ORIGINAL RESEARCH

Effect of sleep duration on the blood glucose level

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ABSTRACT

Background: Lack of adequate sleep, typically defined as less than 6 hours per night, has been linked to an increased risk of insulin resistance and impaired glucose metabolism. The present study was conducted to assess the effect of sleep duration on the blood glucose level. **Materials & Methods:**100 subjects age ranged 14-20 years of both genders were classified as adequate sleep duration at night (ASDN) and inadequate sleep duration at night (ISDN). Data such as name, age, gender etc. was recorded. Waist circumference (WC), Hip circumference (HC), Waist – Hip Ratio (WHR), body fat percentage (BF %), total body fat mass (FM), fat free mass (FFM), fat mass index (FMI) was calculated. **Results:** Age group 14-15 years had 9 boys and 8 girls, 16-17 years had 9 boys and 11 girls and 18-20 years had 12 boys and 11 girls. In ASDN and ISDN boys and ASDN and ISDN girls, mean weight (kgs) was 48.9, 54.3, 43.6, and 43.8, BMI was 18.7, 19.9, 18.2 and 18.7, BF% was 17.2, 19.3, 22.4 and 23.0, FM was 10.1, 10.6, 10.2 and 10.8, FMI was 3.8, 4.9, 4.5 and 4.7, FFM was 40.2, 42.5, 33.2, and 34.1, FFMI was 14.7, 15.8, 14.8, and 15.2, WC was 65.2, 66.1, 62.4, and 48.6, HC was 81.7, 82.5, 79.4, and 78.4, WHR was 0.85, 0.80, 0.79, and 0.78 and FBS was 84.2, 83.2, 84.0, and 83.2 respectively. The difference was significant ($P< 0.05$). **Conclusion:** Subjects in the 14–20 age range do not have a blood glucose level that is impacted by short sleep duration (less than 7 hours). This is most likely due to the fact that sleep deprivation has no effect on body composition.

Keywords:sleep, diabetes, Waist circumference

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INTRODUCTION

Lack of adequate sleep, typically defined as less than 6 hours per night, has been linked to an increased risk of insulin resistance and impaired glucose metabolism. This can lead to higher fasting blood glucose levels and an increased risk of developing type 2 diabetes.[1]

In addition to duration, sleep quality also plays a significant role in regulating blood glucose levels.[2,3] Poor sleep quality, characterized by frequent awakenings or disruptions in sleep architecture, can disrupt hormonal regulation, including insulin sensitivity, which may contribute to elevated blood glucose levels.[4]The exact biological mechanisms linking sleep duration to blood glucose regulation are complex and multifaceted. They likely involve alterations in hormone levels, including cortisol, insulin, and growth hormone, as well as disruptions in circadian rhythms and metabolic processes.[5]It's important to note that individual responses to sleep duration can vary widely. While some individuals may be more sensitive to short or long sleep durations in terms of blood glucose regulation, others may not exhibit significant changes.[6]The present study was conducted to assess the effect of sleep duration on the blood glucose level.

MATERIALS & METHODS

The present study consisted of 100 subjects age ranged 14-20 years of both genders. All gave their written consent to participate in the study.Sleep duration of more than or equal to 7 hours per night was considered as adequate sleep duration at night (ASDN) and sleep duration of less than seven hours was considered as inadequate sleep duration at night (ISDN).

Data such as name, age, gender etc. was recorded. Waist circumference (WC) was measured at the mid-point between the lower costal margin and the iliac crest to the nearest 0.5 cm at the end of normal expiration. Hip circumference (HC) was measured at the highest point of the buttocks. Waist – Hip Ratio (WHR) was calculated as the waist circumference divided by the Hip circumference. Body fat percentage (BF %) and total body fat mass (FM) were assessed by bioelectrical impedance technique. Fat

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free mass (FFM) was calculated by subtracting FM from total body wt. Fat mass index (FMI) was calculated as the FM (kg) divided by the square of height in meters (m2) and fat free mass index (FFMI) was calculated as the FFM (kg) divided by the square of height in meters (m2).Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I Distribution of subjects

Age group (years)	Boys	Girls
14-15	9	8
16-17	9	11
18-20	12	11

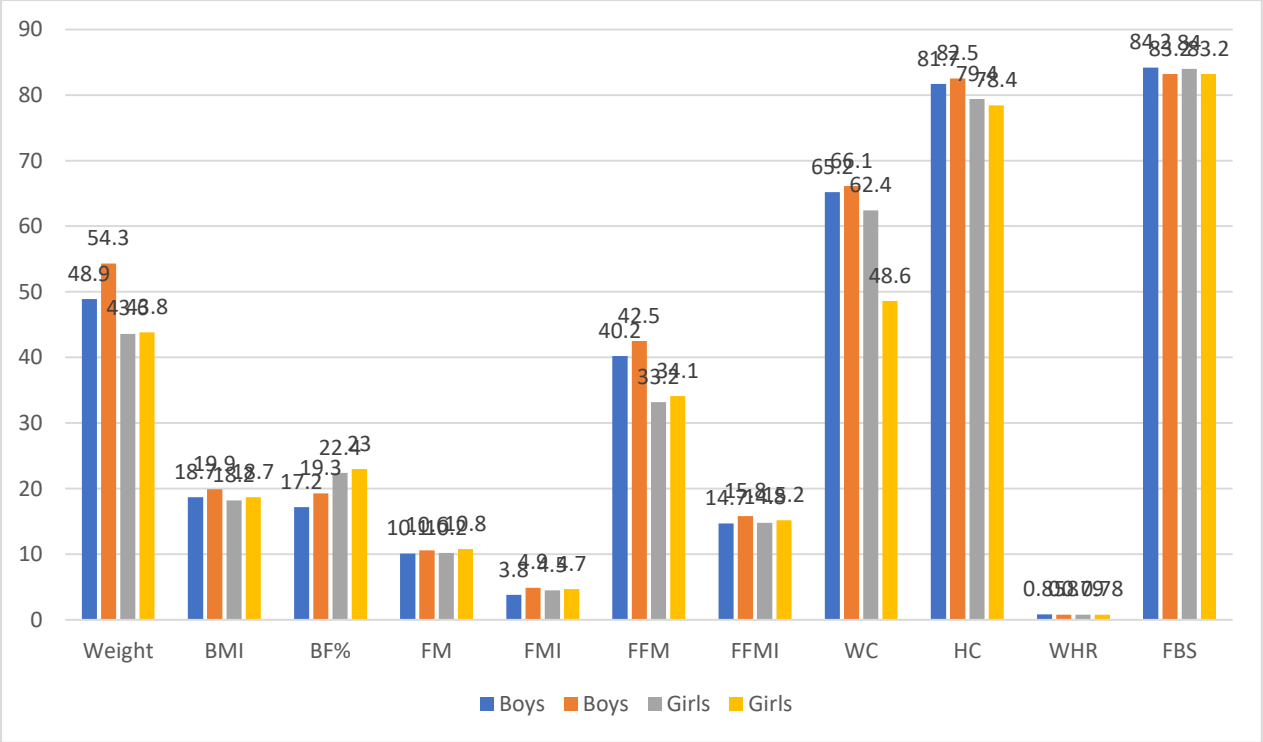
Table I shows that age group 14-15 years had 9 boys and 8 girls, 16-17 years had 9 boys and 11 girls and 18-20 years had 12 boys and 11 girls.

Table II Comparison of parameters

Parameters	Boys		Girls		P value
	ASDN	ISDN	ASDN	ISDN	
Weight	48.9	54.3	43.6	43.8	0.03
BMI	18.7	19.9	18.2	18.7	0.87
BF%	17.2	19.3	22.4	23.0	0.02
FM	10.1	10.6	10.2	10.8	0.90
FMI	3.8	4.9	4.5	4.7	0.53
FFM	40.2	42.5	33.2	34.1	0.02
FFMI	14.7	15.8	14.8	15.2	0.67
WC	65.2	66.1	62.4	48.6	0.05
HC	81.7	82.5	79.4	78.4	0.84
WHR	0.85	0.80	0.79	0.78	0.04
FBS	84.2	83.2	84.0	83.2	0.05

Table II, graph I shows that in ASDN and ISDN boys and ASDN and ISDNgirls, mean weight (kgs) was 48.9, 54.3, 43.6, and 43.8, BMI was 18.7, 19.9, 18.2 and 18.7, BF% was 17.2, 19.3, 22.4 and 23.0, FM was 10.1, 10.6, 10.2 and 10.8, FMI was 3.8, 4.9, 4.5 and 4.7, FFM was 40.2, 42.5, 33.2, and 34.1, FFMI was 14.7, 15.8, 14.8, and 15.2, WC was 65.2, 66.1, 62.4, and 48.6, HC was 81.7, 82.5, 79.4, and 78.4, WHR was 0.85, 0.80, 0.79, and 0.78 and FBS was 84.2, 83.2, 84.0, and 83.2 respectively. The difference was significant (P< 0.05).

Graph I Comparison of parameters



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DISCUSSION

Numerous pathways have been identified that connect insufficient sleep duration to the onset of diabetes.[7] First, lack of sleep can cause weight gain and diabetes because a high body mass index (BMI) can affect sleep quality by inducing a prediabetic condition characterized by increased urine.[8]Second, due to its impact on weight, sleep deprivation may directly cause diabetes to develop.[9] The underlying theory for this is that persistent self-imposed sleep deprivation may raise appetite and cause weight gain because it lowers leptin levels.[10]This could therefore point to a physiological process via which getting too little sleep could make people more likely to acquire weight, which would then accelerate the onset of diabetes.[11,12]The present study was conducted to assess the effect of sleep duration on the blood glucose level.

We found that age group 14-15 years had 9 boys and 8 girls, 16-17 years had 9 boys and 11 girls and 18-20 years had 12 boys and 11 girls. Patel et al[13]studied the effect of sleep duration on the blood glucose level. No significant difference was found in all parameters of body composition and fasting blood glucose level between the ASDN group and ISDN group in both boys and girls. However, gender difference exists in the body composition and blood glucose level.

We found that in ASDN and ISDN boys and ASDN and ISDN girls, mean weight (kgs) was 48.9, 54.3, 43.6, and 43.8, BMI was 18.7, 19.9, 18.2 and 18.7, BF% was 17.2, 19.3, 22.4 and 23.0, FM was 10.1, 10.6, 10.2 and 10.8, FMI was 3.8, 4.9, 4.5 and 4.7, FFM was 40.2, 42.5, 33.2, and 34.1, FFMI was 14.7, 15.8, 14.8, and 15.2, WC was 65.2, 66.1, 62.4, and 48.6, HC was 81.7, 82.5, 79.4, and 78.4, WHR was 0.85, 0.80, 0.79, and 0.78 and FBS was 84.2, 83.2, 84.0, and 83.2 respectively. Gottlieb et al[14]assessed the cross-sectional relation of usual sleep time to diabetes mellitus (DM). Participants were 722 men and 764 women, aged 53 to 93 years. Usual sleep time was obtained by standardized questionnaire. Diabetes mellitus was defined as a serum glucose level of 126 mg/dL or more (> or =7.0 mmol/L) fasting or 200 mg/dL or more (> or =11.1 mmol/L) 2 hours following standard oral glucose challenge or medication use for DM. Impaired glucose tolerance was defined as a 2-hour postchallenge glucose level of 140 mg/dL or more (> or =7.8 mmol/L) and less than 200 mg/dL. The relation of sleep time to DM and IGT was examined using categorical logistic regression with adjustment for age, sex, race, body habitus, and apnea-hypopnea index.The median sleep time was 7 hours per night, with 27.1% of subjects sleeping 6 hours or less per night. Compared with those sleeping 7 to 8 hours per night, subjects sleeping 5 hours or less and 6 hours per night had adjusted odds ratios for DM of 2.51 (95% confidence interval, 1.57-4.02) and 1.66 (95% confidence interval, 1.15-2.39), respectively. Adjusted odds ratios for IGT were 1.33 (95% confidence interval, 0.83-2.15) and 1.58 (95% confidence interval, 1.15-2.18), respectively. Subjects sleeping 9 hours or more per night also had increased odds ratios for DM and IGT. These associations persisted when subjects with insomnia symptoms were excluded.

The limitation of the study is the small sample size.

CONCLUSION

Authors found that subjects in the 14–20 age range do not have a blood glucose level that is impacted by short sleep duration (less than 7 hours). This is most likely due to the fact that sleep deprivation has no effect on body composition.

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