect their choice more than individuals who are not impulsive.

Discounting rates are typically assessed using a hyperbolic function formula that estimates a parameter to account for the rate of discounting. This equation can be represented as:  $V = A / (1+kD)$ . In this equation,  $V$  is the perceived value of the award (also known as the indifference point),  $A$  is the actual amount,  $D$  is the delay to the receipt of the reward, and  $k$

(called the free parameter  $k$ ) is the constant that governs the rate of decrease (Bickel & Marsch, 2001; Myerson & Green, 1995). As  $k$  is a hyperbolic function, a log transformation is typically done to this variable to use in analyses.

Vuchinich and Simpson (1998) conducted two studies, both of which showed that lighter drinkers were less likely to discount hypothetical monetary amounts than were heavy social drinkers and problem drinkers. Similar to the present study, Vuchinich and Simpson used a hypothetical money choice task and had a sample of non-treatment seeking college students. Studies on discounting behaviors in individuals who use alcohol have not been limited to the lab. Naturalistic studies have shown that alcohol use is inversely related to the availability of non-alcohol reinforcers (e.g., health related benefits of abstinence or decreased use, decreased legal consequences, decreased family problems, increases in social activities and intimate relations, and increases in financial stability; Tucker et al., 1994; Tucker et al., 1995). These types of behaviors are considered to be real world examples of delay discounting models, as they are analogous to long-term value (Vuchinich & Simpson). These studies suggest that elevated levels of alcohol use may be correlated with impulsivity as measured by the delay discounting task.

Similar results regarding alcohol use have been reported in studies that use self-report measures of impulsivity (Battaglia, Przybeck, Bellodi, & Cloninger, 1996; Grau & Ortet, 1999; Wills, Vaccaro, & McNamara, 1994). Battaglia et al. used the Tridimensional Personality Questionnaire (Cloninger, Przybeck, & Svrakic, 1991) to group people with various Axis I and Axis II disorders into personality clusters. This study found that participants with alcohol abuse scored higher on novelty seeking. Conversely, Grau and Ortet studied alcohol consumption in females without diagnosable alcohol problems (i.e., alcohol abuse or dependence). The results of this study indicated that alcohol consumption was correlated with impulsivity as measured by

the Karolinska Scales of Personality and the Eysenck Personality Questionnaire-Revised (Grau & Ortet). Also using the Tridimensional Personality Questionnaire, Wills et al. assessed for a variety of constructs as potential predictors for adolescent substance use, in a non-treatment seeking sample. Their results indicated that an increased level of alcohol use was correlated with impulsivity. As evidenced by these examples, research has consistently shown that alcohol consumption is correlated with impulsivity as measured by a variety of self-report measures.

Several studies have found that a large percentage of individuals with eating disorders score higher on self-report impulsivity measures than matched controls. These studies also report that the relationship between disordered eating and impulsivity is more common in BN than AN (Cassin & Ranson, 2005; Conason, Klomek, & Sher, 2006; Loxton & Dawe, 2001; Taylor, Peveler, Hibbert, & Fairburn, 1993). More specifically, impulsivity is most common in individuals who report symptoms of bingeing and/or purging (i.e., BN and bingeing/purging AN). In fact, individuals with characteristics of AN restricting type reported lower impulsivity scores than matched controls (even those without any disordered eating patterns). Cassin and Ranson conducted a review of the literature on eating disorders and personality characteristics and found support for the widely accepted notion that individuals with BN are characterized by impulsivity; these same behaviors are low in AN.

Le Grange et al. (2006) conducted a study comparing individuals with BN and individuals with a subclinical eating disorder featuring BN symptoms on a variety of measures. This study reported no differences between the two groups on measures of impulsivity. This finding supports the idea that individuals with subclinical eating disorders will similarly show increased levels of impulsivity as those with BN. As discussed previously, Battaglia et al. (1996) used the Tridimensional Personality Questionnaire to group people with psychological disorders

into personality clusters. This study found that participants with eating disorders, specifically BN, scored higher on novelty seeking. This relationship is also evident in non-clinical samples. For example, Benjamin and Wulfert (2005) reported that subjective binge eating episodes was correlated with higher levels of impulsivity as measured by Eysenck Impulsiveness Questionnaire. Benjamin and Wulfert also looked beyond self-report measures of trait impulsivity and found that binge eating is correlated with a variety of behaviors that are considered impulsive. For example, participants who reported engaging in binge eating episodes were more likely to also report gambling, shoplifting, and being sexually promiscuous.

These reviewed studies suggest that impulsivity is related to disordered eating. However, to date no studies have been published that look at the relationship between disordered eating behaviors and impulsivity using a task that assesses impulsive decision making. As mentioned above, there are several studies using self-report measures of impulsivity that show symptoms of BN are correlated with increased levels of impulsivity. An extension of this line of research would be to see if similar results are yielded using a measure of impulsivity other than self-report.

Much like the current study, some studies have even looked at impulsivity among individuals who use alcohol and exhibit disordered eating symptoms (e.g., Rush, Becker, & Curry, 2009). These studies have concluded that impulsivity is a possible link between these comorbid disorders. Rush et al. used the NEO Five-Factor Inventory to assess personality characteristics. They divided their participants into four groups: binge eating, binge drinking, binge eating and drinking, and non-binging participants. Their results indicated that the binge eating and drinking group showed lower impulse control scores than the other groups (Rush et al.). However, as with the studies on disordered eating and impulsivity, none of these studies

have included a non-self-report measure of impulsivity. Thus, the current study is expanding on this literature to further explore the relationships among alcohol use, disordered eating, and impulsivity. A similar approach was taken by Petry and Casarella (1999) in their study on discounting rates among substance abusers, substance abusing problem gamblers, and a control group of non-substance abusing/non-gambling participants. As expected, their study revealed that the substance abusing problem gamblers discounted more rapidly than substance abusers and controls.

### *Current Study*

The goal of the present study is to examine the relationships among eating behaviors, alcohol use variables, and impulsivity. Additionally, the present study extends the research in this area by including both a self-report of impulsivity and a task that measures impulsive decision making. Regarding relations between the different sets of variables, we hypothesize the following: (1) individuals who report increased levels of disordered eating (symptoms of bulimia and dieting behaviors; as measured by the Eating Attitudes Test-26 and the Three Factor Eating Questionnaire) will also report increased levels of alcohol use; (2) these disordered eating behaviors will also be correlated with increased levels of impulsivity (as measured by the Eyesnck Impulsivity Scale and a delayed discounting measure); and (3) elevated levels of self-reported alcohol use will also be correlated with increased levels of impulsivity. Though the novelty of the current research is the addition of the task that assesses impulsive decision making, we are also interested in dieting behaviors given that much of the research on eating is related to eating disorders or symptoms of eating disorders. Research on dieting has been an extension of this line of research, and though there is some research on dieting and alcohol use and dieting and impulsivity, more information will allow for a better understanding of the role of

dieting on these variables. Thus, we hypothesize that (4) dieting will have an impact on the various alcohol use and impulsivity variables (i.e., a difference will exist on the scores of alcohol use and impulsivity measures when comparing dieters versus non-dieters).

The literature suggests that impulsivity, alcohol use, and eating behaviors are correlated. However, the exact nature of this relationship is still unclear. So, in addition to the aforementioned hypotheses, we predict that (5) impulsivity will moderate the relation between dieting and alcohol consumption; and (6) impulsivity will moderate the relation between dieting and alcohol related problems. Finally, in taking a different perspective on these relations, we hypothesize (7) individuals who report increased levels of disordered eating patterns and increased alcohol use will score higher on measures of impulsivity than those who are not elevated on these variables and those who are only elevated on one variable.

## METHODS

### *Participants*

The participants were drawn from Auburn University undergraduate females who were enrolled in psychology courses during the Summer or Fall semester, 2008 (n = 416). One participant's alcohol use data was not included in analyses as the data were elevated deeming it non-interpretable. There was additional data loss to the delay discounting variable. Nearly 47% of participants (n = 195) average *k* scores were not computable because they did not have all seven *k* scores (and averaging the remaining *k* scores skewed the data). This loss was due to data that was not interpretable (i.e., participants who never switched from preferring the larger, delayed reward to the smaller, immediate reward). This type of responding was not interpretable because the last question for each delay period asked participants to choose between \$1000 now and \$1000 available at some time in the future. When participants chose the delayed reward on these items, an indifference point could not be calculated, thus, the *k* score could not be calculated. Even with this significant data loss, there were 221 participants with usable *k* scores for analyses. Analyses with delay discounting used these 221 participants, whereas analyses with EPI used 416 participants. A variety of analyses were done to confirm that the samples were equivalent in terms of the alcohol and eating variables. Analyses with the EPI were conducted with both the full dataset (n = 416) and with the 221 participants who had usable *k* scores. Results did not differ across analyses, there were not significant changes to power across

analyses, and using the results with the 221 participants would not have changed the conclusions of the study. Thus, we chose to conduct analyses with the full dataset when available.

Participants included females who were at least 19 years old (85% Caucasian). The current study is one of several that could be completed on an online data collection system. Students who participated received an hour of extra credit for their participation.

### *Self-Report Measures*

Demographics. The demographics/information questionnaire (see Appendix B) included questions regarding gender, age, completed education, membership with a Greek organization, ethnicity, race, and current residence. This information was used for descriptive purposes.

EAT-26. The Eating Attitudes Test-26 (EAT-26; see Appendix B) is a shortened version of the original 40 question Eating Attitudes Test (Garner, Olmstead, Bohr, & Garfinkel, 1982). The EAT-26 contains 26 statements and offers a 6 point Likert scale to answer (ranging from Always to Never). The three responses most indicative of ED symptoms receive a score of 3, 2, and 1, while the other three responses are scored 0. Scores can range from 0 to 78; a score of 20 or above is generally used as an indication of a potential eating disorder (Garner et al.). In addition to the total score, the EAT-26 yields three subscale scores: Dieting, Bulimia and Food Preoccupation, and Oral Control. The Dieting subscale is composed of thirteen questions related to the desire to be thinner and the avoidance of fattening foods. The Bulimia subscale is composed of six questions related to bingeing behaviors, vomiting thoughts and behaviors, and a preoccupation with food. The Oral Control subscale is composed of seven questions that relate to anorexic-like symptoms, including caloric restriction and feeling pressure from others to eat and gain weight (Anderson, Simmons, Martens, Ferrier, & Sheehy, 2006). The EAT-26 has shown reliability and validity in use with undergraduate college students (Thome & Espelage,



2004). In the current study, the EAT-26 had an internal reliability coefficient of .89 for the full scale, a .88 for the dieting subscale, .77 for the bulimia subscale, and .55 for the oral control subscale. Despite the low internal consistency, the oral control scale was still included in initial correlational analyses to allow for a full exploration of the dataset. The oral control scale was not, however, included in any of the more formal hypothesis testing.

Three Factor Eating Questionnaire. The Three Factor Eating Questionnaire (TFEQ; see Appendix B) is a 51-item, self-report measure that assesses for a variety of dieting behaviors (Stunkard & Messick, 1985). In part I of this measure, there are 36 true-false questions, in which the response most indicative of disordered eating is scored a 1, with the other response a 0. Part II consists of 15 Likert scale items with 4 choice responses for each item (one item has a 5 point Likert scale). For the Likert items, the two responses most indicative of disordered eating receive one point, while the other responses are scored 0. Each item loads onto one of three subscales: Cognitive Restraint of Eating, Disinhibition, and Hunger. The Cognitive Restraint subscale is composed of 20 items that relate to intentional restraint of food intake. The Disinhibition subscale is composed of 16 items and assesses for a variety of disinhibitors (e.g., social situations, anxiety, depression, and weight fluctuations). The Hunger subscale is composed of 15 items that relate to the feelings and consequences of hunger (Stunkard & Messick). The TFEQ has shown reliability and validity in use with a college population (Atlas, Smith, Hohlstein, McCarthy, & Kroll, 2002). In the current study, the Cognitive Restraint subscale had an internal reliability coefficient of .87, a .77 for the Disinhibition subscale, and .77 for the Hunger subscale.

AUDIT. The Alcohol Use Disorder Identification Test (AUDIT; see Appendix B) is a ten-question, self-report measure that inquires about behaviors commonly associated with risky

drinking patterns. Scores on the AUDIT can range from 0 to 40; a score of 8 or above is generally used as an indication of an increased risk associated with alcohol use (O'Hare & Sherrer, 1999). Studies have shown the AUDIT is reliable and valid in a college student sample (Fleming, Barry, & MacDonald, 1991; O'Hare & Sherrer), and it was internally reliable in the current sample ( $\alpha = .85$ ).

DDQ. Portions of the Daily Drinking Questionnaire (DDQ; see Appendix B) were used to assess the average quantity of alcohol, as well as the maximum amount of alcohol, participants consumed for each day of the week during the past four weeks. The DDQ also inquires about the types of alcohol consumed (i.e., beer, wine, hard liquor, and mixed drink) and the number of episodes of binge drinking in the past 28 days. The DDQ has shown reliability and validity in use with undergraduate college students (Collins, Parks, & Marlatt, 1985).

RAPI. A modified version of the Rutgers Alcohol Problem Index (RAPI; see Appendix B) was used to assess negative consequences a participant has experienced as a result of alcohol use. The RAPI is a 23 item, self-report measure that requires participants to respond to statements based on how many times they have experienced a particular problem in the past month. Responses are indicated using a five-point Likert scale (0=never, 1=1-2 times, 2=3-5 times, 3=6-10 times, 4=more than 10 times). The RAPI was designed for use with adolescents, ages 12-21, which makes it an acceptable measure for use with college students. Internal consistency has been found to be adequate in previous studies ( $\alpha = .77-.82$ ; White & Labouvie, 1989). One month test-retest reliability was also found to be adequate in a college student sample ( $r = .72$ ; Borsari & Carey, 2000). The original RAPI measured the frequency of alcohol-related problems occurring in the previous three months. The present study used a modified

version of the RAPI to specifically assess alcohol related problems during the previous 28 days. Internal reliability in the current study was .93.

Substance Use Survey. This survey (see Appendix B) was included to inquire about participants' recreational drug use. Participants indicated their age when they first used the drug, when they last used the drug, and the number of days they used the drug in the past 28 days for a list of fifteen different drugs. This survey includes the following drugs: cigarettes, cigars, chewing tobacco, pipe tobacco, alcohol, marijuana, cocaine, diet pills (prescription and OTC), non-prescription use of stimulants, amphetamines, or other opiates, heroine, hallucinogens, ecstasy, and inhalants.

EPI. The Eysenck Impulsivity Scale is a subscale from the Eysenck Personality Inventory (EPI; see Appendix B) and is presented as a 19 question, self-report measure that was used to assess impulsivity. This scale used a forced choice, yes-no response format that assessed how well participants control their behavior. Reliability coefficients exceed .80 for men and women in previous studies (Eysenck et al., 1985,  $\alpha=.82$ ), and was similar in the current study ( $\alpha = .84$ ).

Delay Discounting Task. The hypothetical money choice task (see Appendix B for sample items) is a 184 question measure that requires a forced choice response between two hypothetical monetary rewards, but at different points in time (i.e., either offered immediately or after a delay). For example, questions in this task include "Which would you rather have: \$750 today or \$1000 next week?" and "Which would you rather have: \$600 today or \$1000 next year?" The choices are presented in random order for monetary values and time choices.

## *Procedures*

Students who chose to participate selected the study from the list of approved studies via the online system. Prior to completing the measures, participants were first asked to read an information letter. If they still chose to participate, participants then continued on to complete the measures online. The packet of measures included a demographics/information questionnaire, the EAT-26, the TFEQ, the AUDIT, the DDQ, the RAPI, a Substance Use Survey, the EPI, and a delay discounting task. Once students completed the survey packet, they were directed to a referral list, which contained contact information for services in the community, should they feel the need to talk to someone about their eating habits or substance use. Once they submitted their responses, participants were automatically granted their extra credit. Identifying information was not collected, thus responses were anonymous.

### *Calculating the delay discounting variable*

Prior to running analyses, the delay discounting variable used in the current study, the log transformed  $k$  score ( $\log k$ ), had to be calculated. Following data collection, the database contained the raw data (i.e., participants' preferences on each item). First, these responses were coded into numeric values. Then, for each participant and for each of the seven time points used (i.e., one week, two weeks, one month, six months, one year, five years, 25 years), the indifference point was calculated. The indifference point is the point at which an individual subjectively perceives two rewards [of different values] to be equal in worth, due to the fact that the larger of the rewards is delayed (Bickel & Marsch, 2001; Green, Fry, & Myerson, 1994). The indifference point is meant to be the first time the participant chooses the immediate choice over the delayed choice, indicating that the amount of money available immediately is perceived as equal to \$1000 at some point in the future. However, in many cases, participants were not

consistent in responding and switched back and forth between the immediate and delayed reward (this phenomenon is especially likely to occur when the items are presented in random order, as they were in the current study). In the event of inconsistent responding, an average was taken of the first time the immediate choice was chosen and the point where the participant consistently switched over to the immediate choice. This approach was viewed as the most efficient and straightforward use of the variables for the purpose of the current study.

Once the seven indifferent points were calculated for each participant, the next step was to calculate the  $k$  score for each delay period. To calculate the  $k$  score, the hyperbolic function formula was used:  $V = A / (1+kD)$ . For the purposes of the current study  $V$  was the indifferent point,  $A$  was \$1000, and  $D$  was the delay period (as measured in months). Then, an average  $k$  score was calculated for each participant. The final step was to use a log transformation analysis for the average  $k$  score, since  $k$  is non-normally distributed.

## RESULTS

The descriptive data (i.e., mean, standard deviation, minimum, and maximum) for the primary study variables are presented in Table 1 (Appendix A). Of our sample, 70.9% of participants reported drinking on a regular basis and 55.7% of participants reported engaging in binge drinking episodes in the past month. In addition, 12.5% scored over a 20 on the EAT-26 and 40.5% scored over an 8 on the AUDIT, which, as discussed previously, are clinically significant cutoff values.

### *Inter-correlations among Variables*

Inter-correlations among the eating variable are presented in Table 2 (Appendix A). The subscales of the TFEQ were all correlated with the EAT-26 total score and subscale scores. The Oral Control subscale of the EAT-26 was negatively correlated with the Disinhibition ( $r = -.18, p < .001$ ) and Hunger ( $r = -.14, p < .001$ ) subscales of the TFEQ, but positively correlated with the Restraint subscale ( $r = .25, p < .001$ ). The Dieting and Bulimia subscales were positively correlated with all subscales of the TFEQ ( $r$ 's = .23 to .69,  $p < .001$ ). Inter-correlations among the drinking variables are presented in Table 3 (Appendix A). All drinking variables were inter-correlated, with coefficients indicative of moderate (.44) to strong (.79) relationships.

### *Correlations between eating and alcohol variables*

Correlations were computed to test for the first three hypotheses, which predict relationships between eating and alcohol use variables, eating and impulsivity variables, and alcohol use and impulsivity variables. All correlations between the eating and drinking variables

are presented in Table 4 (Appendix A). Frequency of alcohol consumption (Alcohol Days) was correlated with the Dieting subscale of the EAT-26,  $r = .10, p < .05$ , and the Restraint subscale of the TFEQ,  $r = .13, p < .01$ . The DDQ total score was correlated with the Hunger,  $r = .16, p < .01$ , and Disinhibition,  $r = .12, p < .05$ , subscales of the TFEQ. Additionally, the DDQ was correlated with the EAT-26 total score, and the Dieting and Bulimia subscales of the EAT-26,  $r$ 's = .10 to .13,  $p < .05$ . The EAT-26 total score was correlated with the RAPI and AUDIT,  $r = .17, p < .01$  and  $r = .17, p < .01$ , respectively. Similarly, the Bulimia subscale of the EAT-26 was correlated with the RAPI and AUDIT,  $r = .18, p < .001$  and  $r = .15, p < .01$ , respectively. Dieting was positively correlated with the RAPI,  $r = .16, p < .01$ , the AUDIT,  $r = .18, p < .001$ , and frequency of binge drinking episodes in the past month (Binge drinking),  $r = .10, p < .05$ . The Restraint subscale of the TFEQ was correlated with the RAPI,  $r = .10, p < .05$ , and the AUDIT,  $r = .15, p < .01$ . The Disinhibition and Hunger subscales of the TFEQ were correlated with the RAPI, AUDIT, and binge drinking episodes,  $r$ 's = .14 to .19,  $p < .01 - .001$ . The Oral Control subscale of the EAT-26 was negatively correlated with binge drinking,  $r = -.13, p < .01$ .

Correlations between the measures of impulsivity and the eating and alcohol use variables are presented in Table 5 (Appendix A). The delay discounting measure was only correlated with the Dieting subscale of the EAT-26,  $r = .14, p < .05$ . Contrary to the delay discounting finding, the EPI scores were positively correlated with all of the eating and alcohol use variables, except for the Oral Control subscale of the EAT-26 and the Restraint subscale of the TFEQ, with coefficients indicative of weak (.18) to moderate (.33) relationships. The correlations between the EPI and alcohol use measures were overall stronger than the correlations with the eating variables.

### *The impact of dieting*

A series of independent-samples t-tests were conducted to compare scores of various variables (alcohol use, eating variables, and impulsivity) on low and high scores on the Dieting subscale of the EAT-26, using a median split. As with the correlations, these analyses serve to further test the relationship between dieting and other variables (e.g., alcohol use and impulsivity) and are testing for hypothesis 4. These analyses are presented in Table 6 (Appendix A). All t-test analyses yielded significant differences. Regarding the impulsivity measures, there was a significant difference in logk scores for low dieting scores ( $M = -1.69$ ,  $SD = 3.16$ ) and high dieting scores ( $M = -0.72$ ,  $SD = 2.83$ );  $t = 2.40$ ,  $p < .05$ . Similarly, there was a significant difference in EPI scores for low dieting scores ( $M = 5.61$ ,  $SD = 4.16$ ) and high dieting scores ( $M = 6.86$ ,  $SD = 4.62$ );  $t = 2.88$ ,  $p < .01$ .

T-tests comparing the means of the eating variables (3 subscales of the TFEQ: Restraint subscale, Disinhibition subscale, and Hunger subscale) all yielded similar results, suggesting that high scorers on the Dieting subscale of the EAT-26 also score higher on these variables. The Restraint subscale means were significantly different for low dieting ( $M = 5.72$ ,  $SD = 3.77$ ),  $t = 15.12$ ,  $p < .01$ . The Disinhibition subscale means for low dieting was ( $M = 5.71$ ,  $SD = 3.31$ ) and high dieting ( $M = 8.42$ ,  $SD = 3.52$ ),  $t = 8.05$ ,  $p < .01$ . Consistently, the Hunger subscale scores were significantly different for low dieting ( $M = 5.73$ ,  $SD = 3.25$ ) and high dieting ( $M = 7.29$ ,  $SD = 3.33$ ),  $t = 4.83$ ,  $p < .01$ .

Similar results were obtained when comparing the means of alcohol variables (DDQ, RAPI, AUDIT, Alcohol Days, and Binge drinking) on low and high scores on the Dieting subscale of the EAT-26. There was a significant difference in RAPI scores for low dieting ( $M = 2.94$ ,  $SD = 4.56$ ) and high dieting ( $M = 5.46$ ,  $SD = 8.02$ ) conditions;  $t = 4.02$ ,  $p < .01$ . Similarly,



there was a significant difference in frequency of alcohol use (Alcohol Days) for low dieting ( $M = 4.65$ ,  $SD = 5.00$ ) and high dieting conditions ( $M = 6.04$ ,  $SD = 6.06$ ) conditions;  $t = 2.51$ ,  $p < .05$ . See Table 6 (Appendix A) for complete t-test results. These t-tests suggest that dieting does have an impact on alcohol use and impulsivity variables.

#### *Impulsivity as a moderator*

Regression analyses were conducted to test the moderating effects of impulsivity on the relationship between dieting behaviors and alcohol use. These analyses are presented in Table 7 (Appendix A). Given that dieting behaviors are correlated with alcohol use (in the literature and in the current study), the next step involves trying to understand why this relationship exists. The current study, based on literature, posits that impulsivity moderates the relationship between dieting and alcohol use. That is, that impulsivity alters the strength of the relation between alcohol use (predictor) and dieting (outcome), and the relation between dieting (predictor) and alcohol related consequences (outcome). These regression analyses were used to test hypotheses 5 and 6. In the first of these regression analyses, the Dieting subscale score was regressed on DDQ total score and EPI total. These two predictors accounted for approximately four percent of the variance in the Dieting subscale score and produced a significant model,  $F = 8.63$ ,  $p < .001$ . The EPI total score was the only significant predictor in this model. When the interaction term is added to the model in Step 2 of the regression, the model remains significant ( $F = 5.74$ ,  $p < .01$ ), yet the EPI score remains the only significant predictor. Thus, although the EPI score accounts for some variance in the Dieting subscale score, this measure of impulsivity does not moderate, or strengthen, the relationship between dieting behavior and quantity of alcohol consumed (as measured by the Dieting subscale score and the DDQ total score, respectively).

A second and similar multiple regression analysis was conducted to evaluate the prediction of the Dieting subscale score from the DDQ total score and the delay discounting score. This model accounted for less than three percent of the variance in the Dieting subscale score ( $R^2 = .03$ ) and did not produce a significant model,  $F = 2.96, p > .05$ . The addition of the interaction term ( $\log k \times DDQ$  total) in the second model of this regression did not change the significance of the model.

In a third regression analysis to test the moderating effects of impulsivity, the RAPI score was regressed on Dieting subscale score and EPI total. These analyses are presented in Table 8 (Appendix A). These 2 predictors accounted for ten percent of the variance in the RAPI scores and produced a significant model,  $F = 22.98, p < .001$ . Both predictors were significant in predicting the RAPI scores in this model. When the interaction term is added, the model remained significant,  $F = 16.06, p < .001$ . However, when the interaction was added, the EPI score became the only significant predictor of the RAPI score.

In the fourth regression analysis, the RAPI was regressed on Dieting subscale and the  $\log k$  score (delay discounting). These predictors accounted for approximately four percent of the variance in the RAPI scores and produced a significant model,  $F = 4.67, p = .01$ . The dieting subscale was the only significant predictor in this model. When the interaction term (Dieting subscale  $\times \log k$ ) was added, the model remained significant and accounted for nine percent of the variance in RAPI scores,  $F = 7.10, p < .001$ . The Dieting subscale score and the interaction term were both significant predictors in this model. The significant interaction term suggests that in this model, impulsivity [as measured by  $\log k$ ] is moderating the relationship between dieting behavior and alcohol related problems. Please refer to Figure 1 (Appendix A) for a depiction of this interaction.

### *Effects of eating behaviors and alcohol related problems on measures of impulsivity*

Given the above moderation analyses, this next set of analyses is taking a different perspective. The researcher chose a series of ANOVAs over multiple regression analyses because the interaction terms were not significant and the ANOVAs seemed to present the results more clearly. This series of univariate 2x2 ANOVAs was conducted to test for differences in impulsivity scores (for both the EPI and *logk* scores). The ANOVAs are testing for hypothesis 7, and are the first analyses to look at impulsivity scores for people who score high on both eating and alcohol use variables. The analyses for EPI means are presented in Table 9; refer to Table 10 for the *logk* means (Appendix A). In the first set of ANOVAs, the EAT-26 total score and the AUDIT were the independent variables; these variables were selected because of their clinically significant cutoff values ( $EAT-26 \geq 20$ ,  $AUDIT \geq 8$ ). Mean scores on the dependent variable, the EPI, differed significantly across groups. There were significant main effects for AUDIT split and EAT-26 split,  $F = 21.96$ ,  $p < .001$  and  $F = 3.85$ ,  $p = .05$ , respectively. There was no significant AUDIT x EAT interaction. The ANOVA for *logk* did not produce significant differences.

A second set of univariate ANOVAs were conducted also testing for differences in impulsivity scores (EPI and *logk* scores). In these 2x2 ANOVAs, the dependent variables were RAPI and the Dieting subscale of the EAT-26, using quartile splits for these measures. These variables are selected to represent dieting behaviors and alcohol related problems because research consistently suggests a significant difference in alcohol related problems among dieters, even when consumption is similar to that of non-dieters. When the dependent variable was the EPI, means were statistically significant. However, review of the results reveals that only the

main effect for the RAPI was significant,  $F = 24.20, p < .001$ . As with the previous set of analyses, no differences were noted in the  $\log k$  scores.

### *Summary*

The primary goals of the study were to assess the relations between dieting behaviors and alcohol use, dieting behaviors and impulsivity, and alcohol use and impulsivity. Additional hypotheses included dieters would score higher on various alcohol use and impulsivity measures, impulsivity would moderate the relations between dieting and alcohol consumption and dieting and alcohol related problems, and that dieting and alcohol use would have an additive effect on scores on measures of impulsivity. Of these seven hypotheses, five primary findings emerged. However, there were differences in the findings of impulsivity when comparing the two measures used. Dieting behaviors were correlated with multiple alcohol variables and impulsivity variables. All alcohol use variables were correlated with the EPI, but not with the delay discounting task. Dieters did score higher on the measures of alcohol use and impulsivity than non-dieters, and impulsivity (as measured by the delay discounting task) moderated the relation between dieting and alcohol related problems.

## DISCUSSION

### *Alcohol use and eating behaviors*

Many of the hypothesized relations between alcohol use and eating behaviors were observed. Similar to the results of Anderson et al. (2005), Dunn et al. (2002), and Ross and Ivis (1999), the current study found that eating behaviors (behaviors associated with both bulimia and dieting) are correlated with alcohol related problems. In further similarity with Anderson et al. and Ross and Ivis, the results of the current study also suggest a correlation between eating behaviors and quantity of alcohol consumed. However, the results differ when comparing symptoms of bulimia and dieting. Regarding quantity of alcohol consumed, the Bulimia subscale of the EAT-26 was correlated with average drinks consumed in a week. The Dieting subscale was correlated with average drinks consumed in one week, episodes of binge drinking, and frequency of alcohol use. The Disinhibition and Hunger subscales of the TFEQ were correlated with average drinks consumed in a week and binge drinking episodes, but not with frequency of alcohol use.

Review of the aforementioned correlations suggests that the inconsistency found in the research regarding the correlation between alcohol consumption and problematic eating behaviors is a product of measurement. The current study suggests that average number of drinks consumed in a week is the measure of alcohol consumption that is most consistently correlated with eating behaviors, while binge drinking episodes and frequency of alcohol use are less consistent measures of alcohol consumption.

As noted, the Bulimia subscale of the EAT-26 was correlated with number of drinks consumed in a typical week and alcohol related problems. These findings are consistent with literature (Anderson et al., 2005; Dunn et al., 2002; Krahn et al., 2005; Lilenfeld & Kaye, 1996; Ross & Ivis, 1999) and the pattern of comorbidity served as the impetus for the current project (i.e., if this comorbidity is seen at the diagnostic level of problematic eating behaviors, perhaps the correlation exists at a subclinical level). This researcher, along with other researchers, has shown that these relations exist at subclinical levels, with dieting behavior serving as an example of non-diagnostic but clinically relevant example. Additional analyses revealed that scores on the alcohol use variables were significantly different among individuals who scored high on dieting versus low on dieting. Specifically, participants who scored high on the Dieting subscale of the EAT-26, also scored high on the DDQ (average number of drinks per week), RAPI (a measure of alcohol related consequences), AUDIT (brief measure that assesses both quantity and consequences of alcohol use), frequency of alcohol use, and episodes of binge drinking.

### *Impulsivity*

The definitions of impulsivity are plentiful, as are the means of measurement. In addition to the self-report measures that include characteristics of impulsivity, there are also tasks that assess impulsive decision making. The current study used the Impulsivity subscale of the Eysnck Personality Inventory and a delay discounting measure to assess impulsivity. These measures of impulsivity were not correlated with one another in the current study. The impulsivity hypotheses for the current study were only partially supported.

*Impulsivity and alcohol use.* The results indicate that EPI scores were correlated with many of the alcohol use variables, while the delay discounting scores were not. EPI scores were positively correlated with the DDQ (a measure of quantity of alcohol consumed), RAPI and

AUDIT (both measures of alcohol related problems), and binge drinking and alcohol days (measures of frequency of alcohol use). Delay discounting scores were not correlated with any of the alcohol use variables, which is surprising given the consistency of this finding within the literature.

As described in the introduction, several studies have used a delay discounting task in substance use research (Tucker et al., 1994; Tucker et al., 1995; Vuchinich & Simpson, 1998). All of these studies found significant differences in scores on delay discounting when comparing participants with varying levels of substance use. One major difference between these studies and the current study is the sample. The samples for Tucker et al. (1994) and Tucker et al. (1995) were clinical samples defined as “problem drinkers.” Though the samples in the two studies discussed in the Vuchinich and Simpson paper were college students, they were prescreened and selected based on their level of alcohol use and related problems. At least one recent study had similar findings to the current study. Fernie, Cole, Goudie, and Field (2010) conducted a study with the aim of finding which component of impulsivity or risk-taking best accounted for alcohol use and alcohol related problems among social drinkers. In using a self-report questionnaire and several tasks that assess impulsivity and risk-taking, they found that a behavioral measure of risk-taking, specifically the Balloon Analog Response Task, was the best predictor of variance in alcohol consumption and related problems, while the delay discounting task was not useful in explaining these alcohol variables (Fernie et al.). Thus, the results of the current study could be explained by the multi-faceted construct of impulsivity. Though delay discounting is a widely used measure, there are distinct differences in the findings of research studies when various measures of impulsivity and/or risk-taking are used (Fernie et al.).

*Impulsivity and eating behaviors.* Similar to the correlations with alcohol use, the current study found that eating behaviors were more likely to be correlated to EPI scores than to delay discounting scores. Results of the current study indicate that EPI scores were positively correlated with the EAT-26 total score, Dieting subscale of EAT-26, Bulimia subscale of EAT-26, and Disinhibition and Hunger subscales of the TFEQ. EPI scores were not correlated with either eating subscales that assess eating restraint (i.e. symptoms of anorexia nervosa, restricting subtype; Oral Control subscale of the EAT-26 and Restraint subscale of the TFEQ). This finding is consistent with the literature, as eating restraint is typically seen as a form of self-control (Cassin & Ranson, 2005; Conason et al., 2006; Loxton & Dawe, 2001; Taylor et al., 1993). The Dieting subscale of the EAT-26 was the only variable correlated with delay discounting scores. Although this relationship was hypothesized, this finding is surprising given that no other eating variables were correlated with this measure of impulsivity.

Results of the current study found significant differences in scores on both measures of impulsivity for participants who scored high versus low on the Dieting subscale of the EAT-26; those with higher levels of dieting also showed higher levels of impulsivity. This finding suggests that at the extreme ends of dieting endorsement, there are differences in level of impulsivity, as measured by both the self-report questionnaire and the task that assesses impulsive decision making. As described previously, there is research that supports the relation between dieting and impulsivity as measured by a self-report questionnaire (Benjamin & Wulfert, 2005; Heidelberg, unpublished thesis; Le Grange et al., 2006). Also, as stated earlier, there are no published studies that use a task to assess impulsive decision making in the eating behaviors literature. The research on dieting behaviors and impulsivity is also limited. However, these results are similar to the findings of Rush et al. (2009) which finds that



individuals who engage in binge eating are more impulsive based on scores on a self-report measure. Another study found a relation between the Dieting subscale of the EAT-26 and impulsivity, as measured by the EPI (Heidelberg, unpublished thesis).

*Impulsivity, alcohol use, and eating behaviors.* Many studies on the role of impulsivity on the relation between eating behaviors and alcohol use seem to suggest that impulsivity is an underlying mechanism, or cause, of this relationship. However, given that the relation between eating and alcohol use exists outside of impulsivity literature, it is likely more accurate to view impulsivity as a moderating variable. In other words, impulsivity may strengthen the existing relation between eating problems and alcohol use behaviors, as opposed to working as the pathway through which the relationship exists. Though theoretically this moderating hypothesis makes sense, the results of the current study do not support this hypothesis.

The regression analyses that were conducted suggest that impulsivity is not consistently moderating the relation between dieting and alcohol use as expected. When predicting Dieting subscale scores, neither measure of impulsivity moderated the relation between dieting and alcohol use. When predicting alcohol related problems, EPI scores did not moderate the relation between Dieting and alcohol related consequences. However, delay discounting did moderate this relation between Dieting and RAPI scores. It is surprising that the  $\log k$  is the measure of impulsivity that is moderating this relationship, given that lack of correlation between this and other variables. Nonetheless, this finding suggests that impulsivity may exacerbate the positive correlation between dieting and alcohol-related problems with alcohol related problems increasing along with dieting behaviors and impulsive decision making (Frazier, Tix, & Barron, 2004).

Another goal of the current study was to assess level of impulsivity in individuals who scored high on both eating and alcohol use measures. The hypothesis was that individuals who scored high on a measure of disordered eating and alcohol use would have higher scores on measures of impulsivity than individuals who only scored high on one or neither. The results did not support this hypothesis. Though there were significant main effects, suggesting that a high score on one of the variables contributed to high scores on impulsivity (as measured by the EPI), there was no differences in impulsivity scores for people who scored high on both eating and alcohol use. Specifically, the EAT-26 total score and the AUDIT score provided significant main effects for EPI scores, but were not significant for delay discounting scores. Similarly, alcohol related problems (as measured by the RAPI) were the only significant predictor for EPI scores when using the RAPI and Dieting subscale of the EAT-26 to predict EPI scores. The same analysis did not produce a significant predictor of delay discounting scores.

These findings confirm the relations between alcohol use and impulsivity and problematic eating and impulsivity, but do not suggest an additive component to this relation. At least one study had similar findings. Benjamin and Wulfert (2005) conducted a study testing for multiple possible explanations for the comorbidity of problematic eating behaviors and alcohol use. Their findings suggested that individuals who scored high on one measure (i.e., alcohol abuse or binge eating), but not both, scored more highly on measures of impulsivity. However, individuals who endorsed both behaviors did not score even higher on impulsivity, as measured by a self-report questionnaire. The current study tried to extend their analyses by including the delay discounting task to assess impulsive decision making. Thus, both the Benjamin and Wulfert study and the current study confirm the relations between alcohol use and impulsivity

and eating behaviors and impulsivity, but neither support the additive effect for alcohol use and eating behaviors across various measures of impulsivity.

*Self-report versus task that assesses impulsive decision making.* Although different in many ways, the different types of assessment tools used in the current study are both used to measure impulsivity. However, as with the current study, research has shown that these different forms of measurement often lead to differing results (Fernie et al., 2010). Interpretations of such results vary widely; conclusions range from identifying subtypes of impulsivity; describing impulsivity as a multifaceted construct; contrasting impulsivity with sensation seeking and risk-taking; and preferring certain assessment tools as the optimal way to measure impulsivity.

While delay discounting measures had not been previously used in eating behavior literature, and this seemed like a natural progression to this line of research, these results suggest that more traditional assessment measures of impulsivity may be better suited for this area. These results also lead to some questions regarding the assessment of personality constructs. Perhaps impulsivity is a multifaceted construct, but it still seems that different forms of measures assessing the same construct should yield similar results. The results of the current study, together with the literature that suggests inconsistent findings when using different measures of impulsivity, make one wonder if all these measures are indeed tapping into the same construct. Perhaps more consistent operational definitions of impulsivity would lead to assessment tools that would yield similar results. No matter the explanation, the current study leads to more questions about the construct of the impulsivity and the role of impulsivity in explaining the comorbidity of problematic eating behaviors and alcohol use variables.

*Competing theories.* The current study posits that impulsivity plays a role in the relation between alcohol use and eating behaviors. As the aforementioned results suggest, the current

study found inconsistent results to support the role of impulsivity. Though the relation between alcohol use and eating behaviors has been consistently established in literature (Anderson et al., 2005; Dunn et al., 2002; Heidelberg & Correia, 2009; Krahn et al., 2005; Lilenfeld & Kaye, 1996; Ross & Ivis, 1999), there are competing theories as to explain this relationship. Given the inconsistencies in the results of the current study, perhaps another theory better explains this comorbidity. One such theory is the Restraint Theory, which posits that dieting leads to overeating (Herman & Polivy, 1980). This theory suggests that individuals who normally control food intake, often overeat when faced with a disinhibitor, or trigger. The triggers in this theory include depressed mood and alcohol consumption (Herman & Polivy). Although this theory includes alcohol consumption as a trigger, some researchers have suggested that this overeating, which is essentially an increase in caloric intake, could also include increased alcohol consumption, not as a trigger, but as the product of the overconsumption (Krahn et al., 2005; Bradstock et al., 1988). Although more recent research has not found support for this Restraint Theory (Ouwens, van Strien, & van der Staak, 2003), the promising initial results suggest that additional research is warranted.

Emotional instability is another theory for explaining the comorbidity between alcohol use and problematic eating behaviors (Benjamin & Wulfert, 2005). This theory posits that individuals who are emotionally unstable use unhealthy eating and alcohol use behaviors as an escape and avoidance of negative internal states. In their research for an explanation of the comorbidity between eating behaviors and alcohol use, Benjamin and Wulfert examined several possible correlates, including impulsivity, self-esteem, and emotional instability, among several others. As previously described, the results of their study suggested that individuals who abuse alcohol or binge eat, but not both, scored more highly on measures of impulsivity. However,

individuals who endorsed both behaviors did not score high on impulsivity; these comorbid behaviors seemed better accounted for by emotional instability (Benjamin & Wulfert).

*Delay discounting.* The results of the current study regarding the relationship between the delay discounting task and alcohol use were not consistent with previous literature. Although the task used in the current study has been used previously (e.g., Madden, Bickel, & Jacobs, 1999; Madden, Petry, Badger, & Bickel, 1997), the current study is the first to use the measure presented as a questionnaire, administered online, and among a non treatment-seeking sample of college students. These differences in methodology could account for the differences observed in the results. For example, the current study saw a greater percentage of data lost due to non-interpretable delay discounting data. This could be the result of participants not understanding the instructions of the measure (and as the administration was online, not being able to ask for clarification), or, due to the length of the study, some participants may not have paid attention to item content.

Admittedly, the methodology of the current study is different than previous delay discounting research. However, when reviewing delay discounting studies, it is evident that there is no clear standard on methodology. For example, items are presented in ascending, descending, or random order; sometimes items are repeated; monetary amounts and delay periods vary from study to study; monetary rewards can be real or hypothetical; items can be presented one at a time or all at once; and items can be administered with index cards, paper, or on a computer. Modifications have also been made in which delay discounting questions have been adapted to compare substances and other nonmonetary rewards. Given these differences, the methodology and modifications of the current study does not seem to vary from this research any more than other published research. Additionally, with the growing popularity of online data

collection, several studies have been conducted that show online data collection yields similar results to that of lab studies (Dandurand, Shultz, & Onishi, 2008; Michalak & Szabo, 1998; Riva, Teruzzi, & Anolli, 2003).

Dandurand et al. (2008) replicated a problem-solving experiment that had previously been conducted in a laboratory, in an online sample. Based on similar findings, they concluded that online data collection is similar to laboratory based studies. Of note, they identified a high dropout rate as a disadvantage to online data collection. In a set of published guidelines for internet research, Michalak and Szabo (1998) indicated that if rigorous guidelines are followed (as they are in more traditional, laboratory, settings), results should be consistent. Riva et al. (2003) conducted the same study online and paper-based methodology with the aim of comparing the results of the questionnaires between the two groups. Given the similarities of the results between the two groups in their study, Michalak and Szabo concluded that “Web-based data collection neither statistically enhance nor diminish the consistency of responses, nor compromise the integrity of the test, and are a suitable alternative to more traditional methods,” (p. 78). Taken together, these studies suggest that the online data collection used in the current study should not have drastically altered the results obtained.

Additionally, the current study used the log transformed free parameter  $k$  variable in analyses. The hyperbolic function formula (described previously) has been shown to be a better indicator of the data than exponential or linear functions (Bickel & Marsch, 2001). However, given that  $k$  is not normally distributed, the current study chose to use a log transformed  $k$  score in analyses. In much of the research reviewed for this study, the free parameter  $k$  is the variable used for the discounting task. However, other research has used other variables, including response time, which is the average time it takes an individual to make a choice. Though there

are several scores that can be computed in use of a delay discounting task, the current study was interested in using this task to compute a score that could be used similar to the score on a self-report measure of impulsivity. Additionally, in the substance use research, the  $k$  score is the most widely used variable of delay discounting task. Thus, this is the variable that was used in the current study.

### *Limitations*

As with all research studies, the current project had its limitations. First, the current study used a non-treatment-seeking sample of college students. Although this sample is ideal when studying problematic alcohol use and eating behaviors, given the prevalence of these behaviors among college students, it does limit the generalizability of the results. Also, this sample is a limitation when using the delay discounting task. The studies on alcohol using delay discounting typically use a clinical sample. In the few studies that use a college student sample, the participants are prescreened and selected based on their endorsed alcohol consumption (Tucker et al., 1994; Tucker et al., 1995; Vuchinich & Simpson, 1998). Second, the use of online data collection methods could be viewed as a limitation of the study. Of note, and as stated previously, research has shown that online studies yield results that are similar to lab studies (Dandurand et al., 2008; Michalak & Szabo, 1998; Riva et al., 2003).

Third, the presentation of the delay discounting task was previously discussed. It is possible that how the task was presented impacted the results obtained. The researcher chose to present the delay discounting task with the items in random order, but on one page for two reasons. First, the researcher wanted to collect data online, to increase participation and as to not require participants to come into the lab. Second, given the length of the delay discounting measure used, presenting each item on a separate page would have greatly increased the time to

complete the study because each question would require a new page to load. This could have also led to an increase in data loss if internet connection was interrupted during the study.

Though it may have been best to require participants to come into the lab and complete a more traditional presentation of the delay discounting task, this change would have been met with its own set of limitations.

### *Clinical implications*

The findings of the current study can inform clinical practice. This study provides further evidence of the relationship between elevated alcohol consumption and certain problematic eating behaviors (i.e., dieting and symptoms of bulimia). This confirmed relationship serves as a reminder to assess for alcohol use when a person presents with symptoms of problematic eating, and vice versa. Additionally, there are many programs and services aimed at preventing alcohol use problems and disordered eating behaviors (e.g., National Alcohol Screening Day, National Eating Disorder Screening Program, etc.). However, most of these programs focus on only one of these problems. Clinicians, organizers, and others involved in such events need to be aware of the overlap and educated on how to assess these commonly co-occurring behaviors.

When considering comorbidity in general, there are a few more recent treatment programs that have been developed. For example, Seeking Safety is a treatment program developed specifically for comorbid Posttraumatic Stress Disorder (PTSD) and substance use (Najavits, 2002). Although a novel, and clinically relevant approach, this treatment (as with many treatments identified for dual diagnoses) views substance use as the result of the PTSD. Thus, this approach would be difficult to modify for the comorbidity between problematic eating behaviors and alcohol use, as in this comorbidity, alcohol use is not viewed as the result of engaging in dieting behaviors. Nonetheless, programs that address comorbidity, such as Seeking



Safety, could inform the development of programs to address comorbidities between alcohol use and dieting, specifically regarding integrating treatments for both issues.

Given that both problematic eating behaviors and alcohol use behaviors are most likely to occur during high school and college years, psychoeducation on the potential risk factors for these behaviors could be a preventative measure. Although there are no known programs or treatments to address the comorbidity of the current study, there are some programs/treatments that rely heavily on psychoeducation. One such program is the Brief Alcohol Screening and Intervention for College Students (BASICS; Dimeff, Baer, Kivlahan, & Marlatt, 1998). As the title suggests, this program is aimed at college students who use alcohol. It uses motivational interviewing, psychoeducation, and personalized feedback to promote change behaviors in a student's alcohol consumption. No such program exists for problematic eating behaviors, but it is likely that a similar approach using motivational interviewing, psychoeducation, and personalized feedback would prove beneficial for changing potentially harmful eating behaviors or comorbid alcohol use and eating behaviors. Research seems to suggest that alcohol use and problematic eating behaviors commonly co-occur. A logical future direction in this area would be the development of treatment protocols to effectively integrate the treatment of these disorders.

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## APPENDICES

APPENDIX A: TABLES

Table 1  
*Summary of Descriptive Data for Sample*

	N	Minimum	Maximum	Mean	SD
Eating variables					
EAT-26 Total	416	0	69	11.20	10.96
Dieting	416	0	39	7.90	7.83
Bulimia	416	0	14	1.50	2.74
Oral	416	0	18	1.57	2.11
TFEQ					
Restraint	416	0	21	9.05	5.20
Disinhibition	416	0	16	7.17	3.68
Hunger	416	0	14	6.57	3.38
Drinking variables					
DDQ Total	416	0	56	8.01	9.77
RAPI Total	416	0	47	4.30	6.77
AUDIT Total	416	0	32	6.56	5.79
Binge drinking	414	0	25	2.75	3.95
Alcohol days	414	0	40	5.40	5.63
EPI Total	416	0	19	6.29	4.45
Delay Discounting (log <i>k</i> )	220	-12.24	6.94	-1.18	3.03

*Note. Total n=416*

*EAT-26 Total: Eating Attitudes Test-26*

*Dieting: Dieting Subscale of the EAT-26*

*Bulimia: Bulimia Subscale of the EAT-26*

*Oral: Oral Control Subscale of the EAT-26*

*TFEQ: Three-Factor Eating Questionnaire*

*Restraint: Restraint Subscale of the TFEQ*

*Disinhibition: Disinhibition Subscale of the TFEQ*

*Hunger: Hunger Subscale of the TFEQ*

*DDQ Total: Daily Drinking Questionnaire, number of drinks per week*

*RAPI Total: Rutgers' Alcohol Problem Index*

*AUDIT Total: Alcohol Use Disorder Identification Test*

*Binge drinking: number of days in the past month participant binge drank*

*Alcohol Days: number of days in past month participant used alcohol*

*EPI Total: Eyesnck Personality Inventory, Impulsivity scale*

Table 2  
*Inter-correlations among eating variables*

	EAT-26 Total	Dieting	Bulimia	Oral
TFEQ				
Restraint	.64***	.69***	.38***	.25***
Disinhibition	.33***	.36***	.45***	-.18***
Hunger	.23***	.24***	.33***	-.14**

*Note. Total n=416*

*EAT-26 Total: Eating Attitudes Test-26*

*Dieting: Dieting Subscale of the EAT-26*

*Bulimia: Bulimia Subscale of the EAT-26*

*Oral: Oral Control Subscale of the EAT-26*

*TFEQ: Three-Factor Eating Questionnaire*

*Restraint: Restraint Subscale of the TFEQ*

*Disinhibition: Disinhibition Subscale of the TFEQ*

*Hunger: Hunger Subscale of the TFEQ*

\*\*  $p < .01$  \*\*\* $p < .001$

Table 3  
*Inter-correlations among alcohol variables*

	DDQ	RAPI	AUDIT	Binge drinking	Alcohol Days
DDQ	-				
RAPI	.52***	-			
AUDIT	.73***	.69***	-		
Binge drinking	.79***	.57***	.76***	-	
Alcohol Days	.71***	.44***	.65***	.69***	-

*Note. Total n=416*

*DDQ: Daily Drinking Questionnaire, number of drinks per week*

*RAPI: Rutgers Alcohol Problem Index*

*AUDIT: Alcohol Use Disorder Identification Test*

*Binge drinking: number of days in the past month participant binge drank*

*Alcohol Days: number of days in past month participant used alcohol*

*\*\*\*p < .001*

Table 4  
*Correlations between eating and alcohol variables*

	DDQ	RAPI	AUDIT	Binge drinking	Alcohol Days
EAT-26	.10*	.17**	.17**	.07	.08
Dieting	.13*	.16**	.18***	.10*	.10*
Bulimia	.11*	.18***	.15**	.07	.07
Oral	-.08	.05	-.05	-.13**	-.09
TFEQ					
Restraint	.08	.10*	.15**	.09	.13**
Disinhibition	.12*	.14**	.17**	.17***	.05
Hunger	.16**	.19***	.18***	.17**	.09

*Note. Total n=416*

*DDQ: Daily Drinking Questionnaire, number of drinks per week*

*RAPI: Rutgers' Alcohol Problem Index*

*AUDIT: Alcohol Use Disorder Identification Test*

*Binge drinking: number of days in the past month participant binge drank*

*Alcohol Days: number of days in past month participant used alcohol*

*EAT-26 Total: Eating Attitudes Test-26*

*Dieting: Dieting Subscale of the EAT-26*

*Bulimia: Bulimia Subscale of the EAT-26*

*Oral: Oral Control Subscale of the EAT-26*

*TFEQ: Three-Factor Eating Questionnaire*

*Restraint: Restraint Subscale of the TFEQ*

*Disinhibition: Disinhibition Subscale of the TFEQ*

*Hunger: Hunger Subscale of the TFEQ*

\* $p < .05$  \*\*  $p < .01$  \*\*\* $p < .001$

Table 5  
*Correlations between impulsivity and other variables*

	EPI	Delay Discounting
EAT-26	.19***	.13
Dieting	.18***	.14*
Bulimia	.18***	.06
Oral	.02	.07
TFEQ		
Restraint	.09	.12
Disinhibition	.21***	.04
Hunger	.23***	.00
DDQ	.27***	.02
RAPI	.30***	.11
AUDIT	.33***	.04
Binge drinking	.28***	.00
Alcohol Days	.20***	-.01

*Note. Total n=416 for EPI analyses, n=221 for Delay Discounting analyses*

*EPI: Impulsivity subscale of the Eysenck Personality Inventory*

*Delay Discounting: k scores of the delay discounting measure*

*EAT-26 Total: Eating Attitudes Test-26*

*Dieting: Dieting Subscale of the EAT-26*

*Bulimia: Bulimia Subscale of the EAT-26*

*Oral: Oral Control Subscale of the EAT-26*

*TFEQ: Three-Factor Eating Questionnaire*

*Restraint: Restraint Subscale of the TFEQ*

*Disinhibition: Disinhibition Subscale of the TFEQ*

*Hunger: Hunger Subscale of the TFEQ*

*DDQ: Daily Drinking Questionnaire, number of drinks per week*

*RAPI: Rutgers Alcohol Problem Index*

*AUDIT: Alcohol Use Disorder Identification Test*

*Binge drinking: number of days in the past month participant binge drank*

*Alcohol Days: number of days in past month participant used alcohol*

*\*p < .05   \*\* p < .01   \*\*\*p < .001*

Table 6  
 Summary of T-Test Analyses for Low and High Scores on the Dieting Subscale of the EAT-26

Variable		N	Mean	SD	t
Impulsivity					
EPI	Dieting < 5	191	5.61	4.16	2.88**
	Dieting ≥ 5	225	6.86	4.62	
logk	Dieting < 5	104	-1.69	3.16	2.40*
	Dieting ≥ 5	116	-0.72	2.83	
Eating variables					
Restraint <sup>+</sup>	Dieting < 5	191	5.72	3.77	15.12***
	Dieting ≥ 5	225	11.87	4.52	
Disinhibition	Dieting < 5	191	5.71	3.31	8.05***
	Dieting ≥ 5	225	8.42	3.52	
Hunger	Dieting < 5	191	5.73	3.25	4.83***
	Dieting ≥ 5	225	7.29	3.33	
Alcohol variables					
DDQ	Dieting < 5	191	6.86	0.09	2.22*
	Dieting ≥ 5	225	8.99	10.23	
RAPI <sup>+</sup>	Dieting < 5	191	2.94	4.56	4.02***
	Dieting ≥ 5	225	5.46	8.02	
AUDIT <sup>+</sup>	Dieting < 5	191	5.65	5.17	3.04**
	Dieting ≥ 5	225	7.34	6.17	
Binge drinking <sup>+</sup>	Dieting < 5	190	2.25	3.43	2.42*
	Dieting ≥ 5	224	3.17	4.31	
Alcohol Days	Dieting < 5	190	4.65	5.00	2.51*
	Dieting ≥ 5	224	6.04	6.06	

\* $p < .05$  \*\*  $p < .01$  \*\*\* $p < .001$

<sup>+</sup> Equal variances not assumed due to significance of Lavene's Test for Equality of Variances



Table 7  
*Summary of Regression Analyses for Dieting Subscale*

Variable	$\beta$	SE $\beta$	B	<i>T</i>	<i>R</i> <sup>2</sup>
Step 1					.04***
DDQ	.06	.04	.08	1.62	
EPI Total	.29	.09	.16	3.25**	
Step 2					.04**
DDQ	.07	.08	.08	.78	
EPI Total	.29	.12	.16	2.43*	
DDQ x EPI	-9.00E-5	.01	-.00	-.01	
Step 1					.03
DDQ	.06	.05	.08	1.27	
Log <i>k</i> Score	.33	.16	.14	2.05*	
Step 2					.03
DDQ	.07	.05	.10	1.44	
Log <i>k</i> Score	.23	.19	.10	1.21	
DDQ x log <i>k</i>	.02	.02	.07	.88	

*Note.* Total *n*=416 for EPI analyses, *n* = 221 for Log*k* analyses  
 DDQ Total: Daily Drinking Questionnaire, number of drinks per week  
 EPI Total: Impulsivity subscale of the Eysenck Personality Inventory  
 Log*k* Score: log transformed *k*-score from delay discounting measure  
 \* *p* < .05  
 \*\* *p* < .01  
 \*\*\* *p* < .001

Table 8  
*Summary of Regression Analyses for RAPI scores*

Variable	$\beta$	SE $\beta$	B	<i>T</i>	<i>R</i> <sup>2</sup>
Step 1					.10***
Diet subscale	.09	.04	.11	2.25*	
EPI Total	.42	.07	.28	5.87***	
Step 2					.11***
Diet Subscale	.00	.08	.00	-.01	
EPI Total	.32	.10	.21	3.03**	
Diet x EPI	.01	.01	.16	1.45	
Step 1					.04**
Diet subscale	.15	.06	.18	2.60**	
Logk Score	.17	.14	.08	1.22	
Step 2					.09***
Diet subscale	.20	.06	.23	3.42***	
Logk Score	-.26	.18	-.13	-1.42	
Diet x logk	.06	.02	.30	3.39***	

*Note. Total n=416 for EPI analyses, n=221 for Logk analyses*

*Diet subscale: Dieting subscale of the EAT-26*

*EPI Total: Impulsivity subscale of the Eysenck Personality Inventory*

*Logk Score: log transformed k-score from delay discounting measure*

\*  $p < .05$

\*\*  $p < .01$

\*\*\*  $p < .001$

Table 9  
*Summary of Univariate ANOVAs EPI scores*

		EPI Mean	SD	N
AUDIT < 8 <sup>a</sup>	EAT < 20	5.29	4.05	219
	EAT ≥ 20	5.83	4.29	35
AUDIT ≥ 8	EAT < 20	7.35	4.38	124
	EAT ≥ 20 <sup>b</sup>	9.00	5.30	38
RAPI < 0	DIET < 2	5.24	3.51	46
	DIET > 11	5.32	4.06	41
RAPI > 6 <sup>c</sup>	DIET < 2	8.19	4.52	21
	DIET > 11	9.54	4.92	39

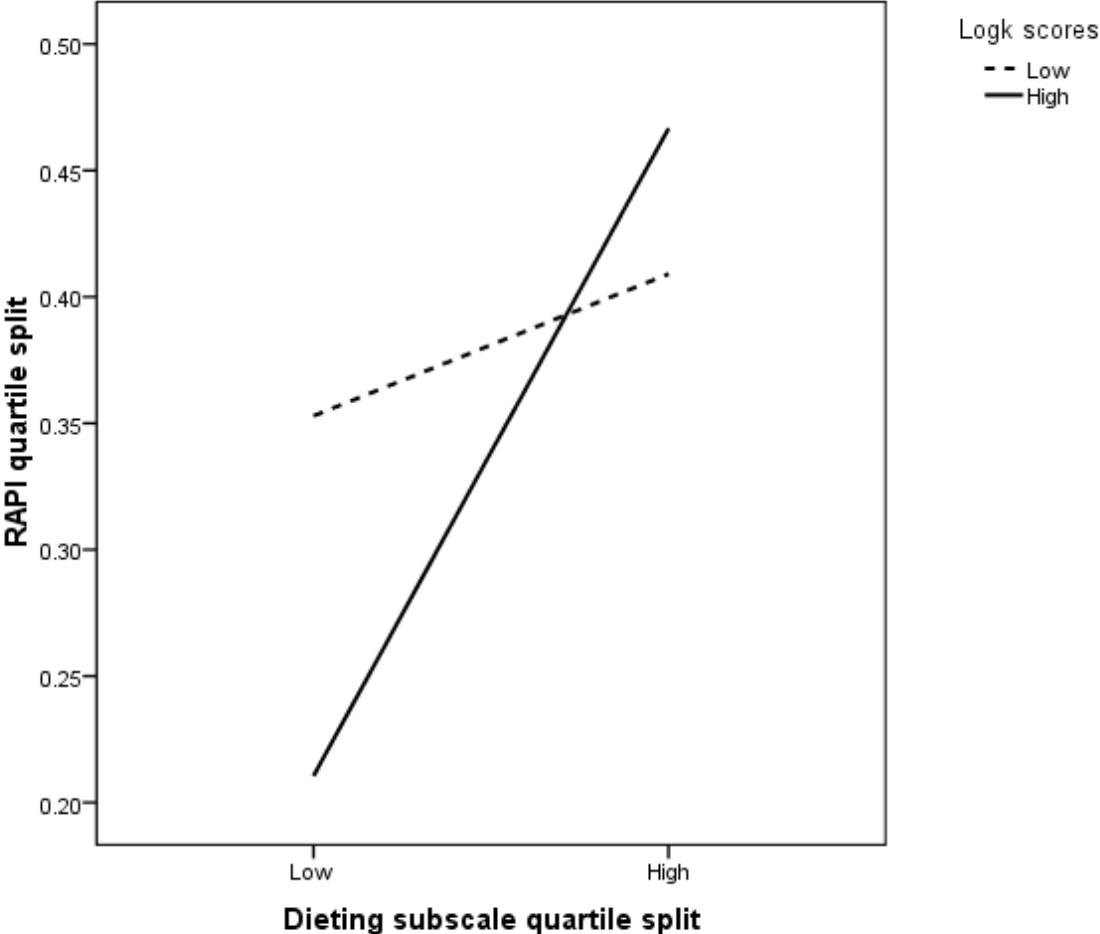
- a. Individuals who scored above the clinical cutoff on the AUDIT scored significantly higher on the EPI than individuals who scored below the clinical cutoff on the AUDIT.
- b. Individuals who scored above the clinical cutoff on the EAT-26 scored significantly higher on the EPI than individuals who scored below the clinical cutoff on the EAT-26.
- c. Individuals who scored in the upper quartile on the RAPI scored significantly higher on the EPI than individuals who scored in the lower quartile.

Table 10  
*Summary of Univariate ANOVAs for logk scores*

		Logk Mean	SD	N
AUDIT < 8	EAT < 20	-1.09	3.39	119
	EAT > 20	-1.49	2.51	17
AUDIT > 8	EAT < 20	-1.37	2.46	73
	EAT > 20	-0.47	3.22	11
RAPI < 0	DIET < 2	-1.08	4.11	26
	DIET > 11	-0.62	3.51	21
RAPI > 6	DIET < 2	-1.66	2.18	10
	DIET > 11	-0.69	3.39	16

There were no significant main effects or interaction effects for logk scores based on these analyses.

Figure 1. Impulsivity (as measured by delay discounting) moderates the relation between dieting and alcohol related problems.



APPENDIX B: MEASURES

Date: \_\_\_\_\_

Subject ID#: \_\_\_\_\_

**General Information Questionnaire**

1. Please indicate your gender: \_\_\_\_\_ Male (1) \_\_\_\_\_ Female (2)
2. How old are you? \_\_\_\_\_ years.
3. How many years of school have you completed (e.g., graduated from high school = 12 years)?  
\_\_\_\_\_ years.
4. Are you a member of a fraternity or sorority? \_\_\_\_\_ Yes (1) \_\_\_\_\_ No (2)
5. Please check one of the following Ethnic categories:  
\_\_\_\_\_ Hispanic or Latino (1)  
\_\_\_\_\_ Not Hispanic or Latino (2)
6. Please check as many of the following Racial categories that apply to you:  
\_\_\_\_\_ American Indian or Alaska Native  
\_\_\_\_\_ Asian  
\_\_\_\_\_ Black or African American  
\_\_\_\_\_ Native Hawaiian or Other Pacific Islander  
\_\_\_\_\_ White
7. Where do you currently reside?  
\_\_\_ Off campus house or apartment (1)      \_\_\_ home with parents/guardians (2)  
\_\_\_ Fraternity House (3)                      \_\_\_ Campus dormitory (4)  
\_\_\_ Sorority House (5)                        \_\_\_ Other : \_\_\_\_\_ (6)

EAT-26

Height \_\_\_\_\_  
 Current Weight \_\_\_\_\_  
 Highest Weight (excluding pregnancy) \_\_\_\_\_  
 Lowest Adult Weight \_\_\_\_\_

**Please fill in the circle to indicate the most accurate response for each of the following statements:**

	<b>Always</b>	<b>Usually</b>	<b>Often</b>	<b>Sometimes</b>	<b>Rarely</b>	<b>Never</b>
1. Am terrified about being overweight	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Avoid eating when I am hungry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Find myself preoccupied with food	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Have gone on eating binges where I feel that I may not be able to stop	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Cut my food into small pieces	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Aware of the calorie content of foods that I eat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Particularly avoid food with a high carbohydrate content (i.e. bread, rice, potatoes, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Feel that others would prefer if I ate more	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Vomit after I have eaten	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Feel extremely guilty after eating	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. Am preoccupied with a desire to be thinner	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. Think about burning up calories when I exercise	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. Other people think that I am too thin	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. Am preoccupied with the thought of having fat on my body	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. Take longer than others to eat my meals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. Avoid foods with sugar in them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. Eat diet foods	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. Feel that food controls my life	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. Display self-control around food	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

20. Feel that others pressure me to eat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21. Give too much time and thought to food	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22. Feel uncomfortable after eating sweets	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23. Engage in dieting behavior	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24. Like my stomach to be empty	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25. Enjoy trying new rich foods	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
26. Have the impulse to vomit after meals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Total Score (see below for scoring instructions) \_\_\_\_\_



Three-Factor Eating Questionnaire  
Part I

1. When I smell a sizzling steak or see a juicy piece of meat, I find it very difficult to keep from eating, even if I have just finished a meal.	<b>T</b>	<b>F</b>
2. I usually eat too much at social occasions, like parties and picnics.	<b>T</b>	<b>F</b>
3. I am usually so hungry that I eat more than three times a day.	<b>T</b>	<b>F</b>
4. When I have eaten my quota of calories, I am usually good about not eating any more.	<b>T</b>	<b>F</b>
5. Dieting is so hard for me because I just get too hungry.	<b>T</b>	<b>F</b>
6. I deliberately take small helpings as a means of controlling my weight.	<b>T</b>	<b>F</b>
7. Sometimes things just taste so good that I keep eating even when I am no longer hungry.	<b>T</b>	<b>F</b>
8. Since I am often hungry, I sometimes wish that while I am eating, an expert would tell me that I have had enough or that I can have something more to eat.	<b>T</b>	<b>F</b>
9. When I feel anxious, I find myself eating.	<b>T</b>	<b>F</b>
10. Life is too short to worry about dieting.	<b>T</b>	<b>F</b>
11. Since my weight goes up and down, I have gone on reducing diets more than once.	<b>T</b>	<b>F</b>
12. I often feel so hungry that I just have to eat something.	<b>T</b>	<b>F</b>
13. When I am with someone who is overeating, I usually overeat too.	<b>T</b>	<b>F</b>
14. I have a pretty good idea of the number of calories in common food.	<b>T</b>	<b>F</b>
15. Sometimes when I start eating, I just can't seem to stop.	<b>T</b>	<b>F</b>
16. It is not difficult for me to leave something on my plate.	<b>T</b>	<b>F</b>
17. At certain times of the day, I get hungry because I have gotten used to eating then.	<b>T</b>	<b>F</b>
18. While on a diet, if I eat food that is not allowed, I will consciously eat less for a period of time to make up for it.	<b>T</b>	<b>F</b>
19. Being with someone who is eating often makes me hungry enough to eat also.	<b>T</b>	<b>F</b>
20. When I feel blue, I often overeat.	<b>T</b>	<b>F</b>
21. I enjoy eating too much to spoil it by counting calories or watching my weight.	<b>T</b>	<b>F</b>
22. When I see a real delicacy, I often get so hungry that I have to eat right away.	<b>T</b>	<b>F</b>
23. I often stop eating when I am not really full as a conscious means of limiting the amount that I eat.	<b>T</b>	<b>F</b>
24. I get so hungry that my stomach often seems like a bottomless pit.	<b>T</b>	<b>F</b>
25. My weight has hardly changed at all in the last ten years.	<b>T</b>	<b>F</b>
26. I am always hungry so it is hard for me to stop eating before I finish the food on my plate.	<b>T</b>	<b>F</b>
27. When I feel lonely, I console myself by eating.	<b>T</b>	<b>F</b>
28. I consciously hold back at meals in order not to gain weight.	<b>T</b>	<b>F</b>
29. I sometimes get very hungry late in the evening or at night.	<b>T</b>	<b>F</b>
30. I eat anything I want, any time I want.	<b>T</b>	<b>F</b>

31. Without even thinking about it, I take a long time to eat.	<b>T</b>	<b>F</b>
32. I count calories as a conscious means of controlling my weight.	<b>T</b>	<b>F</b>
33. I do not eat some foods because they make me fat.	<b>T</b>	<b>F</b>
34. I am always hungry enough to eat at any time.	<b>T</b>	<b>F</b>
35. I pay a great deal of attention to changes in my figure.	<b>T</b>	<b>F</b>
36. While on a diet, if I eat a food that is not allowed, I often then splurge and eat other high calorie foods.	<b>T</b>	<b>F</b>

## Part II

Directions: Please answer the following questions by circling the number above the response that is appropriate to you.

37. How often are you dieting in a conscious effort to control your weight?

1	2	3	4
rarely	sometimes	usually	always

38. Would a weight fluctuation of 5 lbs affect the way you live your life?

1	2	3	4
not at all	slightly	moderately	very much

39. How often do you feel hungry?

1	2	3	4
only at mealtimes	sometimes between meals	often between meals	almost always

40. Do your feelings of guilt about overeating help you to control your food intake?

1	2	3	4
never	rarely	often	always

41. How difficult would it be for you to stop eating halfway through dinner and not eat for the next four hours?

1	2	3	4
easy	slightly difficult	moderately difficult	very difficult

42. How conscious are you of what you are eating?

1	2	3	4
not at all	slightly	moderately	extremely

43. How frequently do you avoid 'stocking up' on tempting foods?

1	2	3	4
almost never	seldom	usually	almost always



5

constantly limiting food intake, never 'giving in'

51. To what extent does this statement describe your eating behavior? 'I start dieing in the morning, but because of any number of things that happen during the day, by evening I have given up and eat what I want, promising myself to start dieing again tomorrow.'

1  
not like me

2  
little like me

3  
pretty good  
description of me

4  
describes me  
perfectly

# AUDIT

PLEASE CIRCLE THE MOST ACCURATE SELECTION

- 1.) How often do you have a drink containing alcohol?  
**0** = Never                      **1** = Monthly or less                      **2** = 2-4 times a month  
**3** = 2-3 days a week                      **4** = 4, 5, 6, or 7 days a week
- 2.) How many drinks containing alcohol do you have on a typical day when you are drinking?  
**0** = 0, 1, or 2 drinks      **1** = 3 or 4 drinks                      **2** = 5 or 6 drinks  
**3** = 7, 8, or 9 drinks                      **4** = 10 drinks and above

*For questions 3 – 8 use these selections:*

- 0** = Never                      **1** = Less than monthly                      **2** = Monthly  
**3** = Weekly                      **4** = Daily or almost daily
- 3.) For women: How often do you have 4 or more drinks a day?    **0**   **1**   **2**   **3**   **4**  
For men:      How often do you have 5 or more drinks a day?    **0**   **1**   **2**   **3**   **4**
- 4.) How often during the last year have you found that you were not able to stop drinking once you started?                      **0**      **1**      **2**      **3**      **4**
- 5.) How often during the last year have you failed to do what was normally expected from you because of drinking?                      **0**      **1**      **2**      **3**      **4**
- 6.) How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session?    **0**      **1**      **2**      **3**      **4**
- 7.) How often during the last year have you had a feeling of guilt or remorse after drinking?                      **0**      **1**      **2**      **3**      **4**
- 8.) How often during the last year have you been unable to remember what happened the night before because you had been drinking?                      **0**      **1**      **2**      **3**      **4**

*For questions 9 and 10 use these selections:*

- 0** = No    **2** = Yes, but not in the last year    **4** = Yes, during the last year
- 9.) Have you or has someone else been injured as a result of your drinking?  
**0**      **2**      **4**
- 10.) Has a relative, friend, doctor, or other health worker been concerned about your drinking or suggested you cut down?                      **0**      **2**      **4**

## Alcohol Survey

Please use the charts below to describe your recent drinking patterns. Please report your drinking in standard drinks, where 1 standard drink equals 12 ounces of beer, 4 ounces of wine, and or a 1 ounce shot of hard liquor.

For the **past month** fill in for each calendar day the number of standard drinks you **usually drink** on that day.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday

Now fill in for the **past month** the **maximum number** of standard drinks you had on each calendar day.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday

- 1) During the last 28 days, on how many days did you drink beer? \_\_\_\_\_
- 2) During the last 28 days, on how many days did you drink wine? \_\_\_\_\_
- 3) During the last 28 days, on how many days did you drink a shot of hard liquor? \_\_\_\_\_
- 4) During the last 28 days, on how many days did you drink a mixed-drink? \_\_\_\_\_
- 5) During the last 28 days, on how many days have you been drunk? \_\_\_\_\_
- 6) MALE ONLY: During the last 28 days, on how many days did you have 5 or more standard drinks? \_\_\_\_\_  
  
FEMALES ONLY: During the last 28 days, on how many days did you have 4 or more standard drinks? \_\_\_\_\_
- 7) During the last 28 days, what is the largest number of standard drinks you consumed in one night? \_\_\_\_\_
- 8) Approximately how many hours did it take you to finish the largest number of drinks mentioned in #7? \_\_\_\_\_

## RAPI

Instructions: Indicate if any of the following have happened during the last 28 days while you were using alcohol, or because of your alcohol use. When marking your answers, use the following code:

0 = never      1 = 1-2 times      2 = 3-5 times      3 = 6-10 times      4 = more than 10 times

1. Not able to do your homework or study for a test	0 1 2 3 4
2. Got into fights, acted bad or did mean things	0 1 2 3 4
3. Missed out on other things because you spent too much money on alcohol	0 1 2 3 4
4. Went to work or school drunk	0 1 2 3 4
5. Caused shame or embarrassment to someone	0 1 2 3 4
6. Neglected your responsibilities	0 1 2 3 4
7. Relative avoided you	0 1 2 3 4
8. Felt that you needed MORE alcohol than you used to use in order to get the same effect	0 1 2 3 4
9. Tried to control your drinking by trying to use only at certain times of the day or certain places	0 1 2 3 4
10. Had withdrawal symptoms, that is felt sick because you stopped or cut down drinking	0 1 2 3 4
11. Noticed a change in you personality	0 1 2 3 4
12. Felt you had a problem with alcohol	0 1 2 3 4
13. Missed a day (or part of a day) of school or work	0 1 2 3 4
14. Tried to cut down or quit drinking	0 1 2 3 4
15. Suddenly found yourself in a place you could not remember getting to	0 1 2 3 4
16. Passed out or fainted suddenly	0 1 2 3 4
17. Had a fight, argument, or bad feeling with a friend	0 1 2 3 4
18. Had a fight, argument, or bad feeling with a family member	0 1 2 3 4
19. Kept drinking when you promised yourself not to	0 1 2 3 4
20. Felt you were going crazy	0 1 2 3 4
21. Had a bad time	0 1 2 3 4
22. Felt physically or psychologically dependent on alcohol	0 1 2 3 4
23. Was told by a friend or neighbor to cut down on drinking	0 1 2 3 4

*Substance Use Survey*

	<b>Did you ever use this substance? (Circle Yes or No)</b>	<b>How old were you when you first used this substance?</b>	<b>How old were you when you last used this substance (write current age if still using)?</b>	<b>On how many days did you use this substance in the last 28 days? (Write 0-28)</b>
Cigarettes	YES NO			
Cigars	YES NO			
Chewing Tobacco	YES NO			
Pipe Tobacco	YES NO			
Alcohol	YES NO			
Marijuana	YES NO			
Cocaine	YES NO			
Use of prescription diet pills	YES NO			
Use of non-prescription (over the counter) diet pills	YES NO			
Non-prescription use of Stimulants, Amphetamines or Methamphetamines	YES NO			
Heroin	YES NO			
Non-prescription use of other Opiates (e.g., OxyContin/Oxycodone or other pain killers)	YES NO			
Hallucinogens (LSD, mushrooms)	YES NO			
Ecstasy	YES NO			
Inhalents	YES NO			



## EPI

Please answer each question by indicating yes or no. There are no right or wrong answers, and no trick questions. Work quickly and do not think too long about the exact meaning of the question.

- |   |     |    |
|---|-----|----|
| 1. Do you often buy things on impulse?  | YES | NO |
| 2. Do you generally do and say things without stopping to think?                                      | YES | NO |
| 3. Do you often get into a jam because you do things without thinking?                                | YES | NO |
| 4. Are you an impulsive person?   | YES | NO |
| 5. Do you usually think carefully before doing anything?  | YES | NO |
| 6. Do you often buy things on the spur of the moment?   | YES | NO |
| 7. Do you mostly speak before thinking things out?  | YES | NO |
| 8. Do you often get involved with things you later wish you could get out of?                         | YES | NO |
| 9. Do you ever get so carried away by new and exciting ideas that you never think of possible snags?  | YES | NO |
| 10. Do you need to use a lot of self control to keep out of trouble?                                  | YES | NO |
| 11. Would you agree that almost everything enjoyable is either illegal or immoral?                    | YES | NO |
| 12. Are you often surprised at peoples reactions to what you do or say?                               | YES | NO |
| 13. Do you think an evening out is more successful if it is unplanned or arranged at the last minute? | YES | NO |
| 14. Do you usually work quickly without bothering to check?   | YES | NO |
| 15. Do you often change your interests?   | YES | NO |
| 16. Before making up your mind do you consider all the advantages and disadvantages?                  | YES | NO |
| 17. Do you prefer to sleep on it before making decisions?   | YES | NO |
| 18. When people shout at you do you shout back?   | YES | NO |
| 19. Do you usually make up your mind quickly?   | YES | NO |

## DD Sample Items

1. Which do you prefer?
  - a. \$10 Today
  - b. \$1000 in 1 Week
2. Which do you prefer?
  - a. \$100 Today
  - b. \$1000 in 2 Weeks
3. Which do you prefer?
  - a. \$450 Today
  - b. \$1000 in 2 Weeks
4. Which do you prefer?
  - a. \$150 Today
  - b. \$1000 in 1 Month
5. Which do you prefer?
  - a. \$400 Today
  - b. \$1000 in 1 Month
6. Which do you prefer?
  - a. \$350 Today
  - b. \$1000 in 6 Months
7. Which do you prefer?
  - a. \$920 Today
  - b. \$1000 in 6 Months
8. Which do you prefer?
  - a. \$40 Today
  - b. \$1000 in 1 Year
9. Which do you prefer?
  - a. \$500 Today
  - b. \$1000 in 1 Year
10. Which do you prefer?
  - a. \$10 Today
  - b. \$1000 in 5 Years
11. Which do you prefer?
  - a. \$200 Today
  - b. \$1000 in 5 Years
12. Which do you prefer?
  - a. \$150 Today
  - b. \$1000 in 25 Years