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### RESEARCH ARTICLE

#### THE ASSOCIATION BETWEEN SLEEP PATTERN AND HYPERTENSION IN HAIL, KSA.

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#### Abstract

**Background:** In adults, sleep has an important role in the development of cardiovascular diseases. Epidemiologic studies have shown that chronic short sleep may be associated with the development of hypertension.

**Objectives:** This study is aimed to assess the quality of sleep pattern in of Hail city, and to study the relationship between sleep pattern and hypertension among of Hail city.

**Methods:** This descriptive study was conducted in Hail city, Saudi Arabia. A total of 1004 participants who are aged above 17 years old were included in the study. Participants were asked about their socio-demographic data, sleep pattern index questions, with the measurement of the systolic and diastolic blood pressure along with heart rate determination. The statistical analysis of data was done by using excel and SPSS version (20). (Chicago, Illinois: SPSS Inc, USA)

**Results:** There was a significant inverse correlation between the sleep duration during weekends and the hypertension which is represented by systolic blood pressure and R-value was (0.116) and P-value of (<0.001) respectively.

**Conclusion:** In Hail, the present study demonstrated that there was a significant association between sleep duration at weekends and elevated blood pressure. Furthermore, a significant correlation between sleep duration during workdays and age, occupation, smoking and BMI.

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#### Introduction:-

Hypertension is considered to be one of the common chronic diseases among individuals around the world. It affects about 1.13 billion people globally <sup>(1)</sup> In the Kingdom of Saudi Arabia it affects almost one fourth of the adult's population <sup>(2)</sup> Hypertension is defined as raised blood pressure above the normal level. Blood pressure had been categorized into four categories the normal level of blood pressure for healthy individual is defined to be less than 120 mmHg for systole and 80 mmHg for diastole. An elevated level is between 120 to 129 mm Hg systole and less than 80 mm Hg for diastole, for first stage hypertension individual 130 to 139 mm Hg systole and between 80 to 90 mm Hg diastole, for the second stage equal 140 mm Hg or higher systole and 90 mm Hg or higher diastole, the last stage which is considered as hypertensive crisis is higher than 180 mm Hg systole and higher than 120 mm Hg

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diastole.<sup>(3)</sup> Hypertension doubles the risk of cardiovascular diseases, including coronary heart disease (CHD), congestive heart failure (CHF), renal failure, ischemic and hemorrhagic stroke and peripheral arterial disease. It is often associated with additional cardiovascular disease risk factors, and the risk of cardiovascular disease increases with the total burden of risk factors.<sup>(4)</sup>

Sleep is a reversible behavioral state that is characterized by a decreased responsiveness to the environment and stereotypical changes in the electroencephalogram (EEG).<sup>(5)</sup> The Saudi adolescent showed a higher percentage of poor sleeping the adolescent from other countries.<sup>(6)</sup> Also, one of each three Saudi adults suffering from short sleep duration per night. Of these, the second most common medical problem has been recorded is hypertension (33.9%). Also (54.2%) has been recommended with long sleep duration.<sup>(7)</sup>

That realization has led us to look for possibility of the association between sleep pattern and hypertension.

**The Aim of the present study** was to assess the quality of sleep pattern in the general population of Hail city, as well as, study the relationship between sleep pattern and hypertension among adults above 18 years old in Hail city, KSA.

#### **Subjects and method:**

##### **Subjects:**

Study setting: this study was carried out in Hail city. The subjects of the present study were 1004 persons of both sexes, aged above 18 years old.

##### **Operational Design:**

**Pilot study:** A pilot study was conducted on 50 people living in Hail who represented 5% of the total sample in order to ensure the clarity of questions, applicability of tools, test their ability to elicit the desired information and the time needed to complete them.

##### **Tools of data collection:**

Tools used in the study were electronic questionnaire together with electronic blood pressure monitors.

The electronic questionnaires were previously written by the authors in a simple Arabic language after reviewing literature. The questionnaire included 3 important domains; socioeconomic status, sleep pattern index, with the systolic and diastolic blood pressure values along with the heart rate. Questions about the socioeconomic status included; age, sex, occupation, smoking, BMI, chronic disease, caffeine consumption. It also included sleep pattern index: is an effective instrument used to measure the quality and patterns of sleep in adults. It depends on five domains: sleep latency, subjective sleep quality, sleep duration, sleep disturbances, use of sleep medication. The respondents subjectively answered each of these five areas of sleep. Measurement of the systolic and diastolic blood pressure along with heart rate determination was measured on-site. Electronic blood pressure monitors were used. Collection of data was carried out by clinical-phase medical and nursing students only, to ensure accuracy of the measurements.

##### **Methods (Statistical design)<sup>(8)</sup>**

##### **Research design:**

a descriptive research design was adaptive to fulfill the purpose of the study. It helped the researchers to describe and document the aspects of the pathogenic mechanism as they naturally occur. This design helped to establish a database for further research.

The second part, analytical statistics, is to test statistically significant correlation between the variables, and P-value were used to test association among the variable<sup>(8)</sup>.

The statistical analysis of data was done by using excel and SPSS program version (20). (Chicago, Illinois: SPSS Inc, USA)<sup>(1)</sup>. The first part of the data was descriptive data which were revised, coded, tabulated, and statistically analyzed using the proportion and percentage.

##### **Field work:**

once officially permission was granted from the research committee, the researchers initiated data collection. The data collections of this study was carried out in period from December 2018 to February 2019 in Hail city. Data

were collected every day. The researchers met (1004) of respondents residing in Hail. The researchers introduced themselves to the respondents who agreed to be included in this study and voluntary consent was taken. Participants were also informed that their responses will be confidential and used for research purposes only. The researchers explained the purpose of the study to each respondent included in the study.

## Results:-

**Table I:-**Gender distribution of the studied sample

		No.	%	Total	%
Sex	male	570	56.8	1004	100%
	Female	434	43.2		

Results of the present work have indicated that among 1004 persons 570 were males (56,8%), while 434 were females (43. 2%). (Table I)

**Table II:-**Age distribution of studied subjects.

		No.	%	total	%
Age	18-28	604	60.2	1004	100%
	29-38	206	20.0		
	39-48	126	12.5		
	49-58	45	4.5		
	59-68	19	1.9		
	69 or more	4	0.4		

Young adults were the most abundant participants (60.2%). They are aged between 18-28 years old (Table II).

**Table III:-**Nationality distribution of the studied persons

		No.	%	Total	%
Nationality	Saudi	856	85.2	1004	100%
	Non-Saudi	148	14.8		

The participants were mostly Saudi (85.2 %.) (Table III)

**Table IV:-**Occupation distribution of the studied subjects

		No.	%	Total	%
Occupation	No job	153	15.2	1004	100%
	Students	457	45.5		
	Has job	394	39.3		

The percentage of students in the sample was 45.5%, and employees in different jobs were 39.3%. While the percentage of those not employed was 15. 2%. (Table IV).

**Table V:-**Distribution of smoking habit in the studied sample

		No.	%	Total	%
Smoking	smoking	128	12.7	1004	100%
	Not smoking	855	85.2		
	Quit smoking	21	2.1		

The smokers were 12.7%, while those who quit smoking represented 2.1% of the sample. (Table V)

**Table VI:-**Chronic disease association in the studied subjects

		No.	%	Total	%
Have a chronic disease	There is	116	11.6	1004	100%
	There is not	888	88.4		

88.4% of the participants did not suffer of any chronic disease. (Table VI).

**Table VII:-**Body mass indexes in the studied cases

		No.	%	Total	%
BMI	Less than 16	23	2.3	1004	100%
	16-18.4	65	6.5		
	18.5-24.9	429	42.7		
	25-29.9	279	27.8		
	30-39.9	197	19.6		
	More than 40	11	1.1		

Regarding BMI, 42.7% of the study participants had a BMI between 25-29.9 kg/m<sup>2</sup>, 27.8% had a BMI of 30-39.9 kg/m<sup>2</sup>. And the percentage of participant who had a BMI of more than 40 kg/m<sup>2</sup> was 20.7%. (Table VII)

**Table VIII:-**Caffeine consumption in the persons under research

		No.	%	Total	%
caffeine consumption	Do not drink	131	13.0	1004	100%
	1 time per day	282	28.1		
	2 time per day	181	18.0		
	3 time per day	162	16.1		
	4 time per day	91	9.1		
	5 time per day	53	5.3		
	More than 5 time per day	104	10.4		

After analyzing caffeine consumption, it was found that the highest percentage of the study persons consumed caffeine once a day (28.1%) following by who consumed twice a day (18%) then three times a day (16.1%) and once a day (13%) (Table VIII).

**Table IV:-**Range sleep duration during weekdays and weekend days (Hours\ day)

		No.	%	Total	%
Range sleep duration during weekdays Hours\ day	0-2	3	0.3	1004	100%
	2-4	37	3.7		
	4-6	293	29.2		
	6-8	460	45.8		
	8-10	145	14.5		
	10-12	78	7.8		
	12-14	10	0.1		
	More than 14 hours	13	1.3		

		No.	%	Total	%
Range sleep duration during weekend days Hours\ day	0-2	-	-	1004	100%
	2-4	20	2.0		
	4-6	142	14.2		
	6-8	352	35.0		
	8-10	279	27.7		
	10-12	128	12.8		
	12-14	38	3.8		
	More than 14 hours	45	4.2		

The usual sleep duration in the weekdays (Sunday to Thursday) showed that: 45.8% of participant sleep 6-8 hours per day, 29.2% of the participants sleep 4-6 hours per day, and then 14.5% of them was found to sleep 8-10 hours per day. The usual sleep duration in the weekend days was found to be different as the results showed a high percentage for whom sleep 6-8 hours per day (35%), followed by 27.7% for whom sleep 8-10 hours per day. While those who sleep 4-6 were found to compose 14.2% of the sample. (Table IV)

**Table X:-**Use of sleep medication in the studied persons

		No.	%	Total	%
Use of Sleep	Yes	50	5.0	1004	100%

medication	No	954	95.0		
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About the sleep pattern for these two groups most of the participant do not use any sleep medication on a regular basis (95%) and the majority of them had a continuous sleep pattern (73.1%). The average time of interrupted sleep per days was found to be 35.2 % of those who had interrupted sleep; twice a day. Most of them could get back to sleep easily (95%). (Table X)

**Table XI:-**Correlation between Sleep pattern, hypertension and different Socio-demographic characteristics of the present study sample

sleep pattern		r	P-value
Sleep duration during weekdays	X2 age	-0.132	<0.001
	X4 occupation	0.098	<0.001
	X5 smoking	0.109	<0.001
	X11 BMI	-0.077	<0.005
Sleep duration during weekend days	X1 sex	-0.136	<0.001
	X2 age	-0.292	<0.001
	X4 occupation	-0.154	<0.001
	X6 chronic diseases	-0.081	<0.005
	X11 BMI	-0.181	<0.005
	X26 blood pressure	-0.116	<0.001
	X27 blood pressure	-0.083	<0.001
Sleep quality	X1 sex	-0.239	<0.001
	X2 age	-0.092	<0.001
	X4 occupation	-0.067	<0.005
	X5 smoking	-0.093	<0.001
	X6 chronic diseases	0.90	<0.001
	X11 BMI	0.075	<0.005
Average times of sleep interruption	X1 sex	0.218	<0.001
	X2 age	0.090	<0.001
	X5 smoking	0.083	<0.001
	X6 chronic diseases	0.077	<0.005
	X11 BMI	-0.072	<0.005
Problems of getting back to sleep after sleep interruption	X1 sex	0.226	<0.001
	X2 age	0.078	<0.005
	X4 occupation	0.065	<0.005
	X5 smoking	0.089	<0.001
	X6 chronic diseases	-0.079	<0.005
Use of sleep medications	X1 sex	0.098	<0.001
	X5 smoking	-0.070	<0.005
	X18 sleep quality	-0.150	<0.001
	X19 sleep disturbance	-0.122	<0.001

Correlation between sleep pattern of studied cases and hypertension is shown in (Table. XI.). Socio-demographic characteristics of the present study sample confirmed significant correlation with sleep duration during weekdays. R-values were (-0.132, 0.098, 0.109, -0.077) respectively and P-values for them were (<0.001, <0.001, <0.001, <0.005), respectively. (Table. XI.).

The current study revealed that the sleep duration during weekends had a significant correlation with sex, age, occupation, chronic diseases, BMI, and hypertension. R-values were (-0.136, -0.292,-0.154,-0.081,-0.181,-0.116) respectively and P-values for them were (<0.001, <0.001, <0.001, <0.005, <0.005, <0.001), respectively. (Table XI.).

The study also revealed that the subjective sleep quality had a confirmed significant correlation with: sex, age, occupation, smoking, chronic diseases, and BMI. R-values were (-0.239,-0.092,-0.067,-0.093, 0.90, 0.075)

respectively and P-values for them were ( $<0.001$ ,  $<0.001$ ,  $<0.005$ ,  $<0.001$ ,  $<0.001$ ,  $<0.001$ ), respectively. (Table XI.).

The third domain of the study was the sleep disturbance and it consisted of two sub-domains: average times of sleep interruption per day, and problems of getting back to sleep after they wake up. The current study revealed that the average times of sleep interruption per day had a confirmed significant correlation with: sex, age, smoking, chronic diseases, and BMI. R-values were (0.218, 0.090, 0.083, 0.077, -0.072) respectively and P-values for them were ( $<0.001$ ,  $<0.001$ ,  $<0.001$ ,  $<0.005$ ,  $<0.005$ ), respectively. (Table XI).

The second sub-domain of sleep disturbances was “if there are any problems of getting back to sleep after they wake up”. It had a confirmed significant correlation with: sex, age, occupation, smoking, and chronic diseases. R-values were (0.226, 0.078, 0.065, 0.089, -0.079) respectively and P-values were ( $<0.001$ ,  $<0.005$ ,  $<0.005$ ,  $<0.001$ ,  $<0.001$ ), respectively. (Table XI).

The last domain of the sleep pattern in the present work was the use of sleep medication. A significant Correlation was found between sleep pattern studied cases and the use of sleep medication and all the socio-demographic characteristics. (Table XI).

The use of sleep medications showed a significant correlation with: sex, smoking, sleep quality, and sleep disturbances. R-values were (0.098, -0.070, -0.150, -0.122) respectively and P-values were ( $<0.001$ ,  $<0.001$ ,  $<0.001$ ,  $<0.001$ ), respectively. (Table XI)

## Discussion:-

The aim of the present study was to assess sleep pattern and hypertension among the population of Hail city. The study was carried out in Hail city on 1004 individuals, from both sex, and age above 18. The present study indicated that there was a relationship between sleep pattern and hypertension. This was supported by a study conducted in Sleep and Heart Health which showed that sleep duration that ranged from 7 to less than 8 hours per night was associated with an increase in blood pressure.<sup>(9)</sup>

According to the present study results, gender had a significant relationship with sleep interruption, problems of getting back to sleep after sleep interruption and use of sleep medications. Among 1004 persons 570 were males (56.8%), while 434 were females (43.2%). Another study in American suggested that women were significantly more likely than men to report interrupted sleep.<sup>(10)</sup>

The current study revealed that young adults were the most abundant participants (60.2%). They aged between 18-28 years old. There was a strong positive significant relationship between average times of sleep interruption and age. This was strongly supported by national sleep foundation which stated that as individuals got older, they faced harder time to get asleep and more problems of keeping asleep than when they were young<sup>(9-11)</sup>

The present study results indicated that about half of the study sample had poor sleep quality during weekends and unsatisfying work performance. A research about prevalence of short sleep duration by occupation has found a high prevalence of short sleep duration among workers and identified specific occupational groups with the highest prevalence of short sleep duration.<sup>(11, 12)</sup> According to the present study findings, there is a positive relationship between sleep duration during weekends and occupation.

The current study declared that the subjective sleep quality had a confirmed association with smoking habits. In a sleep cohort study, found that current smokers were more closely associated with snoring and moderate or severe sleep-disorders than non-smokers.<sup>(12, 13)</sup>

Several studies have founded an association between the duration of sleep and chronic diseases, including diabetes, obesity, and hypertension<sup>(14-16)</sup>. This was an agreement with the current study findings which revealed that, the chronic diseases indicate a strong positive relationship with sleep duration during weekends.

The present study found that 23.5% of subjects slept for 7-8 hours, 22.3% slept for 6-7 hours, and 20.8% slept for 5-6 hours per a normal working day. Comparing to a previous study about prevalence of sleep duration among Saudi adults, 41.4% of their participants slept for 7-9 hours per day, following by less than 7 hours (33.7%) and finally

who slept more than 9 hours (24.7%) per night. They also reported that the majority of participants had interrupted sleep pattern (68.1%)<sup>(6)</sup>. This was in contrast to the present study where we found about 73% had continuous sleep pattern.

In the present study there was only 5% who used sleep medications which was a nearly the same as found by a previous study of "Sleep habits in adolescents of Saudi Arabia". They reported 4% of their student only used hypotonic medications.<sup>(12)</sup>

Moreover, in the current study, there was an association between body mass index (BMI) and socio-demographic characteristics. On the other hand, BMI had other relationships with sleep duration during weekends, sleep quality, and sleep disturbance. The sub-domains of sleep disturbance included; average time of sleep interruption per day, and problems of getting back to sleep after they awake up. More recently, sleep had been identified as a health behavior that might play a role in obesity as well.<sup>(13)</sup>

In the present study, it was found that there was a significant correlation between average sleep duration during workdays and socio-demographic characteristics like age, occupation, smoking, BMI (Table XI). There was a significant inverse correlation between duration during workdays and age (R-value=-0.132, P-value=<0.001). This means that as a person gets older their sleep duration is found to be less. These results were consistent with a study done in Pakistan on participants aged 60 years and above that showed that elderly people with other co-morbidities were at a high risk of insomnia.<sup>(17)</sup> Farazdaq et al, 2018<sup>(17)</sup> also supported the significant inverse correlation found between BMI and sleep duration during workdays. Current studies showed that BMI did not seem to mediate the relationship between sleep patterns and hypertension<sup>(18)</sup>.

The present work found that the sleep duration during weekends had a significant correlation with hypertension (Table XI). (R-value for correlation between sleep during weekends and systolic blood pressure= -0.116, P-value=<0.001), (R-value for correlation between sleep during weekends and diastolic blood pressure=-0.083, P-value=<0.001). This was similar to the result of Wang et al (2015)<sup>(5)</sup>, who found out that longer and shorter periods of sleep may both be risk factors for high blood pressure<sup>(5)</sup>. However, a significant correlation was only found by analyzing the sleep duration during weekends. The reason was attributed to the large percentage of employers and students in the present study who generally slept less during the workdays but had a descent amount of sleep during weekends. This might be an indicator of sleeping well whenever they were free of duties and stress.

The present results also showed significant correlation between sleep quality and other factors including: sex, age, occupation, smoking, chronic diseases, BMI. (Table XI) The correlation between sleep quality and sex was found to be significant and obviously increased in females (R-value=-0.239, P-value=<0.001). Ladies were found to have more interrupted sleep than gentlemen. This result might be an explanation of the high association between sleep pattern and hypertension in females in previous studies<sup>(2,4,5, 15)</sup>. Moreover, women have more interrupted sleep than men because of their lifestyle; women need to wake up multiple times at night to breastfeed their babies for example. This was also supported by the strong significant correlation between sleep quality and age (R-value=-0.092, P-value=<0.001). Younger people were shown to be more prone to sleep interruption. As the age gets older sleep difficulties were found to be less. This might be due to the fact that youth people subjected to more life stress and work duties. Furthermore, they were in their reproductive years that they might have more stress regarding finding their partner, taking care of children.

There was also a significant correlation between sleep quality and chronic diseases in the present research. It was shown that those cases with chronic diseases had more interrupted sleep (R-value=0.90, P-value=<0.001). This was an important alarm that must be considered by physicians since night sleep interruption might affect the patient's quality of life. It resulted in daytime sleepiness which might affect their performance at college and work.

In the present work, sleep quality was found to be significantly associated with BMI. The more the BMI, the more the sleep interruption (R-value=0.075, P-value=<0.005). This might be due to the fact that obese people are more susceptible for obstructive sleep apnea. Similar explanation was stated by Jordan et al in 2014<sup>(19)</sup> and Carrillo-Larco et al 2017<sup>(18)</sup>. They added that obstructive sleep apnea led to disrupted sleep.<sup>(18,19)</sup>

The average times of sleep interruptions per days was found to be 35.2 % of those who had interrupted sleep; twice a day. Most of them could get back to sleep easily (95%). and it showed a positive relationship with male sex.

However in a cross section study about relationship between sleep duration and hypertension in northeast China showed that the differential self-reporting of sleep habits of male and female participants might have an impact on these gender-specific associations.<sup>(20)</sup>

In addition to short sleep duration, sleep disorders such as sleep insomnia, obstructive sleep apnea and other sleep quality problems were reported<sup>(13, 14, 17, 19)</sup>. In present study, there was a significant relationship between the age group between 29-39 years old and sleep interruption. It might be due to facing more socioeconomic stress in that age and it is the age of getting married mostly.

Using sleep medication most of the present sample did not use any sleep medication (95%) and the majority of them had continuous sleep pattern. Since 95% got back to sleep easily so no need to use sleep medication<sup>(6-7)</sup>.

### Conclusion:-

In Hail, the present study demonstrated that there was a significant association between sleep duration at weekends and elevated blood pressure. Also a significant relationship between sleep quality and some of sociodemographic parameters was discovered. Moreover, there was a significant correlation between average times of sleep interruption per day and smoking, chronic diseases and BMI. Furthermore, a significant correlation between sleep duration during workdays and age, occupation, smoking and BMI.

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