Perceived Academic Stress and Weight Bias

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Mentor: Dr. Brandon Sawyer

In requirement for the Honors Scholars Project at Point Loma Nazarene University

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This research project would not have been possible without the contributions of the members of my Honors Scholars Project Committee: Dr. Brandon Sawyer, Dr. Alisa Ward, and Dr. Heidi Woelbern, the students in Point Loma Nazarene University's Fall 2024 Fitness Through Movement, Lifestyle as Medicine and Exercise Physiology classes, and the support of my friends and family.

For Caitlyn: we ARE the sources!

Literature Review

Purpose of Literature Review

The purpose of the literature review is to educate potential readers about the existing literature on weight stigma and weight bias, obesity, the difficulties of weight loss, and existing knowledge on the link between stressors such as life stress, peer stress, and other stressors with weight bias. It is intended to be read before the study so that the reader may have a fuller idea of the multifaceted nature of academic stress and internalized weight bias.

Weight Stigma and Weight Bias

The term weight stigma refers to the social devaluation, stereotyping, discrimination, and prejudice of an individual due to their body weight (1). In the United States, weight stigma has increased by two-thirds in the last decade (2). Weight stigma begins at startlingly young ages, with studies showing that ninety percent of elementary aged children have witnessed weight-related bullying, and two-thirds of overweight or obese children have reported that they have been teased (2). Weight and physical appearance are the most likely targets of bullying in adolescents, to a greater extent than race, ethnicity, disability, or sexual orientation (3). Additionally, weight stigma affects marginalized communities, such as women, people of color, and LGBT at a higher rate (4). Studies indicate that obese women were less likely to be hired than obese men, and that obese women consistently earn less than obese men, with a 3.3% decrease in pay with a 10% increase in BMI compared to a 1.9% decrease in pay in men (5). One survey-based study found that between 45 and 57% of adolescents of diverse sexual preferences and gender identities had experienced weight-based victimization from peers, and 44-70% had experienced it from family members, with the highest rate of family-based victimization reported by individuals who sexually identified as “other” at 70% (6).

Weight stigma in healthcare professionals can lead to internalized stigma in patients, which is linked to lower engagement and adherence to health interventions (4). Additionally, weight stigma internalization is associated with several negative mental and physical health effects, such as depression, anxiety, low self esteem, body dissatisfaction, eating disorder pathology, food addiction symptoms, psychological distress, and poor cardiometabolic health (7). Additionally, weight stigma internalization is consistent with depression, anxiety, low self esteem and eating disorder pathology independent of Body Mass Index (BMI) (7). One study found that weight-based stigmatizing experiences were significantly positively correlated with higher depression scores in racially and gender-diverse treatment-seeking obese adults (8). Perceived weight stigma is significantly associated with increased levels of cortisol and oxidative stress independent of abdominal fat (9). This increase in cortisol can further lead to an increase in caloric consumption and abdominal adiposity (10). Additionally, internalized weight stigma has been found to interfere with the enjoyment and engagement in physical activity in women with high BMI (11).

Obesity

In 1959, the Metropolitan Life Insurance Company published tables of average body weights by height, gender and age, with most of the data collected from adult men (12). From these tables, it was determined that if a person's weight was twenty percent above or below the mean for their height, they could be considered overweight or underweight; however, these values did not accommodate for variables such as frame size, and later versions of height and weight tables attempted to mathematically accommodate for this (12). In the nineties, the World Health Organization adopted the Body Mass Index (BMI), which reduces the effect of height variance, as the standard for defining obesity, and BMI continues to serve as the current metric

(12). There are a number of issues with using BMI as a standard of health and obesity. The National Institutes of Health Consensus Development Conference on the Health Implications of Obesity defined the cutoff of "overweight" as as BMI ≥27.8 for men and BMI ≥27.3 for women from data from the National Health and Nutrition Examination Survey 1976–80, with a number of issues such as measurement discrepancy and self-reported clothing and shoe size prompting the need for further research into standardization of obesity (13). However, the 1985 edition of Dietary Guidelines for Americans utilized the 1959 Metropolitan Life Insurance Company's "desirable" height and weight tables to establish an overweight cutoff of a BMI of 25-26 for men and a BMI of 24-25 for women, later combining the sexes and differentiating by age as greater than 25 for ages 19-24 and greater than 27 for ages 35 and up (13). In 1995, The WHO Expert Committee on Physical Status classified the cutoffs of obesity markers (overweight BMI > 25, obesity BMI > 30, and severe obesity BMI > 40) based on "arbitrary" visual analysis of a BMI-mortality curve and suggested this method should be revised in the future (13). At this point, classes of obesity were established, but using the same cutoffs: "pre obese" (BMI ≥ 25), "overweight" (BMI 25-29.9), "obese class I" (BMI 30-34.9), "obese class II" (BMI 35-39.9), and "obese class III" (BMI ≥ 40) (13). This measurement continues to serve as the standard today. BMI does not differentiate body compensation such as muscle, bone, and fat (14). BMI does not consider ethnic or sociocultural context of height and weight distributions, making it an inadequate metric for health outcomes (4). African Americans in particular are more likely to be misclassified as obese by BMI (14). In western populations, the mean BMI is 24-27, meaning fifty percent or more of the adult population are considered overweight by the BMI metric, and the overweight category is often combined with the obese category in order to dramatize the western obesity epidemic (12). Additionally, BMI does not predict comorbidities or disease risks (15).

The first historical clinical view of obesity is the work of Hippocrates, who considered obesity to be an excess of the four "humors" which keep the body in balance (16). Over time, excess body weight was viewed as a sign of wealth, fertility, and beauty, as it was valued in times of famine and poverty (16). In the 19th century, as food increased in availability, the general population began to gain weight, leading to further research on obesity tracking and intervention (16). In the 20th century, researchers began to experiment with the pharmaceutical intervention of obesity, utilizing drugs such as amphetamine and methamphetamine to try and combat rising obesity rates, even combining them with barbiturates in the 1950s (16). What is widely considered to be the current "obesity epidemic" began in the late 1970s, with the prevalence of obesity in American adults rising from 15.0% in 1976–1980, to 23.3% in 1988–1994, and to 30.9% in 1999–2000 (17). As of 2021, an estimated 15.1 million children and young adolescents aged 5–14 years, 21.4 million adolescents aged 15–24 years, and 172 million adults aged 25 years and older were considered overweight or obese in the USA, and the prevalence of overweight and obesity in adults of both sexes was over 40% across the nation (18).

There are several factors which lead to obesity. There are a plethora of genetic predispositions to obesity, such as genetic mutations which result in issues with appetite regulation and satiety, and congenital syndromic issues which are associated with obesity (19). For example, a monogenic mutation which affects the leptin-melanocortin circuit will cause cells to become resistant to leptin, negatively impacting satiety and causing an individual to remain hungry (19). One example of syndromic obesity is Prader-Willi syndrome, which causes hyperphagia, lack of satiety and decreased energy expenditure, contributing to obesity (24)

Hormones also play a role in the development of obesity. The impairment of estrogen, a female sex hormone, to interact with Estrogen Receptor α (ERα) is linked to dysregulation in glucose homeostasis, increased adiposity and recapitulate various aspects of the metabolic syndrome regardless of sex (25). Additionally, single-nucleotide polymorphisms, or variances in the DNA sequence, of ERα have been linked to adipose tissue distribution (25). For example, one study found that an ERα single-nucleotide polymorphism in premenopausal Japanese women was associated with higher visceral adipose tissue deposition when compared with women who did not have the single-nucleotide polymorphism; another found that an ERα single-nucleotide polymorphism was associated with the development of metabolic syndrome in a group of Egyptian women (25). Additionally, ERα gene single-nucleotide polymorphisms have been linked to the obesity phenotype; specifically, visceral adipose tissue deposition in middle-aged women (25).

Environmental factors can also predispose individuals to obesity. Studies have shown that an abundance of pre and postnatal factors can increase predisposition to obesity, such as maternal smoking, maternal weight gain, infant sleep duration, breastfeeding duration, and growth rate (19). Insufficient sleep, therapeutic drugs, and various non-congenital medical conditions can also predispose one to obesity (19). A number of common antidepressants and antipsychotics have been associated with increased weight gain, likely through hyperactivation of the hypothalamic-pituitary-adrenal (HPA) axis (20). A normal reaction to stress is the activation of the HPA axis (21). Hyperactivation of the HPA axis can suppress corticotropin releasing hormone (CRH), increase leptin resistance, and increase neuropeptide Y (a transmitter which promotes growth and differentiation of adipocytes) release, as well as increase food-associated reward (22). HPA axis hyperactivation may also lead to issues commonly associated with obesity, such as visceral fat deposition, inflammatory cytokine secretion, elevated blood pressure and dyslipidemia (20). Non-congenital conditions, such as hypothyroidism, can predispose individuals to obesity. Individuals with hypothyroidism have increased levels of the hormone TSH and decreased levels of the hormone T4, decreasing metabolic rate and contributing to obesity (23).

Several socioeconomic factors also contribute to obesity, such as inexpensive processed food, increased passive modes of transportation, COVID-19 lockdown leading to physical inactivity, improved technology encouraging sedentary lifestyle, and sedentary employment (19). Individuals from a lower socioeconomic background were found to have an increase in the hormone ghrelin, which combined with other factors such as poverty and food insecurity may contribute to an obesogenic environment (26). The increase of sugar in the western diet through products such as high fructose corn syrup may act on an evolutionary-based response to fructose and contribute to obesity (27). Fructose lowers ATP availability inside the cell and reduces the ability to produce new ATP, and following ingestion of fructose, ATP levels can fall up to 20% in the liver; this triggers the body to increase caloric intake, however, the reduced ability to produce new ATP results in the caloric intake being converted to fat (27). Thus the ingestion of fructose can lead to weight gain, visceral adiposity, insulin resistance, and other conditions associated with obesity (27). Certain ethnicities are also more likely to be predisposed to obesity (19). The causes of obesity are multifaceted, spanning genetics, environment, hormones, medication, socioeconomic status and ethnicity, and are much more complex than calories in and calories out.

Weight loss and maintenance of weight loss is difficult for a multitude of reasons. Obesity intervention is mitigated by the weight stigma held by healthcare providers, which often results in mistrust in providers, avoidance of care or decreased adherence to care plans (28).

Almost all obesity interventions involve a decrease in caloric intake. The body compensates for reduced caloric intake to prevent starvation, producing a number of changes such as hormonal changes which increase appetite and decrease satiety and long-term reductions in energy expenditure which lowers metabolism, which makes weight loss and long-term weight maintenance difficult (28). One such hormone, leptin, decreases in response to weight loss, causing increased food intake and decreased energy expenditure (29). Ghrelin, the appetite-stimulating hormone, increases following diet-induced weight loss, causing increased appetite and cravings (30). Studies have shown that ghrelin levels increase proportionally to the amount of weight loss, and increase after long-term consistent exercise, especially when weight loss is a result of said exercise (30). Elevated ghrelin levels are observed in the previously mentioned Prader-Willi syndrome, demonstrating their effect on insatiable appetite (30). Additionally, these hormonal changes are observed over a year following weight loss, increasing the likelihood of weight regain (28). One study found that for every kilogram of weight lost, there was an increase of ~100 calories per day in energy intake and a decrease of ~30 calories per day in energy expenditure (31). The reduction in the intake of calorie dense foods, when on a diet, often produces unpleasant side effects, such as insatiable cravings, fatigue, and poor mood (28). Many individuals attempt weight loss in order to aid with comorbidities such as type II diabetes. However, diabetics have been shown to lose significantly less weight than non-diabetics with the same interventions (28). Studies show that dieting is likely to predict future weight gain (32). Fifty percent or more of individuals who lose weight via lifestyle modification are likely to have gained the weight back, returning to their baseline weight (33). Additionally, individuals who lose greater than 10% of their body weight are likely to return to their baseline weight within one year (34). The loss, regain and subsequent weight loss attempts that follow are known as weight cycling. Weight cycling can lead to enhanced weight gain, cardiovascular risk factors, abdominal obesity, alterations to resting energy expenditure, cancer risk, and mortality (35). These challenges make weight loss a difficult battle.

Stress and Body Image

Stress is generally linked to negative body image. One study found that acculturative stress, or stress resulting from the assimilation of one culture to another, was linked to high body dissatisfaction and bulimia pathologies in women (36). Another study of nurses in Ohio found that job stress was significantly associated with body dissatisfaction and eating disorder pathology, with 33% reporting eating when stressed, 29.1% reporting thinking about eating when stressed, 11.6% reporting guilt following eating, 11.1% reporting feeling out of control after eating, and 58.4% reporting that they feel they are not a healthy weight (37). Additionally, in individuals with obesity, perceived stress was found to be a significant mediator for both negative and positive body image dimensions, and was found to be the mediator between negative self body evaluation and depressive symptoms ($p < .001$, $R^2 = 0.51$) (38). Several connections have been made between stress and negative body image or weight stigma in adolescents. A study of university students in Saudi Arabia found that body dysmorphic disorder is relatively common among university students and is often linked to depression, anxiety, and stress, with body dysmorphia being a significant predictor of stress at an odds ratio of 1.5 (39). Another study of Chinese adolescents found significant correlations between self-perceived weight and high stress, depression, decreased sleep quality and duration, increased sleep disturbance and daytime dysfunction (40). In this particular study, 48.77% of participants perceived themselves as obese, but only 15.13% of participants were actually obese (40). A study of Iranian adolescent girls found a relationship between poor body image perception coping strategy and eating disorder likelihood regardless of the type of coping strategy ($p = 0.007$) (41). Additionally, 23.7% of participants were found to actually have an eating disorder (41). Another study of Indian adolescents found that negative internal body image was associated with low self-esteem and mental health ($p = 0.036$) (42). Of these participants, 51.46% of males and 48.53% of females were concerned about their body shape, and 64.72% of participants perceived their body incorrectly regardless of over or underweight status (42). Body dissatisfaction has also been associated with high peer-stress and low self-esteem, indicating that body dissatisfaction is a motivating factor for fears of bullying based on appearance in adolescents (43). Mindfulness-based stress reduction techniques were found to decrease long-term body image concerns such as distorted body image and fear of weight gain in adolescent girls ($p < .001$), further illuminating the link between stress and body image (44).

Intervention

There are several educational and informative interventions which have reduced weight stigma. Preliminary results of a study which involved a 3 hour seminar with clinical psychology trainees addressing weight controllability beliefs and size acceptance in a weight-inclusive way showed reduced dislike and negative attitudes towards obese people, with reduced negative attitudes being accounted for by weight controllability beliefs mediating negative attitudes towards obese people over time (45). Additionally, a full-day workshop with public health promoters which focused on stigma reduction and the dangers of weight-centric healthcare was successful in decreasing anti-fat attitudes ($p = .02$) and weight stereotyping ($p = .018$) (46). This intervention was successful at reducing externalized weight bias, but was not effective at reducing internalized weight bias (46). Education on genetic and environmental origins of obesity through a stigma reduction intervention program showed decreased external weight stigma attitudes ($p < .01$) and controllability beliefs ($p < .01$) long-term in German university students (47). A study which involved showing two 17-minute educational videos on weight prejudice and weight bias to Master of Nutrition students in the UK showed decreased fatphobia ($p < .001$), improved beliefs about weight controllability ($p < 0.05$), though the majority of participants evaluated the educational videos as “little useful” or “not useful”, and anti-fat bias improvement was not sustained in the six-week follow up (48). It is important to note that only one of these interventions addressed internalized weight stigma and was unsuccessful in reducing internalized weight stigma.

Introduction

Weight bias is the social devaluation, stereotyping, discrimination, and prejudice of an individual due to their body weight (1). Weight bias is a prevalent issue in the United States, impacting multiple aspects of life, such as bullying in elementary school children, hiring and pay gaps, and deficits in healthcare (2, 4, 5). Additionally, the internalization of weight bias can lead to severe health consequences (7). Several studies have linked stress to weight bias. Different kinds of stress, such as acculturative stress, job stress, and mental health related stress have been linked to body image dissatisfaction and weight stigma (36, 37, 39). Many interventions have been successful in reducing weight stigma, such as seminars on weight controllability beliefs, stigma reduction workshops, reduction intervention programs and educational videos; however none of these successfully reduced internalized weight bias (45, 46, 47, 48). This study aims to identify whether there is a relationship between perceived academic stress and weight bias internalization (WBI), and also explores the impact of various levels of obesity education on perceived academic stress and WBI. We hypothesize that as perceived academic stress scores increase, WBI scores will also increase. Additionally, we predict that courses with more information on obesity and weight loss difficulty will show decreased WBI post-intervention.

Methods

Students in an activity and health course (level 100), a didactic health course (level 200), and a physiology of exercise course (level 300) at Point Loma Nazarene University were given the opportunity to participate in a voluntary anonymous survey to assess perceived academic stress and internalized weight bias throughout one semester. Students in these classes received varying amounts of information on obesity and Health at Every Size in their lectures after the first survey. The activity and health course received a 10 minute video lecture and quiz on weight stigma, discrimination, the effects of weight stigma, difficulty of weight loss and health independent of weight loss. The didactic health course received a 55 minute lecture on weight stigma and discrimination, causes of obesity and difficulty of weight loss, Health At Every Size and health independent of weight loss. The physiology of exercise course received 3 hours of course content covering weight stigma and discrimination, historical context of obesity and measures of obesity, BMI and mortality risk, difficulty of weight loss, and health independent of weight loss. Prior to distributing the surveys, a research proposal was submitted to and approved by the Point Loma Nazarene University Institutional Review Board to ensure that the methods followed federal guidelines for research involving human participants. The distributed survey consisted of 26 questions to assess perceived academic stress and 11 questions to assess internalized weight bias. The stress related questions came from the Lakaev Academic Stress Response Scale (LASRS-2) and the body image questions came from the Modified Internalized Weight Bias Scale. There were also demographic information questions such as age, gender, race, ethnicity, major, class standing, and the class which is offering the survey. One week prior to the survey, a small presentation on the content and intention of the survey was given in each class. The survey was given once in the fourth week of the semester, when stress was likely low, and once in the final week of the semester, which has been identified as one of the peak times for stress throughout the semester (49). The survey took an estimated 15-20 minutes to complete.

The Lakaev Academic Stress Response Scale (LASRS-2) is a validated survey tool and a refined version of the Lakaev Academic Stress Response Scale-1 (LASRS-1), expanding on the thresholds of academic stress (50). Participants are asked to rate the frequency of specific unhealthy coping mechanisms and feelings in the last 7 days on a Likert scale from 1-5, with 5 being “all of the time” and 1 being “none of the time”. Students are given a stress score based on the sum of their responses. The Weight Bias Internalization Scale is a validated survey tool which consists of questions which address weight status, perceived value, mood, and social interaction among other factors (51). Participants are asked to rate how much they agree with statements provided on a Likert scale from 1-7, with 7 being “strongly agree”, and 1 being “strongly disagree”. Students are given a weight bias internalization score based on the mean of their responses. All survey data was collected using Google Forms.

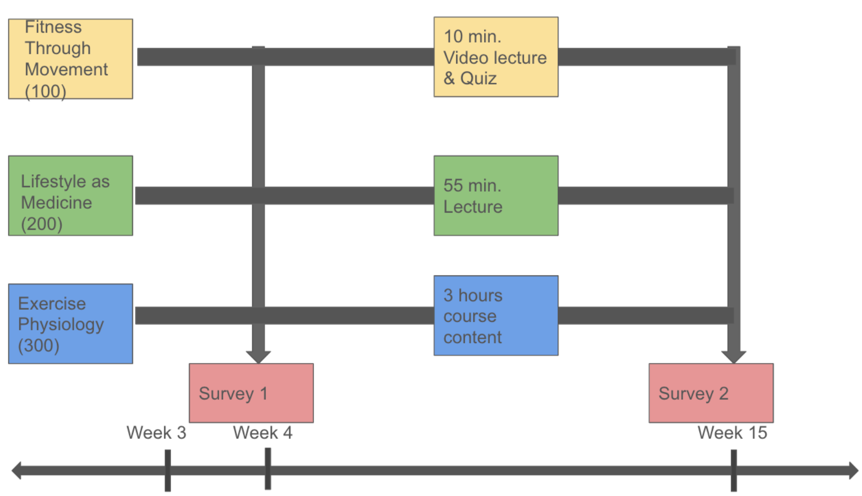


Figure 1: Diagram of Study Design.

Data Analysis

A Spearman's Rho Bivariate Correlation was used to evaluate correlation between perceived academic stress and internalized weight bias of all responses. A Mann-Whitney U test was used to find gender differences in all responses. A Wilcoxon Signed Ranks test was used to evaluate a change in the responses pre and post intervention. A p value of < 0.05 was used to determine significance.

Results

There were 206 total responses to the pre and post surveys (n=206). Of the total participants, 142 were female and 62 were male. Of these participants, 83% were white, 11% were Asian, 2% were native Hawaiian or other Pacific Islander, 1% were Native American or Alaska native, and 3% declined to state. Twenty-six percent of total participants were of Hispanic/Latino/Spanish origin and 74% were not. Of the total participants, 41% were freshmen, 22% were sophomores, 16% were juniors and 21% were seniors. 43 students completed both the pre and post survey, with 31 being female and 12 being male. No males from the Didactic Health course (200) completed both the pre and post survey. Of the participants who completed both the pre and post survey, 47.8% were freshmen, 21.7% were sophomores, 21.7% were juniors, and 8.7% were seniors.

<u>Overall Academic Stress and Internalized Weight Bias</u>

The combined descriptive statistics of age, Weight Bias Internalization (WBI) score and Academic Stress score of all participants from the beginning and end of the semester are shown by gender and grouped together in Table 1.

	n	Age	WBI Score	Academic Stress Score	Correlation coefficient (R)**	p
Females	142	19.15 ± 1.31	2.98* ± 1.44	60.04* ± 17.34	0.366	**<0.001**
Males	64	20.34 ± 2.47	2.15 ± 1.31	48.14 ± 17.58	0.279	**0.026**
All	206	19.52 ± 1.834	2.72 ± 1.45	56.34 ± 18.23	0.463	**<0.001**

*Table 1: Descriptive Statistics of Weight Bias Internalization score, Academic Stress Score and age by gender and together. *Significantly higher than males, p \< 0.05. **Spearman's Rho Bivariate Correlation between academic stress score and WBI score.*

The results of a Spearman's Rho Bivariate Correlation showed a significant correlation between academic stress and internalized weight bias in all participants (n= 206; R = 0.463; P <0.001). The correlation was lower but still significant when split by gender (Females (N=142): R = 0.366; P <0.001; Males (N=64): R = 0.279; P = 0.026). The Mann-Whitney U test was used to find significant gender differences in stress and weight bias measures. Females had higher WBI and Academic Stress scores on average, as seen in figures 3 and 4.

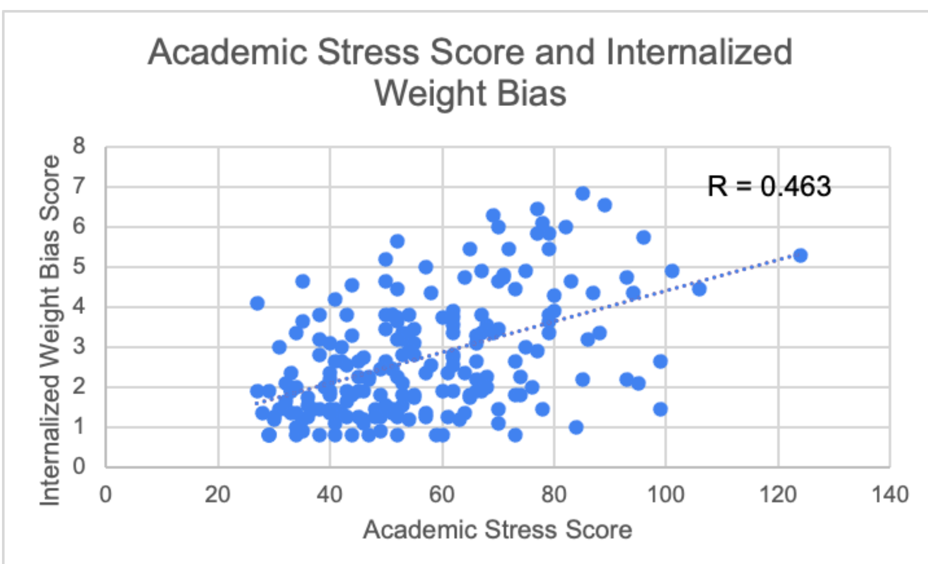
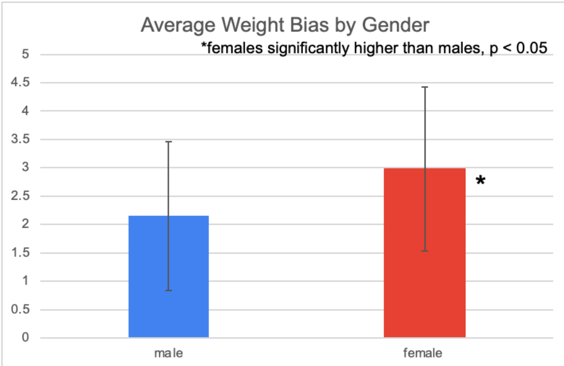


Figure 2: Scatterplot of Academic Stress Score and Internalized Weight Bias for all participants.



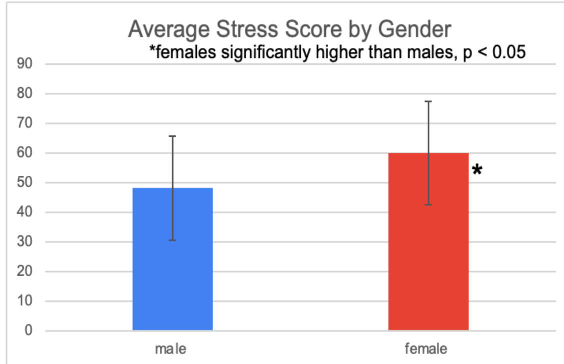


Figure 3: Average Weight Bias Internalization score split by gender. Figure 4: Average Academic Stress Score split by gender.

Pre and Post Intervention

Forty-three participants filled out both pre and post surveys ($n = 43$). The Wilcoxon Signed Ranks test found there was no significant change between pre and post survey scores of Internalized Weight Bias or Academic Stress scores following the course intervention, as seen in Table 2. When split by course, only the activity and health course showed a significant decrease in weight bias ($n = 23$; $p = .046$) (see Table 2). Though not significant, the didactic health course showed an increase in Internalized Weight Bias from the pre to post survey.

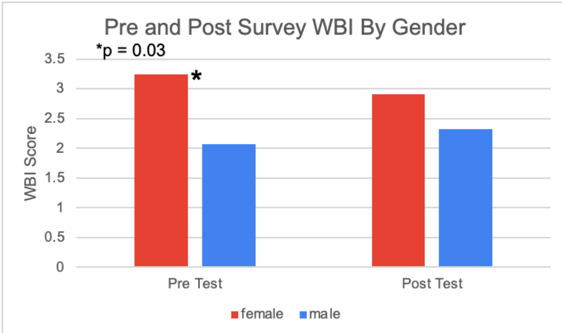
Course & Level	n	WBI Pre Mean ± SD	WBI post Mean ± SD	Academic Stress Pre Mean ± SD	Academic Stress Post Mean ± SD	WBI p	Academic Stress Score p
Activity and Health Course (100)	23	2.98±1.49	2.52±1.10	54±18.65	53.61±20.15	**0.046**	0.0876
Didactic Health Course (200)	8	3±1.72	3.71±1.76	64.88±10.89	57.75±20.43	0.401	0.401
Exercise Physiology Course (300)	12	2.73±1.31	2.54±1.37	64.75±18.52	60.83±16.19	0.906	0.556
All	43	2.913 ± 1.46	2.75 ± 1.36	59.02 ± 17.93	56.40 ± 19.00	0.197	0.503

Table 2: Mean, standard deviation, and p values of all subjects who completed the pre and post surveys split by course.

When subjects who completed both the pre and post survey were split by gender, only females had a significant decrease in stress and weight bias (n = 31; p = 0.034 and p = 0.03, respectively). As seen in figures 5 and 6, males showed an increase in both internalized weight bias and academic stress scores, though not significantly. See Table 3 for the pre and post survey data split by gender.

Gender	n	WBI Pre Mean ± SD	WBI Post Mean ± SD	Academic Stress Pre Mean ± SD	Academic Stress Post Mean ± SD	WBI p	Academic Stress p
female	31	3.24±1.40	2.91±1.39	64.29±16.79	58.19±19.9	**0.03**	**0.034**
male	12	2.07±1.29	2.23±1.24	45.42±13.34	51.75±16.29	0.083	0.068

Table 3: Mean, standard deviation, Z scores and p values for all subjects who completed the pre and post surveys split by gender.



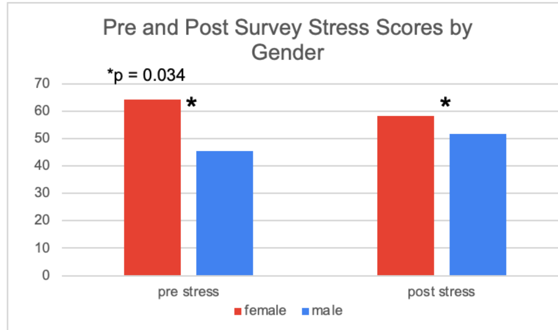
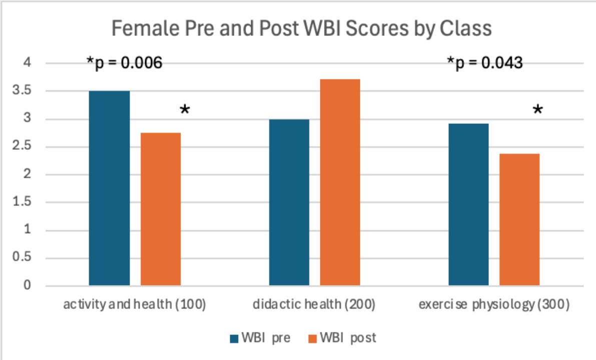


Figure 5: Pre and post survey WBI scores split by gender. Figure 6: Pre and post survey Academic Stress scores split by gender.

When subjects who completed both the pre and post survey were split by gender and class, females from the Activity and Health course (100) and the Exercise Physiology course (300) showed a significant decrease in WBI scores (n = 16; p = 0.006, and n = 7; p = 0.043, respectively) and females from the Exercise Physiology course showed a significant decrease in Academic Stress scores (n = 7; p = 0.018) (see Figures 7 and 8). Males did not show a significant difference in WBI or Academic Stress scores (see Figures 9 and 10). No males from the Didactic Health course (200) completed both the pre and post survey. See Table 4 for pre and post data split by class and gender.

Females Class	N (F)	WBI Pre Mean ± SD (F)	WBI Post Mean ± SD (F)	Academic Stress Pre Mean ± SD (F)	Academic Stress Post Mean ± SD (F)	WBI p (F)	Academic Stress Score p (F)
Activity and Health Course (100)	16	3.5±1.41	2.75±1.18	60.44±18.18	58.31±20.90	**0.006**	0.608
Didactic Health Course (200)	8	3.00±1.72	3.71±1.76	64.88±10.89	57.75±20.43	0.401	0.401
Exercise Physiology Course (300)	7	2.92±1.01	2.38±1.15	72.43±18.10	58.43±20.04	**0.043**	**0.018**
Males Class	**N (M)**	**WBI Pre Mean ± SD (M)**	**WBI Post Mean ± SD (M)**	**Academic Stress Pre Mean ± SD (M)**	**Academic Stress Post Mean ± SD (M)**	**WBI p (M)**	**Academic Stress Score p (M)**
Activity and Health Course (100)	7	1.79±0.92	2.00±0.70	39.29±9.23	42.86±14.23	0.345	0.207
Didactic Health Course (200)	0	N/A	N/A	N/A	N/A	N/A	N/A
Exercise Physiology Course (300)	5	2.45±1.74	2.76±1.75	54.00±14.28	64.20±9.68	0.068	0.138

Table 4: Mean, standard deviation, and p values of all subjects who completed the pre and post surveys WBI scores and Academic Stress scores by class split by gender, (F) for females and (M) for males.



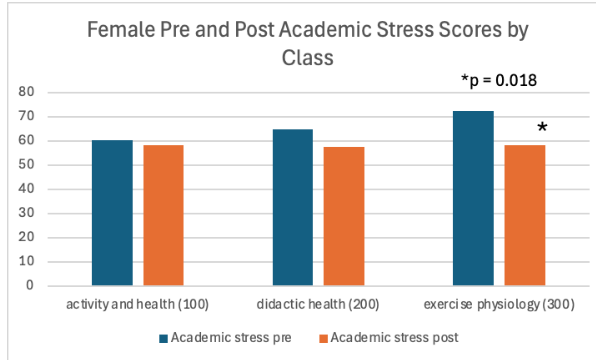
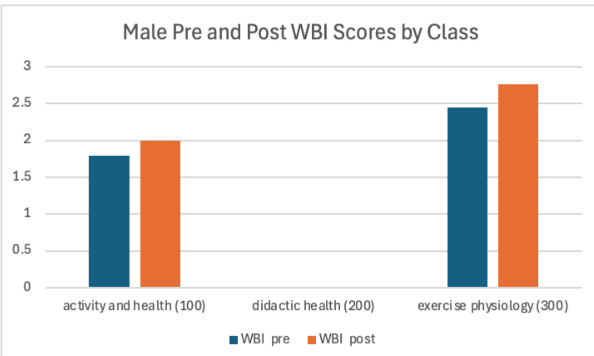


Figure 7: Female pre and post WBI scores by class. Figure 8: Female pre and post academic stress scores by class.



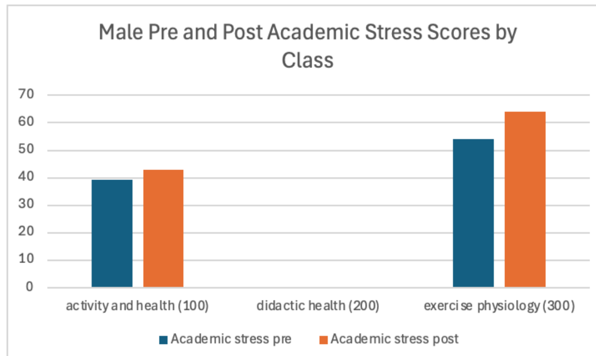


Figure 9: Male pre and post WBI scores by class. Figure 10: Male pre and post academic stress scores by class.

Discussion

This study aimed to investigate the relationship between perceived academic stress and internalized body image, as well as explores the impact of differing levels of obesity education on perceived academic stress and internalized body image. The key findings of this study indicate that there is a significant correlation between perceived academic stress and internalized weight bias. These findings are consistent in both males and females, and are observed more strongly in females. We found that as the semester progressed, perceived academic stress and internalized weight bias both decreased. In contrast with the literature (49), stress did not increase but actually decreased throughout the semester. This may be due to the majority participation of freshmen (41%) and the unique adjustment period they undergo, as well as the female majority participation (69%). One study found that freshmen socially adjust better when they are residing with their peer group, involved in smaller groups such as small class sizes, and surrounded by peers of the same gender (52). These characteristics are all found in Point Loma Nazarene University's freshman population, as Point Loma Nazarene University has an on-campus living requirement for freshmen students, a student to faculty ratio of 13:1, and a 66% female student undergraduate majority (Point Loma Nazarene University).

Our findings show that there was not a significant difference in weight bias internalization or perceived academic stress between pre and post intervention when all participants are grouped together. When separated by class, there is a significant decrease in weight bias in the activity and health course only. This was contrary to our hypothesis, as we expected that the courses with more in-depth information on obesity and weight loss would display the biggest reduction in weight bias post-intervention. This may be due to the activity and health course holding the largest group of the three classes (n = 23), and so holding more statistical power. When separated by gender, females show a significant improvement in both internalized weight bias and perceived academic stress from pre to post intervention. Additionally, when separated by gender and class, females from the Activity and Health course (100) and the Exercise Physiology course (300) showed a significant decrease in WBI scores and females from the Exercise Physiology course showed a significant decrease in Academic Stress scores. Though not statistically significant, the males that submitted both pre and post intervention surveys in both classes saw an increase in both WBI and academic Stress scores. Consistent with our findings, one study shows that female college students often exhibit higher levels of life stress, but also utilize more coping strategies than males, leading to greater short-term release of stress (53). The results of this study suggest that education on obesity and weight loss may be helpful with internalized weight bias reduction when coupled with coping strategies for stress.

Few studies like ours evaluate the relationship between perceived academic stress and internalized weight bias. Some studies focus on the relationship between academic stress and eating habits or disordered-eating pathologies. One study similar to ours evaluated the prevalence of eating disorder pathologies at times of academic examination stress and found that periods of examination stress were significantly correlated with body image, low self esteem and restricted eating (54). Studies which evaluate weight bias similar to ours often evaluate the effects of life stresses such as acculturative stress, job stress, and peer stress rather than academic stress (36, 37, 43). Our results in combination with results from the literature suggest that further research should be conducted on the impact of academic stress management and coping mechanisms on weight bias internalization in college students.

One possible limitation to this study is the small number of participants who completed the pre and post surveys (n=43). The small size limits the ability to reflect the larger population. Another limitation is the majority of white (83%), female (69%) and freshman (41%) participants. Future studies should include more diverse sample populations in order to reach clearer conclusions.

In summary, the results of this study indicate that there is a significant positive correlation between perceived academic stress and internalized weight bias in undergraduate students. These findings are especially strong in females. Additionally, education on obesity and weight loss may be helpful with internalized weight bias reduction when coupled with coping strategies for stress.

Appendix

The following figures contain the validated study tools (LASRS-2 and the Modified Internalized Weight Bias Scale) used to create the Google Form survey which was distributed to the participants in this study.

SIDE A

Lakaev Academic Stress Response Scale-2 (LASRS-2) Questionnaire[1]

Instructions for Lakaev Academic Stress Response Scale-2 (LASRS-2):
The following questions ask about how you have been coping in **the last 7 days**. For each question, mark (☒) the option that best describes the amount of time you felt this way about your academic studies.

CLINICIAN USE ONLY

Please Circle Your Current Academic Level:

School: | Yr6 | Yr7 | Yr8 | Yr9 | Yr10 | Yr11 | Yr12 |

TAFE / Vocational Institution: | Certificate I | II | III | IV | Diploma | Degree |

University/College: **Undergraduate**: Yr 1 | Yr 2 | Yr3 | Yr 4 | **Masters**: Y1 | Yr2 | **PhD:** Yr1 | Yr2 | Yr3 | Yr4 | Yr5 | Other?__________

Post Doctoral: Yr 1 | Yr 2 | Yr 3 | Yr 4 | Other?__________ Associate Professor | Professor | Other? __________

	Question	None of the Time 1	A Little of the Time 2	Some of the Time 3	Most of the Time 4	All of the Time 5	A	B	C	P
1	I had trouble concentrating in class									
2	I used alcohol, drugs or socializing to avoid anxiety/stress									
3	I wanted to sleep all the time or slept all day									
4	I felt I was lazy when it came to university/college/school work									
5	I feel overwhelmed by the demands of study									
6	There is so much going on that I can't think straight									
7	My emotions stop me from studying									
8	I felt uncomfortable in the stomach									
9	I have trouble remembering my notes									
10	I avoided class									
11	I couldn't breathe									
12	I had headaches									
13	I procrastinated on assignments									
14	I yelled at family or friends									
15	I felt worried about coping with my studies									
16	I stayed away from friends and/or family									
17	My hands were sweaty and/or trembling									
18	I have had a lot of trouble sleeping									
19	I was unable to study									
20	I felt angry about unreasonable demands being asked of me									
21	I was distracted in class									
22	I felt emotionally drained by university/college/school									
23	I felt anxious/stressed by university/college/school									
24	My work built up so much that I felt like crying									
25	I had difficulty eating									
26	My heart pounded									

CLINICIAN USE ONLY	Add each column to gain the respondent's *Individual Domain Raw Score*	Four Domain Scores					
	Add the Four Domain Scores together to gain the respondent's *Overall LASRS-2 Total Raw Score*	LASRS-2 Total Score					

[1]Lakaev, N. (2021). *Refinement of the Lakaev Academic Stress Response Scale (LASRS-2) for Clinical & Educational Settings using Rasch Modeling* [Doctoral Candidate]. Monash University.

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Figure 11: The Lakaev Academic Stress Response Scale (50).

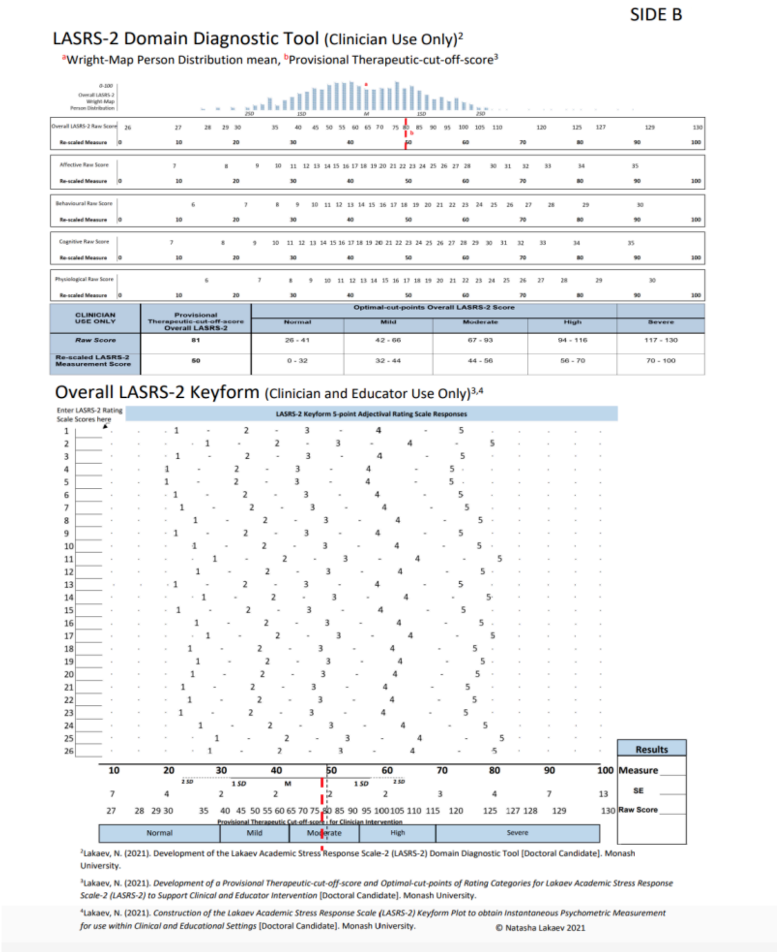

Figure 12: The Lakaev Academic Stress Response Scale Keyform(50).

Please answer the following questions using this scale:

1	2	3	4	5	6	7
Strongly disagree	**Disagree**	**Slightly disagree**	**Neutral**	**Slightly agree**	**Agree**	**Strongly agree**

______1. As an overweight person, I feel that I am just as competent as anyone.
______2. I am less attractive than most other people because of my weight.
______3. I feel anxious about being overweight because of what people might think of me.
______4. I wish I could drastically change my weight.
______5. Whenever I think a lot about being overweight, I feel depressed.
______6. I hate myself for being overweight.
______7. My weight is a major way that I judge my value as a person.
______8. I don't feel that I deserve to have a really fulfilling social life, as long as I'm overweight.
______9. I am OK being the weight that I am.
______10. Because I'm overweight, I don't feel like my true self.
______11. Because of my weight, I don't understand how anyone attractive would want to date me.

Figure 13: The Modified Internalized Weight Bias Scale (51).

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