



# Associations among eating regulation and body mass index, weight, and body fat in college students: The moderating role of gender



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## ABSTRACT

This study investigated associations between eating regulation behaviors and body mass index (BMI), weight, and percent body fat in male and female students over the first two years of college. Subjects included 328 college students (215 females and 113 males). Height and weight (via standard techniques), body composition (via bioelectrical impedance analysis), and eating regulation behaviors (using the Regulation of Eating Behavior Scale) were conducted two to three times during both the freshman and sophomore years. Significant associations between eating regulation and BMI, weight, and/or percent body fat were shown mostly in females. In females, higher BMI, weight, and/or percent body fat at the end of the second year of college were found in those with low levels of autonomous, intrinsic motivation, and identified regulation, and high levels of amotivation, while lower BMI, weight, and/or percent body fat were associated with high levels of autonomous, intrinsic motivation, and identified regulation, and low levels of amotivation. The findings that specific eating behaviors in females during the first two years of college influence BMI, weight, and/or percent body fat may be useful for inclusion in university programs focused on college student health to help decrease the risk of obesity and disordered eating/eating disorders in female college students.

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## 1. Introduction

Weight gain occurs in over two-thirds of college students, especially among freshmen during their first semester of college (Anderson, Shapiro, & Lundgren, 2003; Economos, Hildebrandt, & Hyatt, 2008; Jung, Bray, & Ginis, 2008; Kasperek, Corwin, Valois, Sargent, & Morris, 2008; Lloyd-Richardson, Lucero, DiBello, Jacobson, & Wing, 2008; Lowe et al., 2006; Provencher et al., 2009; Pullman et al., 2009). Moreover, it is primarily body fat that tends to increase, on average greater than 1%, during the freshman year (Edmonds et al., 2008; Gropper et al., 2009; Hajhosseini et al., 2006; Hoffman, Policastro, Quick, & Soo-Kyung, 2006). Yet, studies also have reported weight and body fat gains among students throughout college (Gropper, Clary, Gaines, Wanders, & Simmons, 2011; Gropper et al., 2011; Racette, Deusinger, Strube, Highstein, & Deusinger, 2005). Gropper, Simmons, Connell,

and Ulrich (2012) reported average four-year weight and body fat gains of 6.7 lbs and 3.6%, respectively, among college students; furthermore, when the students who gained weight were examined males gained an average of 15 lbs and females 9.3 lbs over the four years.

The first year of college also has been suggested as a critical time period for the development of disordered eating (Mills, Polivy, McFarlane, & Crosby, 2012; Striegel-Moore, Silberstein, Frensch, & Rodin, 1989). Disordered eating is classified as unusual eating behaviors that negatively impact an individual's physical, mental, and social health. Disordered eating includes a variety of abnormal eating patterns in which the individual becomes fixated on food and weight due to fear of weight gain. Hectic or unruly eating patterns, eating foods or nonfoods at irregular times, restrained eating habits, anorexia and bulimia nervosa, chronic dieting, and compulsive eating habits are all examples of disordered eating (National Eating Disorder Information Centre, 2008). Increased independence and responsibilities as well as identity issues have been theorized to contribute in part to the eating pathologies (Polivy, Herman, Mills, & Wheeler, 2003). However, eating and food habits are also influenced by self-regulatory styles involving varying levels of autonomy (Leong, Madden, Gray, & Horwath, 2012).

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The Self-Determination Theory proposed by Deci and Ryan (1985, Ryan and Deci, 2000) is a critical theory that helps to understand what motivates or does not motivate an individual to regularly control his or her eating behaviors. According to the Self-Determination Theory, individuals experience multiple forms of motivation along a continuum from amotivation (lowest) to external regulation to introjected regulation to identified regulation to integrated regulation, and lastly to the most autonomous level of motivation—intrinsic motivation (Deci & Ryan, 1985; Ryan & Deci, 2000). The first three forms (amotivation, external, and introjected) of regulation represent controlled forms of behavior while the latter three forms (identified, integrated, and intrinsic) represent self-determined or autonomous forms of behavior regulation (Deci & Ryan, 1985; Ryan & Deci, 2000).

Amotivation is a state in which an individual cannot observe contingencies between his or her behavior and the consequences of the individual's actions. Because amotivated individuals are often unable to understand or realize the consequences of their actions, they believe that their behavior is often the result of external forces outside the realm of their control. Externally regulated actions are motivated by external rewards and/or punishments. An individual who is externally regulating his or her eating behaviors would be doing so in order to either seek rewards, such as recognition and/or praise from the family member, health professionals, or, to avoid negative consequences, such as a lectures and warnings from others (Deci & Ryan, 1985). Introjected regulation of behavior occurs when an individual voluntarily regulates his or her behavior (Ryan & Connell, 1989). An individual who is encouraged to introjectedly regulate his or her eating behaviors would be doing so because they would be too embarrassed for not controlling his or her diet or would constantly worry or feel anxious or guilty about the negative consequences of not controlling his or her diet (Ryan & Connell, 1989).

The Self-Determination Theory defines intrinsic motivation as an individual's own personal enthusiasm or self-determination to behave in a certain way that will bring pleasure and satisfaction to the individual. Individuals who are intrinsically motivated will perform or carry out certain behaviors due to their own interest, regardless if there are material rewards or external constraints. Behaviors that are intrinsically motivated are completely voluntarily and are usually absent of material rewards (Deci & Ryan, 1985). Unlike intrinsic motivation, extrinsic motivation includes behaviors that an individual is motivated to perform for others in order to find a means to an end. Extrinsic motivation actions are often done to avoid unpleasant consequences and/or to promote pleasant consequences, such as material rewards for behaving in a way that is deemed as good or beneficial for the individual by another (Deci & Ryan, 1985). Identified regulation of behavior occurs when external sources of regulation have been adopted into the individual's self-identity. The behavior is so important that the individual perceives the behavior to be chosen by him or herself, rather than due to internalization of external controls. Integrated regulation of a behavior occurs when a behavior becomes constant and dependable with other goals and priorities of an individual. The behavior becomes essential to the individual's daily routine and is therefore integrated into the individual's self-identity. Integrated regulation occurs not only because the individual believes the behavior is essential, but also because the behavior corresponds with other past integrated behaviors and standards.

Studies investigating eating habits and these behaviors among college students have found associations between controlled forms of regulation and disordered eating, and associations between autonomous behaviors and healthier eating habits (Pelletier & Dion, 2007; Pelletier, Dion, Slovinec-D'Angelo, & Reid, 2004). The present study extends this work to examine whether or not differences in these eating behaviors were reflected in changes in body mass index, body weight, and/or body fat in a two-year study of male and female college students.

## 2. Methods

### 2.1. Participants

This prospective longitudinal study followed a convenience sample of college freshmen attending Auburn University, Auburn, Alabama from the beginning of the freshman year to the end of the sophomore year. Participants were recruited for the study by emails as well as by oral announcements in introductory courses at the beginning of fall semester both in 2007 (cohort 1) and in 2008 (cohort 2). Recruited participants were age 17–19 years, were not married, were without children, and had no diagnosed eating disorder. Informed consent for those who were at least 19 years of age and informed assent and parental consent for those who were under 19 years of age were obtained prior to study participation. This study was approved by the university's Institutional Review Board for the Use of Human Subjects in Research.

### 2.2. Study design

Cohorts 1 and 2 were assessed at three points during the freshman year; at the beginning of the fall semester—Time 1 ( $T_1$ ) (2007 and 2008, respectively), at the end of fall semester— $T_2$  (2007 and 2008, respectively), and at the end of the spring semester— $T_3$  (2008 and 2009, respectively). During the sophomore year, cohort 1 was again assessed at three points time points; at the beginning of the fall semester— $T_4$  (2008), the end of fall semester— $T_5$  (2008), and at the end of spring semester— $T_6$  (2009); cohort 2 was assessed only at the beginning of the fall semester— $T_4$  (2009) and at the end of spring semester— $T_6$  (2010).

### 2.3. Anthropometric assessments

Anthropometric assessments were conducted between 8 and 11 a.m. at each time point. Height was measured to the nearest one-quarter inch using standard techniques with a height rod attached to a digital scale (Healthometer, Model 500KL, Pelstar LLC, Bridgeview, IL). This digital scale was used to obtain weight to the nearest 0.2 lbs. Scale accuracy was checked with external weights. Participants removed coats, shoes, belts, and/or hats and items from their pockets before being weighed and measured. Body mass index (BMI) was determined by dividing an individual's body weight (in kilograms) by his or her height (in meters squared).

Body composition was measured using bioelectrical impedance analysis (Bodystat, BioVant Systems, Detroit, MI). Prior to conducting measurements, participants laid down on their back for at least 5 min with arms and legs separated laterally from the medial axis and electrodes attached to the right hand and foot. Standard protocols were followed with participants instructed not to eat 2–4 h prior to assessments, as well as not to drink alcohol or caffeine or participate in moderate to vigorous physical activity 12 h prior to assessments (National Institutes of Health, 1996). Body composition measurements varied by less than 0.5% with repeated measurements of the same subject.

### 2.4. Demographic information

Demographic information including date of birth, age, gender, ethnicity, state of permanent residence, as well as campus residency while attending the university (e.g. at home with parents, off-campus or on-campus) was determined by a self-report demographic questionnaire.

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