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Abstract

Short sleep duration could be deemed a risk factor in occurring cardiovascular system and renal physiological malfunctions. Hence, the present study carried out from December 2018 to January 2019, intended to investigate the association between sleep lack with a circulation system and kidney functions among both genders of students (12 females plus 25 males) who have 18–23 years age and attending Salahaddin University-Erbil. The trial included a sleep lack group (sleep duration <6 >h). The second group represented as a control (sleep duration >6 h). Blood pressure (BP) (systolic BP [SBP], diastolic BP [DBP], and mean arterial pressure [MAP]) and weights were estimated for both groups. Blood samples were taken to determine serum creatinine utilizing fully automatically biochemical analyzer and also glomerular filtration rate (GFR) was estimated and calculated according to the Cockcroft-Gault equation. The procured results revealed that SBP was elevated in all participants in the sleep lack group as compared to the control group, while no significant change in DBP was perceived. Furthermore, MAP was increased in all volunteers in the sleep-deprived group. The results also demonstrated that the serum creatinine was raised and concomitantly estimated GFR values were elevated in sleep-deprived group as compared to the control group. Pursuant to the receiver operating characteristic curve, serum creatinine can be a risk factor for sleep lack as well. In the light of the current study, it has been concluded that the sleep lack has a role in elevating SBP but not DBP and it was related with hypertension. Furthermore, the results indicated that serum creatinine was significantly increased in students with sleep lack.

Keywords

Blood pressure, Estimated glomerular filtration rate, Renal function, Serum creatinine, Sleep lack

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RESEARCH ARTICLE

Association of Sleep Lack with Blood Pressure and Kidney Functions among Young People in Erbil City

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ABSTRACT

Short sleep duration could be deemed a risk factor in occurring cardiovascular system and renal physiological malfunctions. Hence, the present study carried out from December 2018 to January 2019, intended to investigate the association between sleep lack with a circulation system and kidney functions among both genders of students (12 females plus 25 males) who have 18–23 years age and attending Salahaddin University-Erbil. The trial included a sleep lack group (sleep duration <6 h). The second group represented as a control (sleep duration >6 h). Blood pressure (BP) (systolic BP [SBP], diastolic BP [DBP], and mean arterial pressure [MAP]) and weights were estimated for both groups. Blood samples were taken to determine serum creatinine utilizing fully automatically biochemical analyzer and also glomerular filtration rate (GFR) was estimated and calculated according to the Cockcroft-Gault equation. The procured results revealed that SBP was elevated in all participants in the sleep lack group as compared to the control group, while no significant change in DBP was perceived. Furthermore, MAP was increased in all volunteers in the sleep-deprived group. The results also demonstrated that the serum creatinine was raised and concomitantly estimated GFR values were elevated in sleep-deprived group as compared to the control group. Pursuant to the receiver operating characteristic curve, serum creatinine can be a risk factor for sleep lack as well. In the light of the current study, it has been concluded that the sleep lack has a role in elevating SBP but not DBP and it was related with hypertension. Furthermore, the results indicated that serum creatinine was significantly increased in students with sleep lack.

Keywords: Blood pressure; Estimated glomerular filtration rate; Renal function; Serum creatinine; Sleep lack

INTRODUCTION

Sleep lack described as abnormal sleep that can be considered as inadequate sleep quantity, structure and/or sleep quality (Krause et al., 2017). A variety of different reviews stated the evidence that healthy body functions is sleep reliable (Krause and Rainville, 2019, Hinz et al., 2017). However, short sleep duration can cause considerable cardiovascular and renal physiological disorders (Martino et al., 2008). Sleep duration, especially short sleep period, may affect blood pressure (BP) through disturbed autonomic balance, alteration of circadian rhythms, hormonal disturbance, high incidence of adiposity, and metabolic destruction (Makarem et al., 2019).

Probably, habitual short sleep is considered as a risk factor in developing cardiovascular diseases (CVD) and the relationship between short sleep and CVD and other risk factors may be mediated by emotional distress and obesity (Seixas et al., 2018). Moreover, short sleep duration is a risk factor for increased hunger and caloric intake, and for weight gain and obesity (Spaeth et al., 2015). Eating at a later clock hour observed as a risk factor for metabolic health; yet, how eating at a later circadian time influences body composition is unknown (McHill et al., 2017). During the night, BP that follows a circadian rhythm decreases 10–20%. It is worth mention that several factors contribute to the changes in night-time BP including alterations in hormonal profiles, variations in the activity of the renin-angiotensin, and the sympathetic nervous systems (Burnier et al., 2007).

On the other hand, the affiliation of sleep length and quality with health outcomes in patients that sufferer with continual kidney diseases stays unstudied properly (Yamamoto et al., 2018). According to Mcmullan et al., 2016, shorter sleep duration is prospectively and independently associated with a faster decline in renal functions. Ultimately, the presence of potential association between shorter sleep duration and more rapid decline in renal function (estimated GFR

[eGFR]) was found, in which should be separated from many established risk factors of chronic kidney diseases.

According to the published literatures, there is no any research article about the impact of sleep lack on BP and renal functions among undergraduate students having 18–23 years age in Kurdistan Region. Therefore, the present study was executed to find an association between sleep lack with cardiovascular and kidney dysfunctions among students pursuing their academic studies in Salahaddin University-Erbil.

MATERIALS AND METHODS

Experimental Design

The participated students, who belonged to both sexes, had 18–23 years age and were attending Salahaddin University-Erbil. The volunteers were nonsmokers and had no clinical evidence of diabetes and infections or other diseases.

The volunteered students were allocated into two groups:
Group 1: Sleep lack group
Sleep duration is <6 h (<6 h).
Number of participants: 12 females plus 25 males.
Group 2: Control (normal sleep)
Sleep duration is more than 6 h (>6 h).
Number of participants: 10 females plus 15 males.

Measurement of BP

BP including systolic BP (SBP), diastolic BP (DBP), and mean arterial pressure (MAP) were estimated using sphygmomanometer, in addition to weighing (kg) participants in both groups.

Estimation of Serum Creatinine

Five milliliters (ml) of venous blood from the participants were collected using disposable plastic syringes in the morning and transferred into gel and clot activator test tube (5 ml capacity), after the blood being clotted and centrifuged at 1000 g for 15 min and the serum was recovered. The serum creatinine was determined using fully automated biochemical analyzer.

Calculation of Glomerular Filtration Rate (GFR)

The GFR was estimated and calculated according to the Cockcroft-Gault equation (Garcia-Covarrubias et al., 2018).

Creatinine clearance CrCl (male) = ([140-age] × weight in kg)/(serum creatinine × 72).

Statistical Analysis

The obtained data were expressed as means ± standard error. Statistical analysis was carried out using unpaired *t*-test by employing GraphPad prism (Version 8). Normality test also was applied to confirm the data distribution. Furthermore, the association between sleep duration with

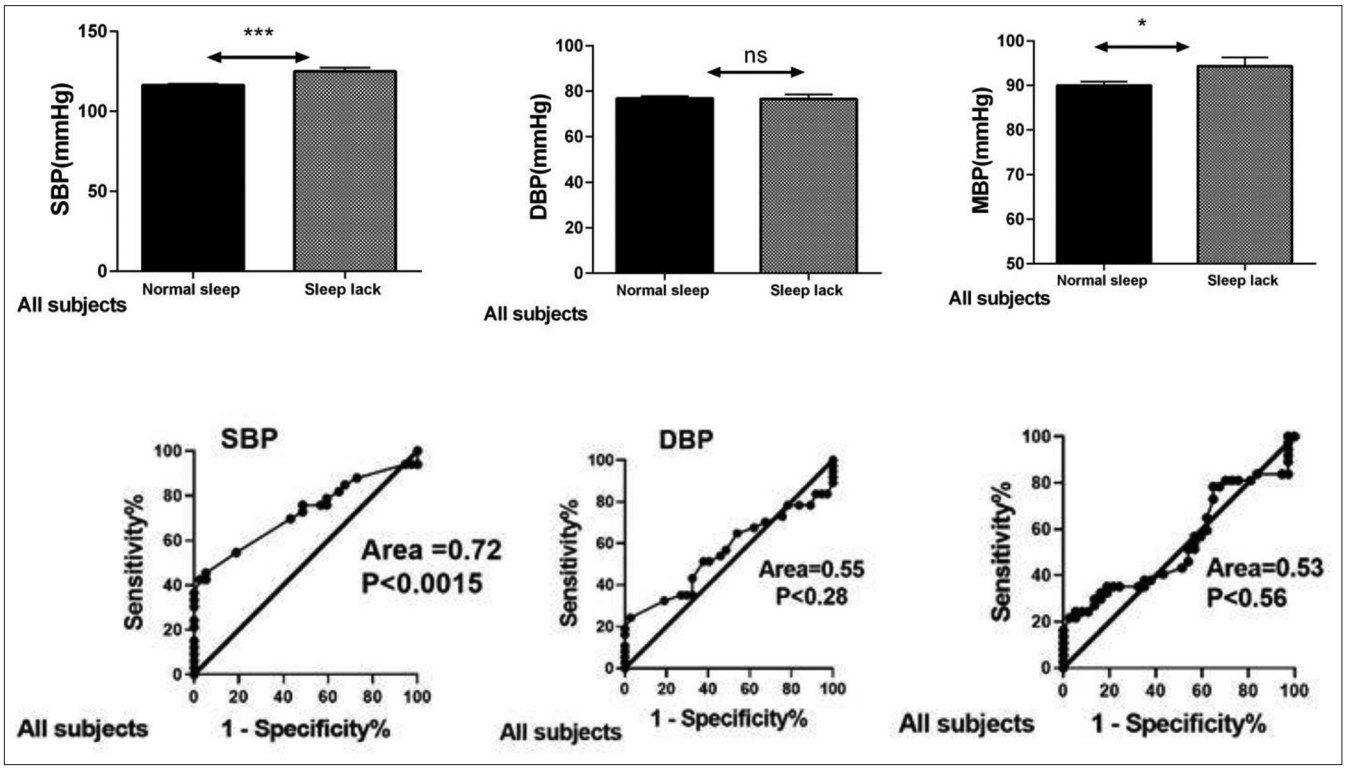

Figure 1: Influence of sleep lack on systolic blood pressure, diastolic blood pressure, and mean arterial pressure with the receiver operating characteristic curves

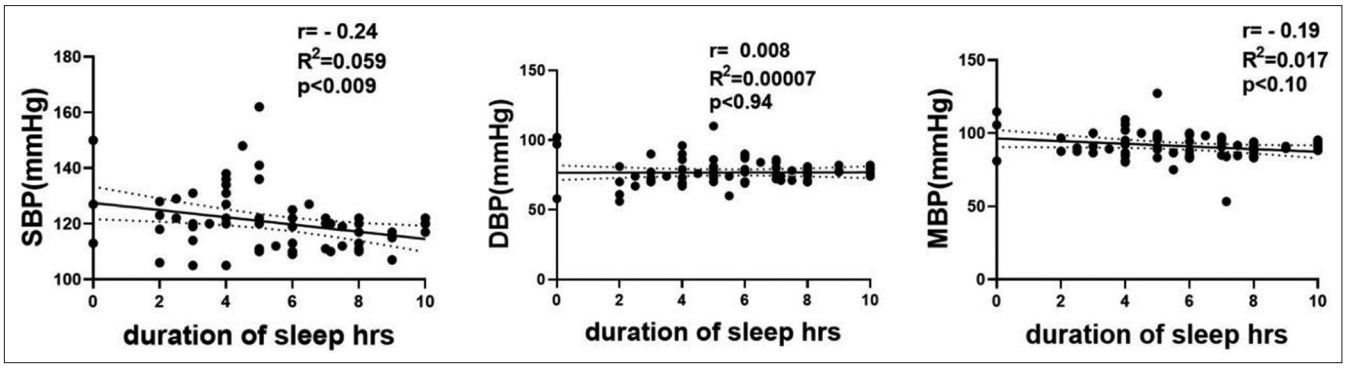

Figure 2: Linear regression presenting the relationships of the duration of sleep in hours with systolic blood pressure, diastolic blood pressure, and mean blood pressure

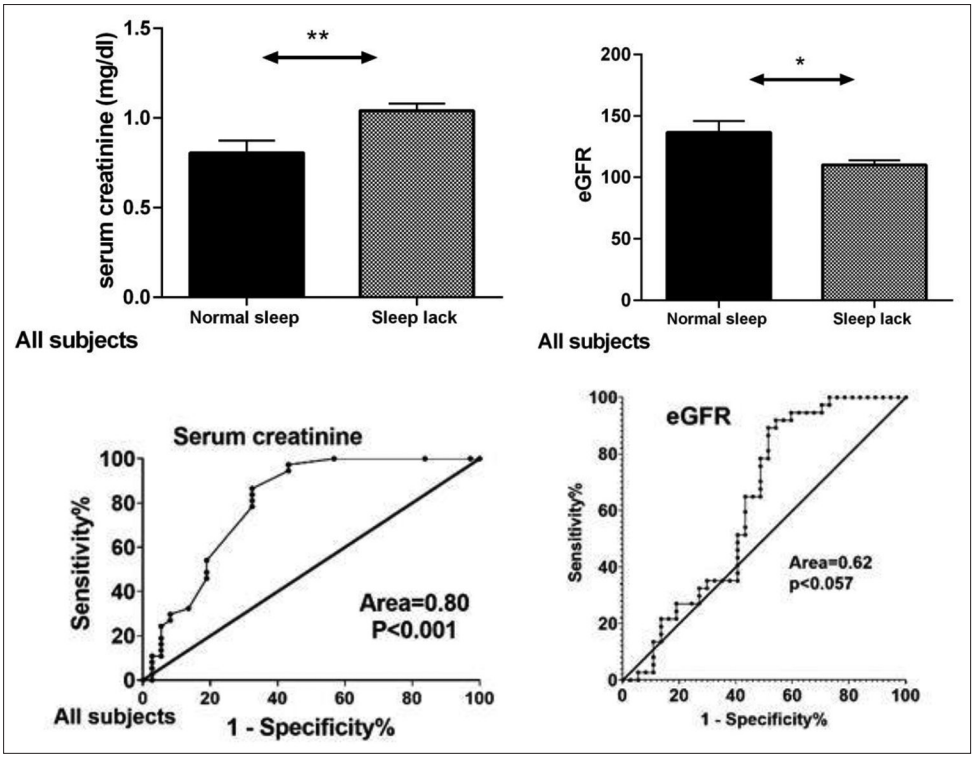

Figure 3: Influence of sleep lack on serum creatinine and estimated glomerular filtration rate with the receiver operating characteristic curves

BP and renal function was done by Pearson coefficient of correlation. $P < 0.05$ considered to be statistically significant.

Receiver operating characteristic (ROC) curve is graphical display of sensitivity on y-axis and (1 – specificity) on x-axis for varying cut-off points of test values. Area under the curve: This is a useful quantitative measure of accuracy. An area ranged of 1 considered a perfect test; an area ranged of 0.5 represents a worthless test.

RESULTS AND DISCUSSION

As displayed in Figure 1, the results had shown that SBP was increased in all participants in sleep lack group as compared to the control group, while DBP was not changed significantly. Furthermore, MAP was increased in all volunteers in sleep lack group, pursuant to most endocrinological studies in this domain, melatonin hormone, which is usually active at night, has a hypotensive effect. On the other hand, in the presence of artificial light during night, this hormone will be suppressed, thus, the BP tends to elevate in sleep-deprived individuals (Paul et al., 2011).

Melatonin deficiency in sleep-deprived persons conduces to an increase of free radicals (Ghosh et al., 2007) which, in turn, escalate BP. Furthermore, suppression of melatonin will increase a potent vasoconstrictor, endothelin-1 (Park et al., 2007). Furthermore, vasodilators particularly, nitric

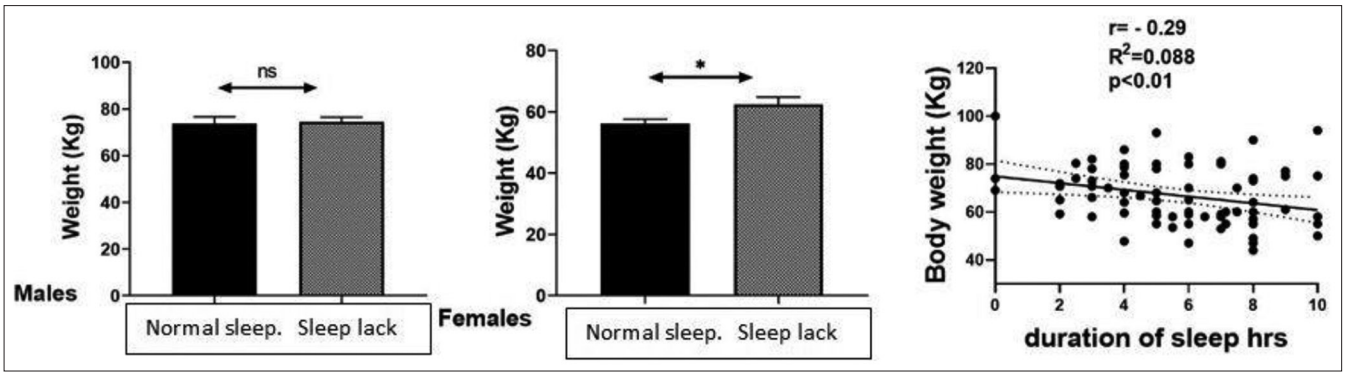

Figure 4: Influence of sleep lack on body weight with linear regression between duration of sleep and weight

oxide tends to reduce in sleep-deprived persons. Having said that inhibition of melatonin increases the level of adrenalin and cortisol hormones which lead to increase in SBP as well (Rimmele et al., 2009). The collected data from the current study illustrated in Figure 2, had confirmed that SBP was inversely connected with the sleep duration. Consequently and depending on the ROC curve, SBP could be represented as a biomarker for disturbances of sleep lack.

Concerning the procured data from the impact of sleep duration on normal renal functions, the results in Figure 3 showed that the serum creatinine tended to rise and concomitantly eGFR values were elevated in sleep-deprived group comparison to the control group. According to the ROC curve, the escalated level of serum creatinine can be a consequence of sleep lack as well. There is obvious evidence that any alteration in sleep length and time of sleep onset may have adverse effects on the kidney. In this connection, the study conducted by Sasaki et al., 2014 had confirmed that short sleep duration and shift work are associated with risk factors responsible for chronic kidney disorders. A range of cross-sectional studies has found that patients with kidney diseases have shorter average sleep durations normal (Turek et al., 2012). In Japan, proteinuria moderately increased in the adults who slept 6 h/night or less as compared to persons who slept for 7 h/night (Yamamoto et al., 2012). However, a prospective association between sleep duration and decline in renal functions has not been demonstrated.

Statistical analysis revealed as shown in Figure 4 shows that sleep lack caused weight gain in female volunteers but in male volunteers it remained unaffected. The possible mechanism may be due to elevation of serotonin level and this is cause increase appetite and hence increased food intake (Bogathy et al., 2019, Coborn et al., 2017). Decreases in leptin hormone and increases in ghrelin levels might be the reason behind sleep-deprived induced weight gain (Caroleo et al., 2019) who recorded that sleep and appetite could be regulated in the depressed patient through coordination between ghrelin, orexin, and nesfatin-1.

CONCLUSION

The present study revealed that sleep lack had increased SBP but not DBP and it was associated with hypertension. Furthermore, the results indicated that serum creatinine was significantly increased in students with sleep lack. We also found a potential relation between those with shorter sleep and a moderate decline in kidney function (eGFR) that was considered as independent risk factor of renal disease. Interestingly, body weight was increased significantly in females but not in male students who had less sleep duration time than normal sleep duration.

RECOMMENDATION

Further investigations are required to detect factors which could increase the risk of hypertension and kidney diseases among sleep lack students. We also recommend extra trials, particularly the difference between genders, in addition to studying confounding factors such as age, gender, oxidative stress, and antioxidant status.

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