Title:
Insulin Resistance in Young Adults With Impaired Sleep

Ashley W. Helvig, PhD¹
Eileen R. Chasens, PhD²
Megan McCrory, PhD³
Patricia Clark, PhD¹
Nannan Zhang, BS⁴
Matthew Hayat, PhD⁴
(1)Byrdine F. Lewis School of Nursing and Health Professions, Georgia State University, Atlanta, GA, USA
(2)Department of Health and Community Systems, School of Nursing, University of Pittsburgh, Pittsburgh, PA, USA
(3)Program in Nutrition, Department of Health Sciences, Boston University/College of Health & Rehabilitation Sciences: Sargent College, Boston University, Boston, MA, USA
(4)School of Public Health, Georgia State University, Atlanta, GA, USA

Session Title:
Health Promotion of the Diabetic Patient

Slot:
K 15: Tuesday, 31 October 2017: 9:00 AM-9:45 AM

Scheduled Time:
9:00 AM

Keywords:
Insulin resistance, Sleep duration and quality and Young adults

References:


Abstract Summary:
Our study determined the proportion of a sample of young adults with impaired sleep that had elevated insulin resistance levels and examined the association of impaired sleep with the total number of additional Type 2 Diabetes Mellitus risk factors and insulin resistance levels.

Learning Activity:

<table>
<thead>
<tr>
<th>LEARNING OBJECTIVES</th>
<th>EXPANDED CONTENT OUTLINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>The learner will be able to describe how various factors, including sleep duration and quality, impact insulin resistance.</td>
<td>What is insulin resistance and how does it potentially lead to T2DM? What are the mechanisms for how short sleep duration and poor quality sleep increase insulin resistance? What are other risk factors for increased insulin resistance?</td>
</tr>
<tr>
<td>The learner will be able to explore the relationships of impaired sleep and insulin resistance levels in this young adult population.</td>
<td>Descriptive and inferential statistics from the study: Insulin resistance levels, sleep measures, relationships between sleep measures, other risk factors (ie., BMI) and insulin resistance levels</td>
</tr>
</tbody>
</table>

Abstract Text:

Almost thirty million Americans have diabetes and nearly 90 million more have prediabetes (CDC, National Diabetes Statistics Report, 2014) all of which costs the U.S. approximately $245 billion each year (ADA, 2016). The prevalence of diabetes in North America is expected to increase by 42% within 15 years (Chen, 2011). Insulin resistance is a precursor to prediabetes and Type 2 Diabetes Mellitus (T2DM) (NIDDK, 2014). Because T2DM is more common in older adults, many young adults may not consider themselves at risk; however, “[f]rom 1990 to 2009, the rates per 100 of diagnosed diabetes in the United States population increased by 217% (from 0.6 to 1.9) for those aged 0–44 years” (CDC, Rate of diagnosed diabetes, 2014, para. 1). Impaired sleep is directly and indirectly associated with development of insulin resistance and T2DM (Reutrakul & Van Cauter, 2014). Impaired sleep affects approximately 50-70 million persons in the US (CDC, Insufficient Sleep, 2014) and is becoming more common in young adults (Petrov et al., 2014). The risk for developing diabetes in persons with difficulty in maintaining sleep is 1.87 times the risk of diabetes in those who don’t have sleep issues. The relative risk of diabetes among people with impaired sleep versus normal sleep quality (1.87) is very similar to the relative risk detected from another commonly recognized risk factor-- family history of diabetes (1.7-2.3) (Reutrakul & Van Cauter, 2014). Few studies have examined habitually impaired sleep in young adults and insulin resistance. Primary prevention efforts aimed at delaying the onset of T2DM may be most effective in this young adult population.

Purpose: Determine the proportion of this sample (young adults with impaired sleep) with elevated insulin resistance levels and examine the association of impaired sleep with the total number of additional T2DM risk factors and insulin resistance levels.

Methods: A cross-sectional, correlational design was used. Young adults (ages 18-25 years) were sampled and data collected on self-reported and objective measures of impaired sleep. These included 7-
day wrist actigraphy assessment for impaired sleep and serum concentrations of insulin and glucose to estimate insulin resistance levels. The non-random sample included 32 young adults ages 18 to 25 years with self-reported impaired sleep determined by either a score of > 5 (poor overall quality sleep) upon screening using the Pittsburg Sleep Quality Index (PSQI) or self-report sleep duration of < 6 hours/night (less than 6 hours is considered as 'short sleep') (NSF, 2015). **Measures:** Insulin resistance levels were calculated from glucose and insulin values observed in fasting serum samples. Impaired Sleep was measured with the PSQI score and objective monitoring of each participant’s 24-hour sleep-wake cycle using wrist actigraphy to obtain sleep duration (total sleep time) and sleep quality (e.g., sleep onset latency, wake time after onset, and sleep efficiency). Measurements were taken for 7 consecutive days. **Discussion:** Participants on average were overweight and slept less than the National Sleep Foundation recommended 7-9 hours per night. A BMI ≥ 25 is associated with higher values of insulin resistance (Blanco et al., 2012) and almost half of this sample were at minimum considered overweight. In this young sample, modifiable risk factors were identified that could potentially reduce risk of T2DM. Approximately 20% of participants (all with either poor sleep quality and/or short sleep) had elevated values of insulin resistance. However, with these young adults BMI is also a significant predictor. This study in young adults with impaired sleep showed that insulin resistance was present and may suggest a potential target population for intervention. **Results:** The study sample included 32 young adults, with 68.8% female, 46.9% African American/Black, a mean age of 20.5 years (SD = 1.87), and a mean BMI of 23.9 (SD = 5.6). Screening data showed 96.9% (n = 31) of participants had > 5 on the PSQI scale, indicating poor quality sleep. Further, 75% (n = 24) of participants self-reported total sleep time as less than 6 hours per night. Actigraphy results indicated that participants slept a mean of 6.49 hours (SD = 6.7) of total sleep time per night during the week and 6.77 (SD = 10.9) hours per night during the weekend. Participants on average had 1.28 (SD = 1.02) ADA T2DM risk factors. The most common T2DM risk factor was BMI ≥ 25 (40% of the total sample). Twenty-five percent of the participants were classified as overweight (BMI 25 to 29.9) and 15.6% of the participants were classified as obese (BMI ≥ 30).

Fasting blood glucose concentrations ranged from 80.05 to 107.55 mg/dL (M = 95.0 mg/dL, SD = 6.28), fasting insulin concentrations ranged from 3.7 to 39.5 microU/mL (M = 10.68 microU/mL, SD = 6.95) and HOMA2 IR (insulin resistance) values ranged from 0.48 to 5.05 (M = 1.39, SD = 0.89). Participants were categorized with elevated insulin resistance values if HOMA2 IR was > 1.775 [elevated IR was used as determined in non-diabetics (Esteghamati et al., 2010)], and 18.8% of the sample had elevated values. Males had higher blood glucose concentrations (100.8 mg/dL) than females (92.73 mg/dL) (t = 3.62, p = 0.001) and a higher number of risk factors for T2DM (2.2) than females (0.86) (t = 4.27, p < 0.001). BMI was significantly associated with blood glucose level (r = .35, p = 0.04), insulin level (r = .55, p = .001), HOMA 2 IR (r = .55, p = .001), and other T2DM risk factors (F = 9.8, p < 0.001). T2DM risk factors was also associated with PSQI (F = 5.3, p = .011). Associations were not detected for sleep variables (duration, sleep latency, wake after sleep onset) with other study variables. Statistical tests for relationships between glucose, insulin, insulin resistance values, and sleep duration failed to reach statistical significance.

**Discussion:** Participants on average were overweight and slept less than the National Sleep Foundation recommended 7-9 hours per night. A BMI ≥ 25 is associated with higher values of insulin resistance (Blanco et al., 2012) and almost half of this sample were at minimum considered overweight. In this young sample, modifiable risk factors were identified that could potentially reduce risk of T2DM. Approximately 20% of participants (all with either poor sleep quality and/or short sleep) had elevated values of insulin resistance. However, with these young adults BMI is also a significant predictor. This study in young adults with impaired sleep showed that insulin resistance was present and may suggest a potential target population for intervention. Preliminary findings highlight the need for increased education and preventative efforts to reduce risk for developing T2DM in this population. This preliminary study adds to our understanding of risk factors for insulin resistance, sleep quality and T2DM. Nurses have a prime opportunity for assessment of impaired sleep and education regarding risk of and methods to improve impaired sleep. A more comprehensive and adequately powered study is necessary for better understanding the relationships observed and identifying possibilities for intervention.