



RELATIONSHIP BETWEEN TOTAL SLEEP DURATION AND BODY COMPOSITION

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Abstract

In the endless pursuit of possible causes for obesity and overweight, it has been hypothesized that sleep may have an effect on body composition. Some studies have shown that sleep deprivation is associated with a lower energy expenditure; however, other studies have shown that there is no correlation between body composition and sleep. The purpose of this study was to examine the relationship between body composition, specifically percent body fat (%BF), determined by hydrostatic weighing versus sleep quality, specifically sleep duration and efficiency. Seven kinesiology students from the University of Texas at Arlington participated in this study, in which body fat percentages were assessed using hydrostatic weighing methods. Additionally, waist-to-hip ratio and BMI were calculated from measurements of waist and hip circumferences, as well as height and weight. These results were compared to sleep data obtained from Fitbit trackers worn for three nights. A sleep assessment questionnaire was completed to provide additional information regarding sleep patterns. An examination of the means indicated that there is very little association between body composition and quality of sleep, but a moderate association between sleep duration and the values of body fat percentage and waist to hip ratio.

Purpose

The purpose of this study was to examine the relationship between body composition, specifically percent body fat (%BF), determined by hydrostatic weighing versus sleep quality, specifically sleep duration and efficiency

Introduction

Obesity is a societal problem approaching epidemic proportions. The CDC reports that 35.7% of adults in the U.S. are obese. Additionally, approximately 17% of U.S. children are considered obese. Considerable research has been and continues to be conducted, so that we may begin to resolve this widespread problem. Much of the research has focused on obesity and behaviors, such as excess intake, sedentary lifestyles, and also sleep patterns. Studies regarding sleep and adiposity abound in exercise science journals. Some of these studies have hypothesized that a lack of sleep is related to increased adiposity, but have ultimately rejected that hypothesis. One such study found that sleep deprivation actually increased lipolysis, and thus resulted in decreased adiposity. Many studies have confirmed a relationship between inadequate sleep and adiposity. Several studies of children have found that there is an inverse relationship between BMI and sleep duration. Conflicting findings make it necessary to further explore the relationship between sleep and body composition.

Methods

Participants

Seven physically women volunteered to participate in this study. They were chosen from an introductory kinesiology class. Participants ranged in age from 18 to 24.yrs

Instrumentation

The University of Texas at Arlington hydrostatic weighing tank was used to measure body fat percentages. Sleep was tracked using the Fitbit wireless tracker (Fitbit, Inc. San Francisco, CA) Also utilized was the Pittsburgh Sleep Quality Index (University of Pittsburgh, Pittsburgh, PA).

Procedure

Participants were asked to meet the investigator at an exercise science laboratory on the University of Texas at Arlington campus, in two groups on two occasions. First, the participants filled out an informed consent for the study that was approved by the Institutional Review Board of the University of Texas at Arlington. Then the participants filled out the PSQI sleep questionnaire. Next, the participants were each given a Fitbit and instructions on its use. Each participant in the group logged three nights of sleep onto the Fitbit website. Following sleep tracking, participants met with the investigator at the hydrostatic weighing tank at the University of Texas at Arlington kinesiology laboratory. Body fat percentage values were calculated using the hydrostatic weighing tank. Waist and hip measurements, height and weight were recorded at this time for calculation of waist-to-hip ratio and BMI. Variables of sleep efficiency and duration, PSQI scores, body fat percentage, waist-to-hip ratio, and BMI were analyzed using a correlation test to determine relationship.

Results

The correlation analysis indicated a weak positive linear relationship between body fat% and sleep efficiency ($r=0.27$) and a moderate negative linear relationship between BF% and sleep duration ($r=-0.61$) with a weak positive relationship between BF% and the PSQI score ($r=0.27$). There appeared to be no relationship between waist-to-hip ratio and sleep efficiency ($r=0.06$). Analysis showed a moderate positive linear relationship between waist-to-hip ratio and sleep duration ($r=0.48$). A weak negative linear relationship was found between BMI and both sleep duration and efficiency ($r = -0.17, r = -0.13$, respectively). The analyses also revealed a moderate positive linear relationship between BMI and the PSQI score ($r=0.58$).

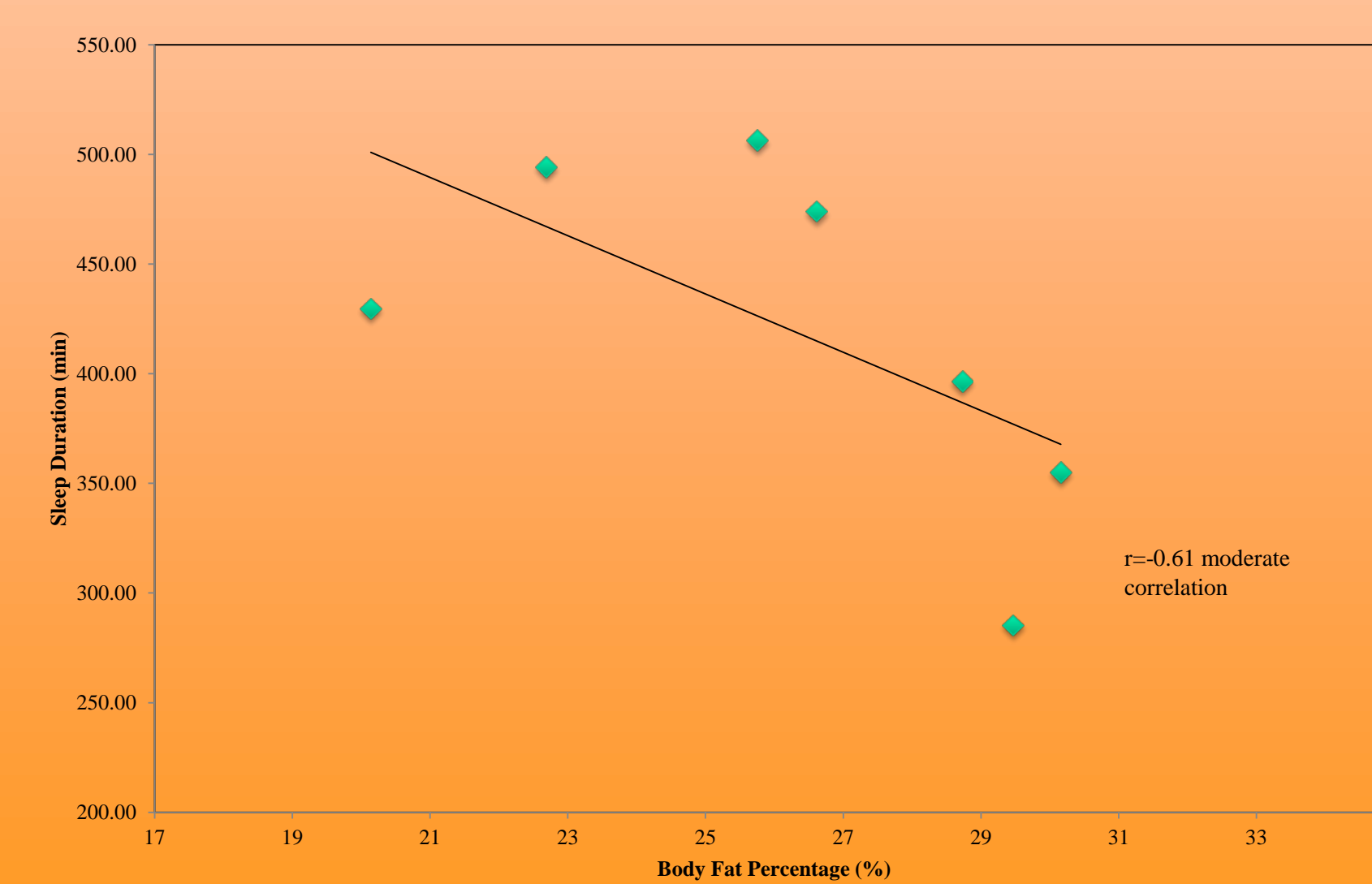


Figure 1. Sleep Duration Versus Body Fat Percentage

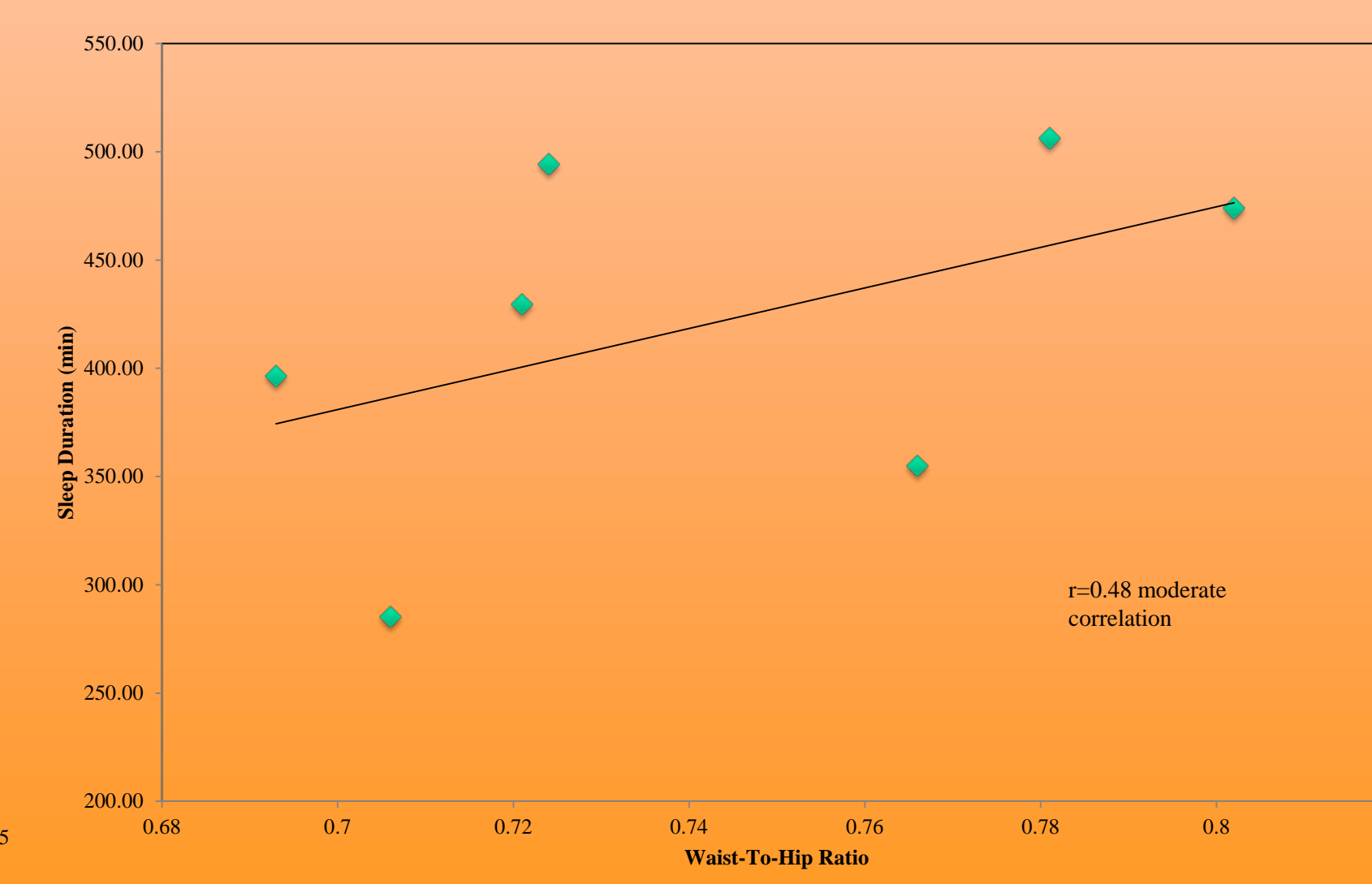


Figure 2. Sleep Duration Versus Waist-To-Hip Ratio

Results (cont'd)

Variables	Mean Values (\pm SD)
Age (years)	21(\pm 2.4)
Height (cm)	166.91(\pm 5.23)
Weight (kg)	66.03(\pm 10.49)
Body Fat (%)	26.22(\pm 3.70)
Body Mass Index	23.69(\pm 3.53)
WTH Ratio	0.74(\pm 0.04)
Sleep Efficiency(%)	93.46(\pm 2.98)
Sleep Duration (min)	420.15(\pm 80.51)
PSQI Score	6.14(\pm 1.95)

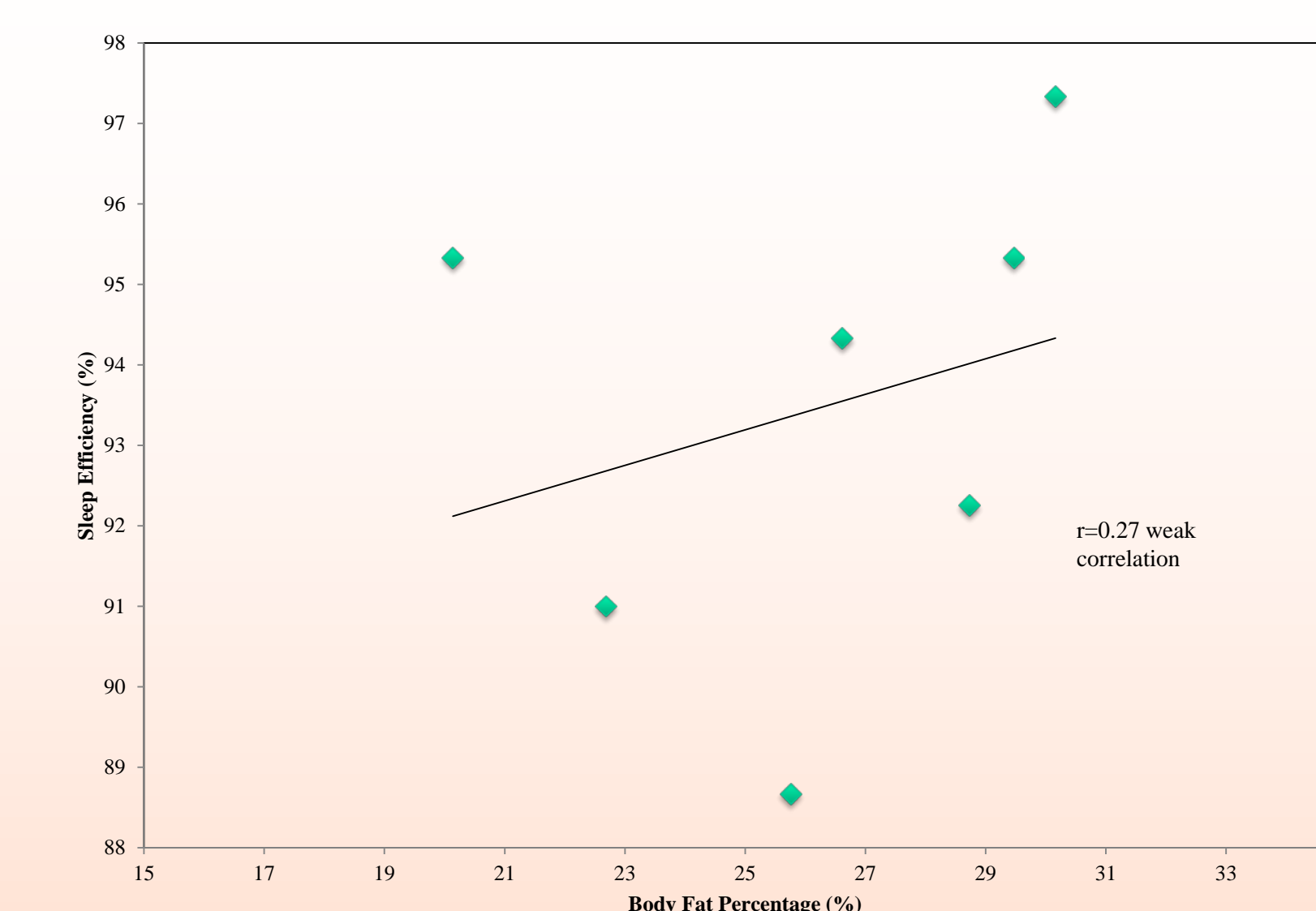


Figure 3. Sleep Efficiency Versus Body Fat Percentage

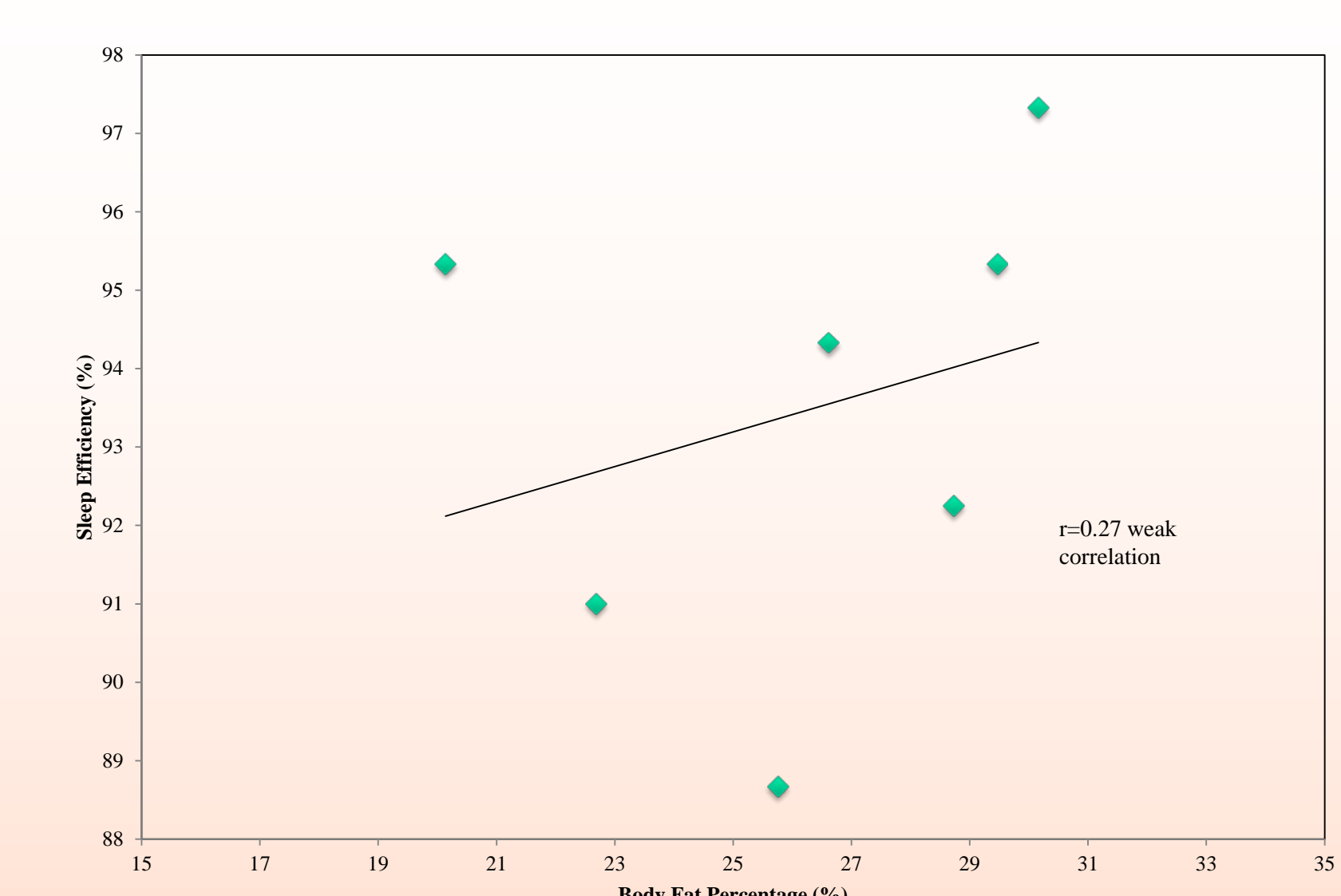


Figure 3. Sleep Efficiency Versus Body Fat Percentage

Conclusions

The results of this study suggest that there is only a weak relationship between sleep efficiency and values of body fat percentage, BMI, PSQI score and waist-to-hip ratio. Analysis indicated a moderate relationship between body fat percentage and sleep duration, as well as waist-to-hip ratio with sleep duration. These results indicate very little association between body fat percentage and quality of sleep, but a moderate association between sleep duration and the values of body fat percentage and waist-to-hip ratio. These results might lead one to say that sleep duration is much more a factor in body composition than sleep efficiency, if sleep is indeed a factor at all. The fact that there was not a high correlation between any measures in this study calls into question the effect of sleep on body composition. Further studies could also employ the use of DEXA, which may give more accurate body fat percentages.