

Positive Emotions, Stress from Pain and Danger, and Daily Sleep Negatively Affect BMI in College Age Males

Introduction

A person's body mass index (BMI) may be impacted by many different factors. The goal of this research project is to determine specific behavioral and/or physical findings that correlate with BMI. We focused on three factors that we believe may play a key role in determining BMI: stress, emotional eating and physical activity (Barrington, et. al, 2012). Research has shown that those with a high BMI are at greater risk for developing diabetes, cardiovascular disease, musculoskeletal disorders, and some cancers (Craggs-Dino, 2017). Having a high BMI can also potentially raise blood cholesterol and triglycerides; lower high-density lipoprotein and raise low-density lipoprotein; increase blood pressure; and much more. The more knowledge we have about factors associated with increased BMI, the more health care providers can do to help control it.

Stress is an emotional, mental or physical factor that causes bodily or mental tension (Toppler, 2016). Stressors may come internally or externally. Internal stress may derive from a sickness or surgery. External stress may come from a social situation, the environment, or physiological damage. When the "fight or flight response" is triggered by stress, the hypothalamus communicates with the sympathetic nervous system. The body becomes very alert, speeds up, and tenses up. Epinephrine (adrenaline) and norepinephrine (noradrenaline) are released into the bloodstream. These are "stress hormones", which trigger several changes in the body; specifically, increased heart rate and blood pressure (Klein, 2013).

Many children and adults use food as a way to cope with their stress and anxiety. The foods they tend to consume are high in sugar and unhealthy fats. Obese and non-obese children under the age of three have about equal chances becoming obese adults if they have normal-weight parents. However, if the child's parent is obese, the risk of being them becoming obese as an adult almost triples for the non-obese toddler, and quadruples for the obese one. The percent of children with obesity is continuing to grow at an alarming rate (University of Washington, 1997).

Several studies have looked at stress, emotional eating and activity in relation to BMI. The first randomized study was completed in the Seattle metropolitan area and demonstrated that stress was correlated with a higher weight. This study included 621 working adults. The results of this study were that higher levels of perceived stress were associated with lower levels of eating awareness, physical activity, and walking. Also, the participants who reported a higher level of stress did not consume as many fruits or vegetables, and had a higher consumption of fast food (Barrington, 2012). Another study analyzed scientific articles to determine the effects of exercise on body mass index (BMI). The article reviewed papers from 1990 through 2012 with participants between the age of 2 to 18. The results of the 4,999 citations reviewed was that exercise significantly decreases overweight and obesity of children and adolescents (Kelley, 2009). However, college students may have very different lifestyles so generalization from these studies is difficult.

A third study demonstrated that stress and emotional eating had a significant relation to BMI. This study found a positive correlation between compulsive eating and stress. As stress increases, so does food consumption. Our studies were similar, because we both used the Stressful Situations Questionnaire

to determine what role stress played on weight status in college students. They used the Compulsive Eating Scale in order to measure uncontrollable eating patterns of the participants. We differ from this study, because we studied participants at a public college, rather than a private Christian liberal arts college (Gower, et. al, 2017). We are also specifically examining college males, because of the limited research done solely on this group of individuals.

The last study we reviewed found that emotional eating in college students does play a role with an increased BMI (Nolan, 2017). The 232 male and female participants that participated showed that the college student's BMI increased with answers that reported a higher negative emotional response. This study showed that there was no difference between the male and females on negative emotion. Both men and women in this study ate more when dealing with positive emotions. However, women did score higher on the Dutch Eating Behavior Questionnaire which measures restrained eating, emotional eating, and external eating. Our study differs from this one, because while we also examined how stress and exercise play a role in BMI, it has a very specific target, which is 18-24-year-old males. We conducted the study on a public college in Oklahoma, which is located in the south rather than the North East. Comparing colleges with different locations may potentially give different results, due regional differences in diet behaviors, climate, and culture.

We hypothesized that students who exercise less, eat more when in emotional situations, and are very stressed will tend to have a higher BMI (Kelley, 2009). Research has shown that stress can increase food consumption and it can play a significant role in the hormones in your body, which may lead to being overweight or obese (Gower, Hand, & Crooks, 2017). Stress may also lead to a higher BMI due to bingeing on food, because of emotional eating. Lack of exercise can also contribute to a higher BMI.

Methods

Participants:

We had 48 male participants aged 18-25 in the study. We did not include students for our study that demonstrate the following: disability affecting mobility, medical conditions such as diabetes, kidney disease, cardiac disease, liver disease, or people that have had transplants. Our study was approved by the Institutional Review Board prior to asking people to participate.

Procedure:

The study involved recruiting students from classes and from a university wide research recruitment program. The recruiters asked the students to participate in the study, and they passed out a piece of paper in the classrooms for the students to write down their names and phone numbers. They were then contacted, in order to set up a meeting time for them to come to a lab, located in Human Sciences. Students received extra class credit for participating. Participants were assigned a number in order to keep information private

When participants arrived for their visit, they read the consent form and asked to sign. Before anthropometric measures were taken, the students were asked to remove bulky clothing, such as jackets, shoes, and sweatshirts in order to get an accurate weight for the individuals. After their weight was recorded, the height was taken. Their height was measured in inches down to 1/8 of a cm with the ShorrBoard by Shorr Productions from Onley, Maryland. The weight was measured with a floor scale by Seca from Chino, California in pounds to one decimal place. Lastly, they were asked to complete the three questionnaires. BMI was calculated by using the BMI calculator on the National Heart, Lung, and Blood

Institute website. We also used the BMI categories from this website as well (National Heart, Lung, and Blood Institute, 2017).

Measures:

Three questionnaires were used to evaluate our participants and were developed with college students. These included the Physical Activity Scale (PAS), The Emotional Appetite Questionnaire (EMAQ), and the Stressful Situations Questionnaire (SSQ).

The PAS 2.1 measured the average daily hours of sleep, sitting or lying, standing or walking, strenuous work, cardio, and hours spent watching TV or a leisurely activity. PAS also determined the weekly minutes of strenuous, moderate, and light physical activity (Anderson, 2010). It covered 9 areas, and had numeric responses (hours/minutes). The original version was validated against accelerometer, physical activity logs and maximum oxygen uptake (Aadahl, M., et al., 2017). For a sample of the PAS, refer to Appendix B.

The EMAQ (Nolan, Halperin, Geliebter, 2017) contains 22 questions concentrating on how often the participants eat after dealing with positive or negative stimuli. There were 14 questions that covered the negative emotions or situations, and 8 questions that cover the positive emotions or situations. The participants answered the EMAQ on a 9 point Likert-type scale, with “Much less” being 1, “The same” being near 5 and 6, and “Much more” being 9. There was also the option to select “not-applicable” or “don’t know”, in which these answer choices were excluded from the analysis. The emotion and situation scores are added to yield the overall positive or negative EMAQ score. The EMAQ has been shown to have high test-retest reliability and to have a Cronbach’s α of a .65 and .57 positive EMAQ respectively and .78 and .75 for the negative EMAQ, and (Geliebter & Aversa, 2003). In our sample, the Cronbach’s alpha for the positive emotion and situation was .83 and .45 respectively and the Cronbach’s alpha for the negative emotion and situation was .68 and .81 respectively. For a sample of the EMAQ, refer to Appendix C.

The SSQ was used to determine the amount of stress that the individuals undergo in specific situations. This questionnaire asked 45 simple questions with a rating of “None at all”, “Slight”, “Moderate”, “Considerable”, and “Extreme” on a scale of 1-5 respectively. Hodges and Felling(1970) did not report reliability. Validity was shown through associations with trait anxiety measures and with the Combined Stressful Situations Questions score (Gower, Hand, & Crooks, 2008). The SSQ has 4 factor scales; pain and danger, class anxiety, social anxiety, and dating. The pain and danger section consisted of 13 questions, including on bleeding profusely from a cut, seeing a dog get ran over by a car, and having a cavity filled. There were 8 questions in the class anxiety section. Examples of this were giving a speech in front of the class and asking a teacher to clarify a question. Social anxiety consisted of 12 questions asking about stress when belching in front of class, forgetting the lines in a school play, and being refused a membership in a social club. There were only 4 questions in the dating section. It asked about stress levels when going on a blind date or kissing a date for the first time. The Cronbach’s alpha for the pain and danger is .720. The class anxiety has a Cronbach’s alpha of .601. Social anxiety was .777 and dating was .359. to Appendix D for a sample of the SSQ.

Statistical analysis:

We used the program IBM SPSS statistics version 23.0 to analyze the results. We measured the frequencies and descriptions as appropriate for all our variables. We also assessed the skewness of the continuous variables. We measured the bivariate Pearson correlations as skewness was limited, to identify

demographic or scale variables related to BMI. We used backward regression with BMI as the dependent variable and independent variables identified in the previous step (sleep, positive emotion and pain/danger related stress). A $p < 0.05$ was set as significant.

Results:

The average age of the male participants was 20.3 years, with a standard deviation of 1.6. The average hours of those students who worked; was 18.0 hours per week, with a standard deviation of 8.3. Table 1 demonstrates the demographics collected in the study. Relations between these variables and BMI were explored but no significant relations were found.

Table 1: Demographics n=48

	Number	Percent
Race		
White	36	75.0
Black	5	10.4
Hispanic	3	6.3
Native American	0	0.0
Other	5	8.3
Class Rank		
Freshman	17	35.4
Sophomore	8	16.7
Junior	13	27.1
Senior	10	20.8
Marital Status		
Single	46	95.8
Married	2	4.2
Work While Taking Classes		
Y	26	54.2
N	22	45.8

The average BMI was 25.7, with a minimum of 17.9, maximum of 32.9, and a standard deviation of 3.8. Table 2 presents the distribution of participants in BMI categories.

Table 2: Frequency of BMI Categories. N = 48

BMI Categories	Frequency	Percent
Underweight <18.5	1	2.1
Normal-weight 18.5-24.9	18	37.5
Over-weight 25-29.9	22	45.8
Obese >30	7	14.6

Questionnaire Results

The following section summarized the responses to the three questionnaires. There was one significant relation with BMI found in each questionnaire, as indicated by italics. Table 3 describes the average activity level of the participants.

Table 3: Activity of participants

Activity	Mean (min)	Standard Deviation
Daily		
Sleep	440.7	65.8
Sedentary Work	236.5	175.4
Standing or Walking	134.3	123.4
Heavy Physical Work	100.6	144.5
Bicycle	57.5	69.7
TV/Sitting/Reading	166.7	109.3
Weekly		
Light Activity	253.1	231.8
Moderate Activity	222.5	234.6
Strenuous Activity	289.6	263.8

Table 4 shows the correlation and p value of the different activity of participants in our study and BMI.

Table 4: Correlations between PAS and BMI

Activity	correlation coefficient	p value
<i>Daily sleep</i>	-3.45	.016
Sedentary work	-.154	.296
Standing or walking	.066	.657
Heavy physical work	-.041	.780
Bicycle hours	-.131	.375
TV/ sitting/ reading	-.184	.212
Light Activity	-.124	.400
Moderate Activity	-.016	.914
Strenuous Activity	.082	.580

Table 5 presents the mean and standard deviation of the EMAQ questionnaire.

Table 5: EMAQ Descriptive Statistics

EMAQ Scales	Mean	Standard Deviation	Maximum score
Positive emotions	25.7	3.8	45
Negative emotions	42.5	5.8	81
Positive situation	16.3	2.9	27
Negative situation	20.4	7.6	45
Positive all	42.8	7.2	72
Negative all	62.9	15.1	126

Table 6 shows the correlation coefficient and p value of the EMAQ questionnaire.

Table 6: EMAQ Results

EMAQ Scales	correlation coefficient	p value
<i>Positive emotions</i>	-.409	.004
Negative emotions	-.072	.629
Positive situation	-.100	.499
Negative situation	-.177	.428
Positive EMAQ	-.367	.010
Negative EMAQ	-.014	.926

Table 7: SSQ Descriptive Statistics

SSQ	Mean	Standard Deviation	Maximum score
Pain and Danger	33.2	7.7	51.0
Class Anxiety	17.9	5.8	36.0
Social Anxiety	36.2	6.9	53.0
Dating	11.6	4.2	28.0

Table 8 demonstrates the correlation coefficient and the p value of the SSQ questionnaire in the study.

Table 8: SSQ Results

SSQ	Correlation Coefficient	P value
<i>Pain and danger</i>	-.317	.028
Class anxiety	-.040	.785
Social anxiety	-.138	.350
Dating	-.250	.087

To evaluate the overall effect of the three identified variables on BMI, a regression model was tested. The Model had an r of .576, an r^2 of .332, adjusted r^2R of .287, and a $p < 0/000$. Table 9 presents the individual variables contribution to the model.

Table 9: Activity, Positive Emotion, and Pain and Danger's contribution to subjects BMI

Variable	B	Std. error	Beta	t	Sig.
Constant	43.988	4.085		10.768	.000
Positive Emotions	-.201	.083	-.307	-2.411	.020
Daily Sleep	-.018	.007	-.310	-2.433	.019
SSQ Pain and danger	-.154	.061	-.315	-2.519	.015

Discussion:

We evaluated how many different factors affect 48 male college students' BMI. We had a comprehensive distribution of BMI in our study. We found that daily sleep, positive emotions, and pain and danger had a negative correlation with BMI. Daily sleep, positive emotions, pain and danger all contributed about equally in the study accounting for about one third of the variance in BMI.

We anticipated based on other studies that more stress would cause a higher BMI (Barrington, 2012). We did not however think that more stress can relate to a lower BMI. Thus, our findings that having higher stress in situations dealing with pain and danger are very interesting. We were also surprised to find that emotional eating is more prominent when it is in a positive situation. The results from the PAS 2.1 were also very surprising. In this study the only activity that showed a significant correlation was sleep.

The study conducted by Barrington in 2012 in the Seattle metropolitan area found that stress was negatively correlated with a higher weight. Our study differs from this one, because we only found stress to be correlated in negative way with BMI. The stress that specifically triggered a lower BMI was related to pain and danger. An article we reviewed found information that agreed with what we found. A sample of 32 adults found that a higher anxiety sensitivity was associated with greater calorie consumption overall in women, but men actually consumed less (Hearon, 2014).

The 232 male and female study that we reviewed has similarities and differences from our findings (Nolan, 2017). Their study showed that college student's BMI increased with answers that reported a higher negative emotional response, whereas ours had a negative association between BMI and positive emotions.

The results of a study that reviewed 4,999 citations found that exercise significantly decreases overweight and obesity of children and adolescents (Kelley, 2009). However, in male college students, we saw no difference in BMI based on physical activity. We did find that daily sleep does play a significant role. A study that included 14,906 participants found that longer habitual sleep duration may be associated with a lower BMI and possibly age and sex specific dietary behaviors. They also found that the "influence of obesity-associated Circadian Locomotor Output Cycles Kaput variants on the association between sleep duration and macronutrient intake suggests that longer habitual sleep duration could ameliorate the genetic predisposition to obesity via a favorable dietary profile". (Dashti, 2015)

In the study done with Gower, they decided at the end to separate the men and women to see the differences. They saw that the men had a significant relation to stress and food consumption and the women did not. They said that this might be because women are more likely to turn to friends or family in stressful situations and men are not. We think that in the future it would be more accurate to separate the male and female's responses.

The limitations of this study are that we only had 48 participants, and a larger sample size would give us a better representation of the college. We also only did college students that were a certain age, and could give us a misrepresentation of how someone would respond post college. We also only asked people in Stillwater, Oklahoma which could provide different results than another state or region in America. Something that we would do differently would be to measure body composition. BMI often times gives a misinterpretation of a person's health, because it does not bring muscle mass into account.

In conclusion, positive emotion, more daily sleep, and stress when dealing with pain and danger are all negatively associated with BMI. I believe that more research needs to be done with how positive emotions affect BMI, specifically differentiating males and females. I also think that much more research should be done on the effect of pain and danger and stress.

Subject Number: _____

Appendix A:

Please fill out each of the following.









Age: Years _____ Months _____ Race _____

Gender _____ Class rank _____ (freshman, sophomore, junior, senior)

Major _____ Marital Status _____

Do you work while taking classes? _____ If yes, how many hours per week? _____

Appendix B:

9. Physical activity in everyday life The following questions deal with your daily physical activity at work, at home and during your leisure time. Therefore, this includes more than sports and exercise. It includes all types of physical activity and inactivity that you perform in everyday life.			
Daily 	How many hours and minutes do you sleep on an average weekday <i>(include rest or naps during the day)</i>	[] [] Hours	[] [] Minutes
Daily 	In your work/studies *, how many hours and minutes per day do you engage in: Sedentary work? Standing or walking work?  Heavy physical work? <i>(for instance heavy lifting or climbing stairs)</i> Not working <input type="checkbox"/>	[] [] Hours [] [] Hours [] [] Hours [] [] Hours	[] [] Minutes [] [] Minutes [] [] Minutes [] [] Minutes
Daily 	How many hours and minutes per day do you ride a bicycle or walk for transportation to and from work? Not working <input type="checkbox"/>	[] [] Hours	[] [] Minutes
Daily 	In your leisure time , how many hours and minutes per day do you spend with watching TV, sitting quietly, reading, and listening to music or the like?	[] [] Hours	[] [] Minutes
Weekly 	In your leisure time , how many hours and minutes per week do you engage in light physical activity such as walking, light cleaning, <u>raking lawn</u> , or lightly strenuous exercise such as yoga, bowling or similar activities? <i>(do not include transportation to and from work)</i>	[] [] Hours	[] [] Minutes
Weekly 	In your leisure time , how many hours and minutes per week do you engage in gardening, <u>carrying loads upstairs</u> or moderately strenuous sport such as gymnastics, <u>swimming</u> , <u>bicycling</u> , strength conditioning or similar activities? <i>(do not include transportation to and from work)</i>	[] [] Hours	[] [] Minutes
Weekly 	In your leisure time , how many hours and minutes per week do you engage in strenuous sport and conditioning exercise such as running, jogging, soccer, tennis, aerobics or similar activities? <i>(do not include transportation to and from work)</i>	[] [] Hours	[] [] Minutes

*Underlining mark revision from PAS 2 to PAS 2.1.

Appendix C: The following refer to EMOTIONS:

When you are _____ As compared to usual, do you eat:

	Much less				The Same				Much more	NA	Don't Know
	1	2	3	4	5	6	7	8	9		
Sad											
Bored											
Confident											
Angry											
Anxious											
Happy											
Frustrated											
Tired											
Depressed											
Frightened											
Relaxed											
Playful											
Lonely											
Enthusiastic											

The following refer to SITUATIONS:

As compared to usual, do you eat: Much less The same
 Much more

	Much less				The Same				Much more	NA	Don't Know
	1	2	3	4	5	6	7	8	9		
When Under Pressure											
After a heated argument											
After a tragedy of someone close to you											
When falling in love											
After ending a relationship											
When engaged in an											

enjoyable hobby											
After losing money or property											
After receiving good news											

Appendix D: Subject Number: _____

Situations Questionnaire (SSQ)

Everyone is faced with situations in life that makes one feel more or less apprehensive. Below is a list of situations that you may have experienced or might be placed in some day. First, read through the entire list; then, for each situation, indicate at the left the number that best describes the degree of apprehensiveness or concern you have felt or believe you would feel if in that situation. Do not skip any items. Work rapidly and put down your first impression.

- 1 = None at all
- 2 = Slight
- 3 = Moderate
- 4 = Considerable
- 5 = Extreme

- ____ 1. Going on a blind date.
- ____ 2. Asking someone for a date to a party.
- ____ 3. Seeing someone bleed profusely from a cut arm.
- ____ 4. Asking a teacher to clarify an assignment in class.
- ____ 5. Giving a speech in front of class.
- ____ 6. Introducing a friend and forgetting his name.
- ____ 7. Putting iodine on an open cut.
- ____ 8. Having someone angry at you.
- ____ 9. Taking a test that you expect to fail.
- ____ 10. Seeing a dog run over by a car.
- ____ 11. Walking in a slum alone at night.
- ____ 12. Giving blood at the Blood Bank.
- ____ 13. Riding in an airplane in a storm.
- ____ 14. Being present in a storm at an operation or watching one in a movie.
- ____ 15. Belching aloud in class.
- ____ 16. Having a tooth cavity filled.

- ___ 17. Climbing too steep a mountain.
- ___ 18. Paying respects at the open coffin of an acquaintance.
- ___ 19. Being refused membership in a social club.
- ___ 20. Asking a question in class.
- ___ 21. Doing poorly in a course that seems easy to others.
- ___ 22. Reciting a poem in class.
- ___ 23. Having your date leave a dance with someone else.
- ___ 24. Reciting in language class.
- ___ 25. Finding the questions on a test extremely difficult.
- ___ 26. Having to ask for money that was borrowed from you.
- ___ 27. Forgetting lines in a school play.
- ___ 28. Riding a car going 95 miles per hour.
- ___ 29. Asking a teacher to explain the grading of your test.
- ___ 30. Getting hurt in a fight.
- ___ 31. Telling an uninvited guest to leave a party.
- ___ 32. Passing a very bad traffic accident.
- ___ 33. Being the only person at a party not dressed up.
- ___ 34. Introducing yourself to someone attractive of the opposite sex.
- ___ 35. Spilling your drink on yourself at a formal dinner party.
- ___ 36. Having an interview for a job.
- ___ 37. Volunteering an answer to a question in class.
- ___ 38. Getting back a test you think you may have failed.
- ___ 39. Skiing out of control.
- ___ 40. Asking the person behind you to stop kicking your seat.

- ___ 41. Kissing a date for the first time.
- ___ 42. Asking a teacher to explain a question during a test.
- ___ 43. Asking people in a study room to make less noise.
- ___ 44. Being in a difficult course for which you have inadequate background.
- ___ 45. Participating in a psychology experiment in which you receive electric shock

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