Effect of Sleep Deprivation on Blood Glucose and Vital Data.

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Abstract: Background: The shift work affects human health and performance by disrupting circadian rhythms and by causing numerous alterations in human behaviour. We have taken night shift workers as they were sleep deprived people, comparing with the same variables in same persons during day shift work, to assess, how sleep deprivation (night shift work) impacts on persons health. So we decided to study the effect of sleep deprivation on blood glucose and vital data. Method: 58 normal healthy male volunteers aged ranging from 25 to 45 years were selected from Madras cement factory Limited and tested for Fasting Blood Glucose, Pulse Rate, Respiratory Rate, Temperature, Systolic Blood Pressure, Diastolic Blood Pressure before and After Sleep Deprivation. Results: Mean Fasting Blood Glucose levels after sleep deprivation, when compared to mean fasting Glucose levels after normal sleep is significantly increased (P value < 0.05). The mean Temperature after sleep deprivation, when compared to mean Temperature after normal sleep is significantly decreased (P value < 0.05). The mean Systolic Blood Pressure after sleep deprivation when compared to mean Systolic Blood Pressure after normal sleep is significantly Raised (P value < 0.05)The mean Diastolic Blood Pressure, mean respiratory rate and mean pulse rate after sleep deprivation was not significant (P value > 0.05). Conclusion: This study concludes that sleep deprivation play a role to increase blood glucose levels and blood pressure.The results suggest that sleep deprivation play a role in the etiology of hypertension and diabetes mellitus. [Devi S et al NJIRM 2012; 3(3) : 28-32]

Key words: Sleep deprivation, Fasting Blood Glucose.

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Introduction: Sleep deprivation (General lack of the necessary amount of sleep) is a common problem in modern society. A number of non mutually exclusive hypotheses have been proposed: for example, energy conservation [1], brain thermoregulation [2], brain detoxification [3], and tissue "restoration" [4]. Because sleep is a time for the body to regenerate vital parts, especially neurons, it has been the subject of scientific studies. Unfortunately, with lack of sleep come many unwanted side effects, including impaired thinking, memory, and the depression of some vital signs [5]. It has been suggested that fragmented sleep or sleep deprivation may increase the incidence of cardiovascular events [6, 7].

Masahiko Kato et. al. 2000 suggests Sleep deprivation results in increased resting blood pressure, decreased muscle sympathetic nerve activity [8]. Obstructive sleep apnea has an impairment of resistance-vessel endothelium-dependent vasodilation. This may be implicated in the pathogenesis of hypertension and heart failure in this condition [9]. Thomas et. al. 2000 suggests that complex tasks performance is impaired as shown through tests of working memory, verbal fluency, logical reasoning, and creative thinking and planning [10]. In a documented experiment testing cerebral response following sleep deprivation, the brain showed greater responsiveness to some cognitive demands during sleep deprivation (Drummond et. al. 2001)[11].

So, we have been interested to take this problem and checked the impact or the effect of sleep deprivation on blood glucose and vital data.

Method: The study was approved by Ethical Committee. The volunteers gave their informed written consent for participation in the study.
The present study was conducted on 58 normal health Male volunteers aged from 25 to 45 years.
The subjects are working in Madras cement factory Limited situated at Jayanthipuram

village, Jaggayyapet Mandal, Krishna District. They work on shift base. Their working hours are:

A shift: 06 AM to 06 PM
B shift: 06 PM to 06 AM

These two shifts alternate for every three days. Each worker will be in A shift for three days and in B shift for the next three days in a week.
Packing of cement powder occurs round the clock. As they are in packing section meticulous alertness needed whole night. And they also have frequent invigilation and check – ups by night officers. So, they have to bind to their night duty strictly.

The workers are randomly selected.
Inclusion Criteria:
Age: 20 years to 45 years males.

Exclusion Criteria:
The subjects were excluded from study if they had any History of Diabetes Mellitus, Hypertension, and Cardiovascular Diseases.

Each subject was explained about the method. The study was conducted in the factory itself. Their Blood Glucose levels were measured by using Glucometer optimum point of care (Abbott). Glucometer optimum blood glucose test stripes quantitatively measure glucose in blood and are designed for use with optimum blood glucose meter only. When the tip of the test strip touches a drop of blood, the strip fills automatically through simple capillary action. The blood is drawn in to a reaction chamber and reading is displayed on the meter after 20 seconds. The test provides a quantitative measurement of glucose from 20 – 500 mg /dl. Sample volume is 25 micro lit.

All the subjects were informed about the test protocol. The First Recordings are taken from the subjects who are going to Day Duty i.e. after normal Sleep at early morning around 06.00 AM. They were questioned about their last night sleep.

The Second Reading are taken from the same subjects at the same time after doing Night Duty i.e. after Sleep Deprivation and were asked to fill a Questionnaire.The subjects were instructed to sit calm and quiet without any nervousness.

The parameters taken from them are:

- Fasting Blood Glucose
- Pulse Rate
- Respiratory Rate
- Temperature
- Systolic Blood Pressure
- Diastolic Blood Pressure

The subjects Pulse rate was recorded with the "Finger on the Wrist" technique for 60 seconds. Respiratory rate was recorded manually. The Blood Pressure was measured with the aid of Sphygmomanometer cuff and stethoscope.
Body temperature was taken with an oral thermometer. In all subjects the Fasting Blood Glucose was recorded from capillary Finger prick with help of a lancet and is calculated by using Optimum Point of Care (Abbott) Glucometer.

Results: Results are tabulated. If the paired t – test value is > 2, the P value is < 0.05 is considered significant.

Table 1 : Comparison Of Values After Sleep Deprivation And After Normal Sleep

Parameter	After Normal Sleep	After Sleep Deprivation	P
	Mean	Mean	
FBS in mg/dl	96.66	105.69	< 0.05

The **mean Fasting Blood Glucose levels** after sleep deprivation shown in Table I, when compared to mean fasting Glucose levels after normal sleep is significantly increased (P value < 0.05)

The **mean Pulse Rate** after sleep deprivation show in Table II, when compared to mean Pulse

Rate after normal sleep is not significantly increased (P value > 0.05).

Table : 2

Parameter	After Normal Sleep	After Sleep Deprivation	P
	Mean	Mean	
PR Number of Beats / Min	76.98	77.9	> 0.05

Table : 3

Parameter	After Normal Sleep	After Sleep Deprivation	P
	Mean	Mean	
RR in a min	15.47	15.66	> 0.05

The **mean Respiratory rate** after sleep deprivation shown in Table III, when compared to mean Respiratory rate after normal sleep is not significantly Raised (P value > 0.05)

Table : 4

Parameter	After Normal Sleep	After Sleep Deprivation	P
	Mean	Mean	
Temperature in °F	96.82	95.54	< 0.05

The **mean Temperature** after sleep deprivation shown in Table IV, when compared to mean Temperature after normal sleep is significantly decreased (P value < 0.05).

Table: 5

Parameter	After Normal Sleep	After Sleep Deprivation	P
	Mean	Mean	
Systolic Blood Pressure In mm Hg	104.48	108.45	< 0.05

The **mean Systolic Blood Pressure** after sleep deprivation shown in Table V, when compared to mean Systolic Blood Pressure after normal sleep is significantly Raised (P value < 0.05)

Table: 6

Parameter	After Normal Sleep	After Sleep Deprivation	P
	Mean	Mean	
Diastolic Blood Pressure In mm Hg	70.86	71.21	> 0.05

The **mean Diastolic Blood Pressure** after sleep deprivation shown in Table VI, when compared to mean Diastolic Blood Pressure after normal sleep is not significantly Raised (P value > 0.05)

Discussion : Researchers at the University of Chicago Medical Centre conducted a landmark study to assess the harmful effects under Eve van caurer [12]was found that the metabolic and endocrine changes resulting from a significant sleep debt mimic many of the hall marks of aging and they suspect that chronic sleep loss may not only hasten the onset, but can also increase the severity of age – related ailments such as Diabetes, Hypertension, Obesity and Memory loss. They observed Glucose and insulin levels were consistent with a clear impairment of carbohydrate tolerance. These profound alterations of Glucose metabolism during sleep deprivation, were parallel with those observed in patient with type two diabetes, Subjects took 40% longer time than average to regulate their blood sugar levels following a high carbohydrate meal. Similarly, the rate of Glucose clearance after intravenous injection was nearly 40% slower in the sleep – debt condition than in the sleep – recovery condition.

In our study the increased Fasting Blood Glucose with sleep deprivation is in agreement with the work done by Spiegel K. et al [13]

According to Analyses of the First National Health and Nutrition Examination Survey by James E. Gang Wish; Steven B. Heyms field et. al[14] "short sleep duration" Is a risk factor for hypertension. They found that on the days after nights of sleep deprivation, significant increase in systolic Blood pressure were accompanied by increases in the urinary excretion of nor epinephrine indicative of increased sympathetic nervous system activity. These findings have led to the hypothesis that the mechanism by which sleep deprivation, a stressful condition, raised blood pressure is by increasing the synthesis of catecholamines.

The observed significant rise of systolic blood pressure with sleep deprivation is correlated with above study. According to study of Mashiko kato, Bradley G. Phillips et. al[15] the diastolic blood pressure is elevated when compared with sleep deprivation. In our study, there is no significant rise in Diastolic Blood Pressure with sleep deprivation.

The same study by Mashiko Keto, Bradly G. Philip et. al[15] stated that there is no significant raise in Heart rate with sleep deprivation. It is in agreement with my observed result. The same study by Amy Martin, Christine Davis and young – Mioh et. Al[5] found that sleep deprivation leads to an overall decrease in body temperature. It is in agreement with my present study as there is significant decrease in body temperature with Sleep – Deprivation.

Conclusion: Sleep is essential to the body. Its functions are promoting bodily rest and rejuvenation in the neurons and other cells that are replaced or repaired during sleep. Sleep has also been proposed to conserve energy, detoxify the brain and control thermo regulation with in the brain. Chronic sleep restriction is known to reduce the capacity of even young healthy adults to perform basic metabolic functions like processing and storing carbohydrates as well as regulating hormone secretion.

The results from this study suggest that sleep deprivation also play a role in the etiology of increase blood pressure (hypertension) and increase blood glucose (diabetes mellitus). Further research is needed to investigate the biological mechanisms that link sleep deprivation to high blood pressure and blood glucose

Acknowledgement: We would like to thank the director of the Madras cement factory, Jayanthipuram village, Jaggayyapet Mandal, Krishna District. We are grateful to the volunteers for their cooperation.

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