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The Association Between Sleep and Body Mass Index (BMI) in College Freshmen at Utah State University

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THE ASSOCIATION BETWEEN SLEEP AND BODY MASS INDEX (BMI) IN COLLEGE FRESHMEN AT UTAH STATE UNIVERSITY

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ABSTRACT

Background: Obesity has become a major health problem with increasing prevalence in the United States. Cases of obesity have increased at alarming rates and have almost doubled over the past 40 years. During this same period of time, sleep duration for all age groups has significantly declined. Because sleep duration is a potential mediator of energy metabolism and body weight, it is an important aspect of health. An association between short habitual sleep time and increased body mass index (BMI) has been reported in large population studies for US young adults. Freshmen college students may encounter many environmental and emotional changes that may lead to sleep deprivation. Perhaps, it is sleep deficit within college freshmen that contributes to the phenomena of "The Freshmen 15", which suggests that college freshmen often gain weight during their first year of college.

Objectives: The purpose of this study was to determine the relationship between sleep duration and body mass index (BMI) in a subset of college freshmen at Utah State University during their first academic year.

Methods: The "USU Freshmen Health Study" (PI: Heidi Wengreen, PhD, RD) provided all the data needed to study the relationship between sleep duration and BMI. As such, three data collections during the academic year of 2005-2006 were conducted for 186 college freshmen students, ages 18-19, at Utah State University. The data collections occurred during the beginning of fall semester, the end of fall semester, and the end of spring semester. Participants were asked to report an estimate of their average sleep duration for weekdays and weekends during each data collection period. BMI (kg/m^2) was calculated based on measured weight and heights, which were measured during each of the three data collection periods.

Results: No significant changes in average sleep or average BMI were seen between each data collection for this population. Therefore, the overall mean duration of sleep was 7.33 hours per night while the mean BMI was 23.48. At baseline, shorter sleep duration was correlated with higher BMI among men but not women ($p=.021$ vs. $p=.738$). Average sleep duration was lowest in the first data collection compared to the second and third data collections (7.05 hours (SD=1.10), 7.42 hours (SD=1.12), 7.51 hours (SD=1.10), respectively), although these differences were not statistically significant.

Conclusion: This population of college freshmen students are not getting the recommended 8.5-9.25 hours of sleep, as outlined by the National Sleep Foundation for adolescents and teens (12-19 years of age). Sleep deprivation may be a potential risk factor for higher BMI at least among college freshmen males. Observed differences between men and women for sleep duration and its affect on BMI, may be the result of gender differences in physiology and hormonal regulation.

INTRODUCTION

In recent years, obesity has emerged as a major public health threat in the United States as well as other developed and developing countries around the globe. Despite the U.S. emphasis on healthy habits, the rates at which people are becoming [1]overweight and [2]obese are rapidly increasing. According to the 2003-2004 National Health and Nutrition Examination Survey (NHANES), an estimated 66% of U.S. adults are either overweight or obese ([3]BMI<=25 kg/m^2). Of this 66%, 32.9% (66 million) of adults were obese and 5% were extremely obese (1). In addition to the rising overweight and obesity rates in adults, data for children and adolescents show similar drastic inclines. In 2003-2004, 17.1% of children and adolescents 2-19 years of age (over 12 and a half million) were overweight (2).

Particularly important for the purposes of our research is the estimated 27%-35% of college students whom are overweight or obese (3, 4). Traditionally, college students represent a population of older adolescents/young adults that bridge the gap between the 17.1% overweight children to adolescents and the 66% overweight adults. For many, the transition from high school to college defines the transition from adolescence to young adulthood. This transition in life-stage is often characterized by changes in environment and behavior that may include moving away from home to live with other roommates, working a full-time job, and/or attending college. Studies have shown that the transition

1. **Overweight** refers to an excessive amount of body weight compared to set standards. The excess weight may come from muscle, bone, fat, and water.
2. **Obesity** specifically refers to an excess amount of body fat.
3. **BMI** stands for **Body Mass Index**. It is a recommended way to measure body fat in most individuals. BMI assesses body weight relative to height. BMI equals weight in kilograms divided by height in meters squared, or **BMI=(kg/m^2)**

   BMI <18.5 are considered *underweight*
   BMI 18.5-24.9 are considered *normal*
   BMI 25-29.9 are considered *overweight*
   BMI >29.9 are considered *obese*

from adolescence to young adulthood poses acute and sometimes dramatic changes that increases one's risk for developing obesity (5). For example, The Behavioral Risk Factor Surveillance Study, conducted between 1991-1997, showed the greatest increase in obesity rates was found among 18-29 year olds and those with some college education (6).

As further evidence that this transition poses vulnerability to weight gain, researchers of the Add Health Study followed a nationally represented sample of almost 10,000 teenagers through the transition from adolescence to young adulthood for 5 years. By the end of the 5-year study, 22% of the then 19-26 year olds were obese including 1165 or 12% who had converted from a healthy weight at the baseline interview in 1996 to a status of overweight at the follow-up (7).

The USU Freshmen Health Study, as well as other similar studies, have have been conducted to address the phenomenon of the "Freshman 15", which is a general belief that freshmen will gain 15 pounds of weight during the first year of college (7,8). Several research groups have examined this trend and most (9-13), but not all (8), report weight gain ranging from less than one pound after 6 months to 8.52 pounds after the entire first year of college.

In order to further understand the impact of the "Freshmen 15" at a local level, the USU Freshmen Health Study aimed to gather health-related information from a subset of incoming USU Freshmen during the 2005-2006 academic year. The objectives of the Freshmen Health Study were to:

1) Document weight and weight change among college freshmen during their first year at Utah State University,

2) Examine Change in dietary intake and physical activity behaviors among freshmen during the transition from high school to college,

3) Examine quality of diet in freshmen based on age and gender specific intake recommendations for nutrients and food groups,

4) Examine factors associated with weight gain among freshmen during their first semester and year of college; such as diet, physical activity, eating attitudes, sleeping patterns, living environment, family history of overweight and obesity, and other health and environment factors,

5) Examine biomarkers of chronic disease risk among freshmen including serum lipid levels (total cholesterol—TC), high-density lipoproteins (HDL), low-density lipoproteins (LDL), very low-density lipoproteins (VLDL), triglycerides (TG), and total cholesterol: HDL ratio, waist-circumference, and blood pressure.

By utilizing data from this health study, the association between sleep duration and body mass index (BMI) were examined. Several studies have shown sleep duration to be a potential regulator of body weight and energy metabolism (14,15). As sleep patterns are often significantly altered among college freshmen, this could be a potential habit that contributes to rising obesity rates, especially among this population. Because sleep duration helps to regulate body weight and energy metabolism, the objective of this paper is to examine associations between sleep duration and body mass index (BMI) among participants of the USU Freshmen Health Study.

Literature Review—Sleep and BMI

Studies suggest that the transition from adolescence to young adulthood is often accompanied by weight gain (5,6). The "Freshmen 15" is a label given to describe this phenomenon of gaining weight during the first year of college that for most defines the life-stage transition from adolescence to young adulthood. There are several potential reasons for gaining weight during this transition. Environmental changes such as moving out of the house and living with other students onto a college campus is one such possibility. Others include changes in exercise habits; stressors associated with work, school, and extracurricular activities; changes in dietary habits as a result of purchasing inexpensive, convenience meals; increased caffeine consumption; and changes in sleeping habits. The change in sleep habits is of particular interest because of its association as a potential regulator of body weight and energy metabolism (14).

According to the 2004 National Sleep Poll as conducted by the National Sleep Foundation (NSF), sleep duration in the U.S. population has decreased by 1-2 hours in the past 40 years for all age groups. (17) Though all age groups within the United States experience sleep deprivation, the national statistics for persons during adolescence and young adulthood are alarming. The 2004 National Sleep Poll also found that the proportion of young adults sleeping fewer than 7 hours per night has more than doubled between 1960 and 2001-2002 (from 15.6% to 37.1%). During this same time period, the incidence of obesity nearly doubled (25). Despite the declining amount of sleep in this age group, NSF recommends that adolescents and teens (ages 12-19) get 8.5-9.25 hours of sleep per night (17). Alarmingly, 1/3rd of adolescents and young adults are not getting enough sleep and sleep deprivation has been associated with a myriad of negative consequences for health.

Metabolic and Hormonal Responses to Sleep Deprivation

As reported in large population samples, there is an association between short habitual sleep and increased body mass index (BMI) during young adulthood (15). Sleep is known to help regulate energy metabolism and body weight, and sleep deprivation disrupts the hormonal balance that is important for energy regulation. (14) Specifically, two appetite hormones Leptin and Ghrelin become imbalanced when inadequate sleep occurs. (14) Ghrelin is a stomach-derived peptide hormone that stimulates appetite. Leptin is an adipocyte-derived hormone that suppresses appetite. According to a recent study, researchers found that participants who habitually slept 5 hours or less had higher blood serum levels of ghrelin and lower blood serum levels of leptin than participants who slept 8 hours or more (14). Since ghrelin stimulates appetite and sleep-deprived participants have high levels of ghrelin, they are likely to eat more. These differences between leptin and ghrelin in those with shorter average sleep duration may help to explain the increased BMI observed among those with shorter sleep duration in other studies.

Another study that examined the relationship between leptin, ghrelin, sleep duration, and BMI also found that short sleep duration was associated with higher ghrelin and lower leptin levels. (16) However, this study also found that participants who underwent short sleep duration of 4 hours had a 33-45% increase in appetite for calorie-dense nutrients with high carbohydrate content such as fatty foods, sweets, salty snacks, and starchy foods. This increase in hunger for short-sleep participants was strongly correlated with the increased ghrelin-to-leptin ratio correlation coefficient (16). This finding of increased appetite because of increased ghrelin during sleep restriction,

suggests a reason for weight gain and higher BMI in people who habitually sleep less than the recommended amount.

In addition to imbalances in leptin and ghrelin , imbalances in Cortisol have also been observed among those with sleep deprivation (18). According to the American Medical Association, imbalanced levels of cortisol are one of many factors known to contribute to the development of type II diabetes. Cortisol is a stress hormone that helps to regulates blood sugar glucose concentrations. Prolonged sleep deprivation causes the body to continually release cortisol into the bloodstream. This causes blood glucose levels to increase, which results in the release of more and more insulin to lower the blood glucose level by causing glucose to be taken up by the cells. Over time, increased insulin production and high cortisol levels contribute to insulin resistance, which is a condition where cells no longer respond to insulin. Insulin resistance characterizes type II diabetes. Not only does increased insulin contribute to insulin resistance, increasing one's chances for diabetes, but through its role in regulating fat metabolism. That is, high levels of insulin may encourage the body to store fat and thus increase risk for obesity. (18)

It is important to note that sleep duration is one of many factors, such as diet, physical activity, and genetics that contribute to insulin resistance, type II diabetes, and obesity.

Sleep and Psychological effects that affect BMI

Sleep duration is not only important for hormonal regulation, but also for psychological health and cognitive performance. It is widely accepted that sleep deprivation negatively affects one's ability to complete cognitive tasks (19,20).

However, it is not so widely known how important sleep is for psychological health. According to the National Institute of Neurological Disorders and Stroke, sleep duration strongly influences the symptoms of mental disorders such as depression and schizophrenia (21). While extreme sleep restriction can lead to psychotic states of paranoia and hallucinations in otherwise healthy people, depressive illness is almost universally associated with disturbed sleep (18).

Though sleep deprivation is an effective therapy for people with certain types of depression, it is the cause for depression in several others (21). Major depression is associated with chronic elevation of the stress hormone, cortisol, which contributes to abdominal obesity (22). Therefore, if sleep disturbances lead to depression, and major depression is associated with abdominal obesity, then adequate sleep duration may be very important for psychological and physiological health. College students who do not get adequate sleep may be more likely depressed and, therefore, more prone to gaining weight.

Sleep Deprivation as a Physiologic Stressor that Leads to Other Diseases

A recently published study found that sleep deprivation serves as a stressor that increases allostatic load. (22) According to the article, allostatic load is the cumulative wear and tear on body systems caused by too much stress and/or inefficient management of the systems that promote adaptation through allostasis. Allostasis refers to "maintaining homeostasis through change". As the body and brain cope with stress and change, allostasis is the way that the body seeks to maintain balance of wear and tear on its systems. (22).

Therefore, as the body experiences a stressor such as chronic sleep deprivation, the body produces an allostatic overload that can have detrimental consequences. For example, sleep deprivation of 4 hours per night increases blood pressure, increases appetite (possibly due to increased pro-appetite hormone, ghrelin), increases energy expenditure, increases levels of proinflammatory cytokines, decreases parasympathetic and increases sympathetic tone, increases cortisol levels, and elevates blood glucose and insulin. These consequences of sleep deprivation lead to other long-term consequences and diseases such as type II diabetes, depression, hypertension, obesity, and cardiovascular disease (22).

During chronic sleep deprivation critical parts of the brain that control memory and emotion, such as the hippocampus, amygdala, and the prefrontal cortex, are negatively affected. It may be that these deleterious effects on the brain are a large contributor to the chronic diseases and long-term consequences mentioned above. For example, both type I and type II diabetes mellitus affect the hippocampus, a region of the brain sensitive to levels of insulin and glucose. Both types of diabetes are associated with cognitive impairment, which increases risk for Alzheimer's disease (22). Clearly, chronic sleep deprivation can have detrimental effects for developing terminal diseases.

Literature Review Summary

From a hormonal, metabolic, cognitive, psychological, and physiological perspective, adequate sleep is critical for health. The guidelines from the National Sleep Foundation suggest that teens sleep 8.5-9.25 hours per night, while adults should sleep 7-9 hours (17). Because the freshmen college participants in this study are 18-19 years of age, and still in their teens, they should be getting 8.5-9.25 hours of sleep. Obvious

benefits of adequate sleep include positive cognitive performance, mood, decreased likeliness of drowsy driving, and an overall positive effect on health (14). On the other hand, sleep deprivation is not only associated with weight gain and higher BMI, but with other long-term chronic diseases such as type II diabetes, obesity, and cardiovascular disease (18, 22). Therefore, adequate sleep is essential for maintaining body weight and energy metabolism (14).

METHODS

In Logan, Utah the USU Freshmen Health Study was conducted in order to assess the health habits of college freshmen in their first year in college. Associations between sleep duration and BMI are examined here. Participants for this study were 186 incoming USU college freshmen, ages 18-19, who were recruited on a voluntary basis during new student orientation in summer 2005 at USU. Each participant was given a T-Shirt and a $10 payment for attending each of the three required data collections.

During the academic school year of 2005, participants in the study attended a data collection within the first week of fall semester, the last week of fall semester, and during the last week of spring semester. During each data collection, students were given an extensive health questionnaire that addressed aspects such as eating habits, dietary intake, amount of sleep per night, ways for handling stress, exercise patterns, drug behaviors, dietary supplements, and an in-depth food-eating inventory. In addition to the questionnaire, measurements of weight, height, waist circumference, waist-hip ratio, body fat %, and blood pressure were measured by a trained research assistant. Weights were taken on a calibrated digital scale wearing light clothing and no shoes, while heights

were measured using a stadiometer. Body mass index (BMI) was calculated for each participate based on their weight and height (BMI= kg/m^2).

Within the first data collection, the Eating Attitude Test (EAT) as well as questions about family history of chronic conditions (such as overweight and obesity, diabetes, heart disease, Alzheimer's disease), medication use, birth measurements, and demographic and lifestyle characteristics were administered. The EAT is a standardized objective measure of symptoms and concerns characteristic of eating disorders. Students who had a score more than 20 were excluded from this study because it may indicate the presence of an eating disorder. For the purposes of this project, students in the first data collection were asked to report the average amount of sleep per night during their last six months of high school.

The second and third data collections included repeat assessments of diet, physical activity, and additional questions about medication use, demographics, and lifestyle. Within the third data sampling, a sample of blood was taken from each participant in order to examine biomarkers of chronic disease within the DNA as well as assess serum lipid levels. A critical difference in the second and third collections was that instead of reporting average sleep duration within a week, participants reported average sleep for weekdays and weekends.

Although 186 participants were chosen for this study, 67.7% or 126 completed all three data collections. The 33.3% drop-out of participants was affected by USU's 75% first year retention rate as well as several of the male participants who left for church-related service after the first semester. Others simply did not return for subsequent phases of the data collection.

For this specific inquiry on sleep and BMI, the duration of sleep recorded by each participant during each data collection was analyzed along with the calculated BMI from their measured weights and heights.

RESULTS

According to the self-reported data on sleep duration of 186 participants from the first data collection, average sleep duration during the last 6 months of high school was 7.05 hours per night (SD=1.10) with insignificant variance between men and women (See figure 1). From the 2nd collection, average week sleep duration was 7.42 hours while it was 7.51 hours in the 3rd collection. Average sleep duration was similar among men and women. As was expected, sleep reported on the weekends (Friday through Sunday) was significantly higher than average sleep reported for weekdays (Monday through Thursday) (8.2 hours versus 6.7 hours, wave 2 data). Similar results for weekday versus weekend average sleep duration were found for all three data collections.

Figure 1. Average Amount of Sleep per Night Reported by College Freshmen during their last 6 months of high school:

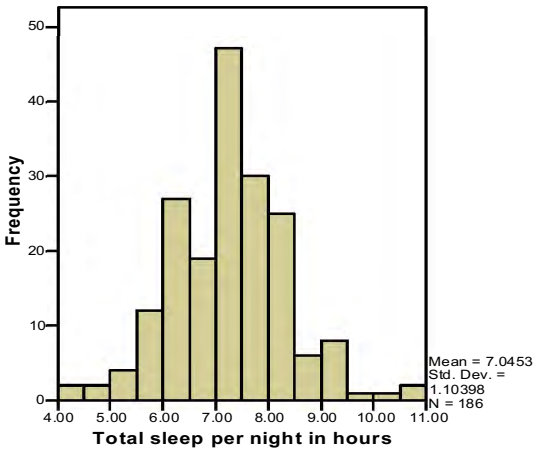
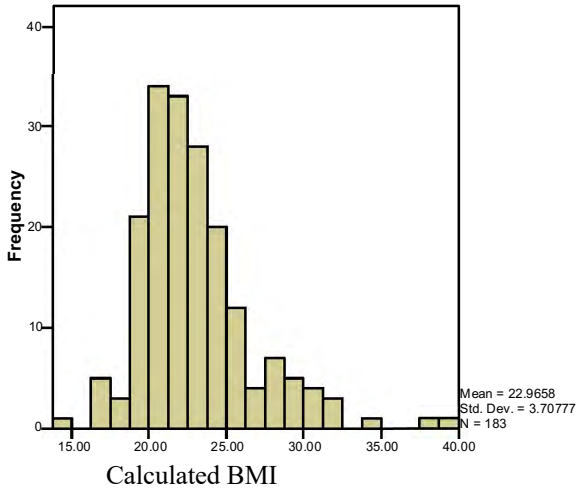


Figure 2. Calculated Body Mass Index (BMI) for College Freshmen at USU.



In figure 2, Body mass index (BMI) was calculated from measured heights and weights for participants within the first data collection. Average BMI was 22.97 (SD=3.71) with the mean slightly, but not significantly, higher in men (23.68 versus 22.60 in women). Participants were categorized into two groups representing those with BMI's <25 indicating a healthy weight, and those with BMI's ≥ 25 indicating being overweight. Although 39% of participants gained at least 2 kg of weight during their first year of college, relatively few participants gained an amount of weight that caused them to convert from a BMI of <25 to a BMI of ≥ 25. However, at all data collection phases and for participants of both genders, having a BMI of ≥ 25 was associated with shorter average durations of sleep. This association was statistically significant among men, but not among women. (See Table 1)

Table 1. Average Sleep Duration Among Normal Weight (BMI< 25) and Overweight Freshmen (BMI≥25) by Gender For All Three Data Collections.

Data Collection (Average Sleep in hours/night)	Men (n=67, 57, 40)			Women (n=114, 95, 78)		
	BMI<25	BMI≥25	P-value	BMI<25	BMI≥25	P-value
Aug. 2005	7.28 (*.92)	6.73 (*.84)	.02	7.03 (*1.19)	6.72 (*1.15)	.74
Dec. 2005	7.79 (*.79)	7.02 (*1.26)	.01	7.32 (*1.21)	7.23 (*1.67)	.77
May 2006	8.02 (*.71)	6.61 (*1.36)	.00	7.48 (*1.16)	6.91 (*.83)	.12

* indicates standard deviation.

DISCUSSION

Our study is among several that have assessed the health of freshmen college students in order to target factors that contribute to the "Freshmen 15". The results achieved from this study are similar to other studies conducted on college campuses for freshmen. In particular, our study found an association between shorter average sleep

duration and higher BMI in the men, but not the women. Another study, conducted with a sample size of 4486 adolescents, also found that sleep duration predicted risk of being overweight in males, but not females (23). It is interesting that our study and this larger population study discovered the same relationship of sleep and BMI in men, but not women. This larger population study concluded that this observation may be due to sex-related differences in the physiology of puberty. That is, there are hormonal differences between pubescent males and females that may account for these observations between sleep duration and BMI. (23)

Interestingly enough, another study examined gender differences of leptin hormone in adolescents, and found a strong positively correlated relationship between leptin levels and BMI and % fat mass for both sexes. Although leptin is a hormone that suppresses appetite, it may also be the mediator between fat mass, or energy storage in humans. (24) In mice, leptin communicates with the central nervous system to modulate sexual development and reproductive function. Therefore, it may have similar function for sexual development in humans. This research study found that adolescent girls experienced an increase in % fat mass during puberty, and this change in body composition was associated with elevated leptin levels. On the other hand, leptin concentrations declined for adolescent males as % fat mass decreased and lean body mass increased. (24) Although leptin concentrations declined in pubescent males, those with higher % fat mass presented higher leptin levels. Clearly, % fat mass is associated with higher leptin levels (24, 26). The study suggested that estradiol, as the prominent female hormone during puberty, stimulates leptin production whereas testosterone in adolescent males suppresses it. Because of these effects, leptin levels increase during puberty for

females but decrease for males (24). This physiological difference between the genders may account for trends of sleep duration and its affect on BMI.

As was discussed before, leptin is a hormone that suppresses appetite (14). If leptin levels increase in girls through adolescence, but decrease for males, we would expect males to have increased appetites (24). If sleep deprivation upsets the balance of leptin and ghrelin (14), possibly adolescents and young adult men would be more apt to eat more food because of higher levels of Ghrelin (appetite-stimulating hormone) and originally lower levels of leptin. On the flip side, college freshmen females who habitually have shorter sleep duration may have imbalanced levels of leptin and ghrelin. However, the way they respond may not be so much to increase appetite, as females already have higher levels of leptin appetite-suppressing hormone (24). There is a possibility that this physiological difference of leptin hormonal levels between men and women account for our observations of sleep duration and BMI.

On the other hand, elevated levels of leptin in men may suggest leptin resistance in the development of obesity and its associated disorders (26). Again, leptin levels decrease for males as they experience adolescence, but increase as body fat % increases (24). Although body fat % and leptin are strongly correlated, it may be leptin resistance rather than leptin production, that serves as a marker for further weight gain in overweight males (26). That is, if the body is resistant to leptin, an important appetite suppressing hormone, then further weight gain can be expected.

A follow-up study to evaluate how dietary and lifestyle factors are associated with leptin concentrations was conducted in men. (27) It found that increased physical activity was associated with lower leptin concentrations due to decreased body fat mass

and increased leptin sensitivity (27). Physical activity, therefore, is an important lifestyle factor for regulating % fat mass, and consequently, leptin hormonal levels.

Although associations between shorter sleep duration and higher body mass index have been observed for men, I predict that there are factors, other than sleep, that more strongly account for higher BMI in women. These other factors could be the amount of physical exercise she gets, her eating habits, drug use, home environment, and her genetics. Although these factors might also influence the BMI in males, our findings show that sleep duration may be a more prominent factor for BMI in men. The possible reason behind this is the known gender differences in concentrations of hormones that regulate appetite and energy balance.

CONCLUSION

Sleep deprivation may be a potential risk factor for higher BMI at least among college freshmen males. Although there were insignificant differences between sleep duration between men and women, it is interesting that body mass index was correlated with sleep deprivation in men, but not women. Shorter sleep duration and increased body mass index in men is explainable by sleep's important role in regulating concentrations of hormones known to modulate appetite and energy metabolism. Observed differences between men and women for sleep duration and its affect on BMI, may be the result of gender differences in physiology and hormonal regulation.

On the other hand, there are other factors that contribute to higher BMI in women that may not be associated with sleep duration. These factors may be due to genetics, environment, or habitual behaviors. As was discussed, the differences in leptin levels in women may somewhat "protect" them from having an increased appetite during sleep

deprivation. This explanation for the differences seen between men and women sleep durations and BMI are theoretical, and future research should clarify these hormonal associations.

Lastly, this population of college freshmen students are not getting the recommended 8.5-9.25 hours of sleep, as outlined by the National Sleep Foundation for adolescents and teens (12-19 years of age). Because sleep is an important regulator for energy metabolism and overall health, freshmen students should be educated about the importance of sleep.

Other college campuses have integrated short courses for freshmen students that include topics about healthy eating, balancing college stresses in healthy ways, and the importance of proper sleep hygiene. I suggest Utah State University integrate such a program for freshmen so that students can be aware of factors that affect their health. Battling the rising obesity epidemic in the United States is present, not because we do not know about it, but perhaps because we are not educated as to *how* to act or change our habits. The freshmen year of college, when students are adjusting to new environments, is a critical time to emphasize lifelong healthy habits.

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Biography on ***Mary-Marie Austin Sullivan***

***The Beginning through High School*:**
Mary-Marie Austin was born on July 31, 1984 in Logan, Utah at 7:38 A.M. Ever since her early morning birth, she has since enjoyed waking up early to sing, read, write, and exercise. She graduated from Mountain Crest High School in 2003 and left behind a record of student body leadership positions, a 3rd place ranking for girls tennis in the State, a 1st place award for the annual piano competition, a regional finalist Sterling Scholar for English, and other such honors. She continued to be actively involved at Utah State University in similar ways.

***College Major**:*
Mary initially planned on majoring in Piano Pedagogy and fulfilling premed requirements, but she realized that it would be quite stressful, and perhaps impossible, to do both in four years. Therefore, she kept her hobby of piano playing, and pursued a major in Liberal Arts and Sciences, with minors in biology and chemistry. In this perfect major, Mary has had opportunities to take many other classes outside of her premed science requirements.

***College Involvement**:*
Because of Mary's positive experiences at USU, she worked for 2 years on USU's New Student Orientation Staff as a student facilitator and mentor. Between orientation days in the summer, Mary enjoyed teaching tennis to children, teens, and adults in her community. She additionally enjoyed serving others as a teaching mentor for Human Anatomy in spring 2006. Mary spent a summer working as a literacy mentor for the USU Early Language and Literacy Project, traveling to daycares and teaching children to enjoy reading and learning.

Though Mary delights in working with children and college students through these jobs, she loves all ages of people and enjoys adopting "grandparents" as she serves elderly and terminally ill people as a hospice volunteer. She is interested in understanding other cultures and enjoys using some of her Spanish-speaking skills as a volunteer at the Cache Community Health Clinic, a free clinic for uninsured people in Cache Valley.

After working this last summer as an American Heart Association Fellow, she realized that working with heart cells extracted from mice was interesting, but not as meaningful as working on-on-one with other people. Despite her difficulty, at first, of spending the day in the lab doing experiments, she discovered that treating her lab-cultured heart cells as living organisms and giving them personalities made her work more meaningful…. And fun!

A meaningful project that Mary worked on for two years during her college experience was her in-depth research involvement with the USU Freshmen Health Study. Her honors senior thesis on sleep duration and body mass index in freshmen students was derived from this study. In addition to completing her senior thesis, Mary also enjoyed serving the Honors program as the pioneering hiking instructor for two years for its newly offered hiking class (see picture—she is on the far left with 2 braids).

Honors Societies and Award::

Mary is currently involved as an officer for the Alpha Epsilon Delta (AED) premedical service society. She was recently inducted into the Phi Kappa Phi National Honors Society as the top selected student from the College of HASS. In April 2006, she received the Helen B. Cannon Award for her senior thesis, and also the American Heart Association Summer Undergraduate Research Fellowship. She is an advocate of good health and even organized two health events during the academic school year of 2005-2006; "Women's Health Forum" and "Go Red for Women".

She presented her research on sleep and BMI at *The Society for Research in Human Development* (Fort Worth Texas) in April 2006, *Posters on the Hill* (SLC, Utah) in January 2007, and the *Student Showcase* (USU) in April 2007. She has been placed on the USU Dean's List 6 times as well as recognized on the National Dean's List for all academic years at USU.

Important Life Event*:*

After a wonderful 22-month courtship, she officially became Mary-Marie Austin Sullivan when she married her best friend, Neal Sullivan, on May 27, 2006 in the Logan LDS temple. They are a dynamic couple who enjoy playing tennis, basketball, running, playing the piano, working together, singing together, and saying to other each day, "This is Gonna be the Best Day of Our Lives!".

They agree that marriage is absolutely wonderful and they highly recommend it to everyone!

Future Goals:

Mary will be attending the University of Utah Medical School next fall where she hopes to specialize in Obstetrics and Gynecology, Family Practice, or Pediatrics. Because she enjoys people and is caring and compassionate, she will make a fine doctor. Mary has a stick-to-it-ness attitude that is fueled by her personal motto of "NO REGRETS". As medicine is a profession that incorporates the important themes in her life, such as teaching, healing, teamwork, research, and service, Mary knows that pursuing medicine is a goal in which she will have no regrets.

Because family health will be an important part of both Mary and Neal's profession, they have a fun goal to develop a family-focused clinic together. That is, Mary will work as a doctor alongside her husband Neal, who is a Marriage and Family Therapist. In addition to perhaps working together professionally, they look forward to working together as parents in the future. As past often predicts the future, they are confident that if they continue to seek experiences that are meaningful, they will continue to lead vigorous lives of *no regrets*!

Maybe include or not??

FUN FACTS ABOUT MARY-MARIE:
Nickname: All variations on the theme of Puff (i.e. Puffles, Pufflet, Princess Puff, Poof-Poof, et)
Favorite Place on Campus: The locker-room at the Hyper. She has always loved locker rooms!
*Favorite College Course*s: Genetics 3200, Human Dissection 4000, and American Writers 4310.
Favorite Beverage: Hazelnut Hot Chocolate.
Most disliked Body Part: Pinky Fingers.