

## Assessment of Sleep Quality and Quality of Life in Hypertensive Subjects at a Tertiary Care Hospital in Uttarakhand, India

### Abstract

**Background:** Hypertension is a leading risk factor for cardiovascular diseases with prevalence of 33% in urban and 25% in rural population in India. Studies have suggested that hypertension significantly affects the sleep quality and quality of life of subjects. Therefore, this study aimed to establish a correlation between sleep quality, quality of life, and hypertension in Uttarakhand. **Methods:** This observational cross-sectional study was carried out on hypertensive subjects at a tertiary care hospital in Uttarakhand following ethics approval. After taking consent from participants, blood pressure and anthropometric measurements were recorded. Then, their sleep quality and quality of life was assessed using Pittsburgh sleep quality index (PSQI) and WHO-QOL BREF questionnaire respectively. Statistical analysis was then carried out to correlate these parameters. **Results:** 168 participants were recruited for this study, with 43.5% males and 56.5% females. It was found that 77.4% of these subjects were having poor sleep quality with the mean global PSQI score as  $7.90 \pm 3.713$ . These subjects assessed their Quality of life to be worst in physical domain ( $12.68 \pm 3.13$ ), followed by psychological, social relationship domain and environment domain. A significant association was found between sleep quality and different stages of hypertension ( $P$  value = 0.039) but quality of life and stages of hypertension have no significant association ( $P$  value > 0.05). **Conclusions:** Sleep quality, quality of life and blood pressure are correlated. So, clinicians should also focus on improving their patient's sleep quality and quality of life besides pharmacological treatment.

**Keywords:** Blood pressure, hypertension, India, quality of life, sleep

### Introduction

Hypertension is a long-term medical condition in which blood pressure is persistently elevated in the arteries. It is a leading risk factor for cardiovascular diseases which affects the mortality and disability-adjusted life years worldwide.<sup>[1]</sup> Statistics report the prevalence of hypertension to be 26.4% worldwide in 2000, which is expected to increase to 33% by 2025.<sup>[2]</sup> Indian studies report hypertension to be 33% prevalent in urban and 25% in rural population.<sup>[3]</sup>

The role of sleep quality in hypertension is an upcoming research area which needs to be explored. It has been shown that short sleep duration affects hypertension due to alteration in stress system function.<sup>[4]</sup> Another study suggested that sleep intervention showed insignificant improvement in 24 hour ambulatory systolic blood pressure.<sup>[5]</sup> Hypertension also affects the QOL due to its chronic nature with

adverse effects on their physical, emotional and social well-being.<sup>[6]</sup> A study stated that the patients without complications had significantly better improvement in quality of life than complicated patients on follow up.<sup>[7]</sup> These lifestyle interventions along with pharmacological treatment can contribute a lot to prevent and treat hypertension if proper correlation is established.

Nearly, one-third of the adult populations in India is estimated to have hypertension.<sup>[8]</sup> Despite this high burden, the relationship of hypertension with sleep duration and QOL has been largely unexplored. There are no studies on relationship of sleep quality and QOL with hypertension in this region. World statistics show that they are correlated. Therefore, we have done this observational study, to evaluate sleep quality and quality of life among hypertensive subjects and their correlation with the stages of hypertension. This will aid the policy makers since there is a need to think beyond the pills. Studies like this will strengthen the baseline data of

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**DOI:**  
10.4103/ijpvm.IJPVM\_465\_20

### Quick Response Code:



**How to cite this article:** Jain N, Pathania M, Bahurupi Y. Assessment of sleep quality and quality of life in hypertensive subjects at a tertiary care hospital in Uttarakhand, India. *Int J Prev Med* 2021;12:158.

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hypertensive subjects, which will pave the way for future preventive interventions.

### Methods

In this observational cross-sectional study, hypertensive subjects attending general OPD and Lifestyle Diseases Clinic of Department of Medicine at a tertiary care hospital of Uttarakhand during July and August were enrolled. Males and females of age group 30-65 years, newly diagnosed and self-reported pre-diagnosed hypertension, according to AHA 2017 guidelines were enrolled after taking informed consent.<sup>[9]</sup> Subjects already diagnosed with any end organ damage, malignant hypertension, pregnant females, and those unwilling to participate in the study were excluded from the study. The sample size of the study was 168.

Subjects were enrolled after assessing for inclusion and exclusion criteria. An informed written consent was taken by the principal investigator. Detailed personal history including age of subject, medical history, addiction history, family history and treatment history was recorded. Anthropometric measurements like height (cm), weight (kg) were recorded and body mass index (BMI) calculated. Waist and hip circumference was measured in inches and waist hip ratio calculated. Blood pressure was recorded in sitting posture in right arm 3 times after the subject had rested for 5 min, then mean blood pressure was calculated in mmHg.

Standard questionnaires were used to assess sleep quality and quality of life. Permission for using these scales was taken. The questionnaires were filled by principal investigator.

### Tools for Assessment

**Pittsburgh Sleep Quality Index (PSQI):** Sleep quality was assessed using PSQI, a validated questionnaire for assessment of sleep patterns and its predictors. It is a self-reported questionnaire assessing sleep quality over a 1-month time interval. The global score ranges from 0 to 21, where subjects scoring more than five points were considered having poor sleep quality.<sup>[10]</sup> The internal consistency and validity of PSQI was confirmed with Cronbachs  $\alpha = 0.76$ .<sup>[11]</sup>

**‘WHO Quality of Life – BREF’ scale:** QOL of subject was assessed by using ‘WHO QOL – BREF’ scale. It evaluates QOL in four domains; physical, social, psychological, and environmental. Higher the total score, better is the quality of life.<sup>[12]</sup> The instrument showed good internal consistency with Cronbach’s  $\alpha = 0.87$ .<sup>[13]</sup>

**Statistical analysis:** Data was entered in Microsoft excel and analyzed using statistical software by IBM Corp. Released in 2015. IBM SPSS Statistics for windows, version 23.0. Armonk, NY: IBM Corp. Categorical data from the study was summarized as frequencies and

proportions. Continuous data was expressed in means and standard deviations. Normality of continuous data were evaluated using Kolmogorov-Smirnov test. Association of sleep quality with different grades of hypertension was analyzed using Chi square test. A comparison of mean QOL scores with different grades of hypertension was performed using Mann–Whitney tests. Association between sleep quality and quality of life was analyzed using Spearman’s correlation tests and univariate and multivariate linear regression analysis. Graphs were made wherever necessary. A “P value” of less than 0.05 was considered significant.

**Ethical clearance:** Ethical clearance for the study was obtained from the Institutional ethics committee. The subjects who agreed to participate in the study signed an informed consent form. Besides, they were entitled to drop out at any time and anonymity was promised. The ethical code was AIIMS/IEC/19/824 dated 10/5/2019.

### Results

In the present study, out of 168 hypertensive subjects enrolled, 73 (43.5%) were males and 95 (56.5%) were females. Their mean age was  $51.55 \pm 10.06$  years. Subjects’ demographics are summarized by stages of hypertension in Table 1.

The mean BMI in the study population was  $26.96 \pm 4.98$  kg/m<sup>2</sup> which is in the range of obesity. 12.5% subjects were categorized as overweight and 66.07% subjects were included in obese category according to Asian BMI guidelines. The mean waist hip ratio was  $0.954 \pm 0.06$ . The mean systolic and diastolic BP was reported to be  $151.82 \pm 15.33$  and  $89.75 \pm 10.36$  mmHg respectively. Out of 168 hypertensive subjects, according to AHA guidelines, only 37 (22%) of them were in stage 1 hypertension and the remaining in stage 2 hypertension.

According to PSQI, 130 (77.4%) people reported having poor sleep quality while only 38 (22.6%) reported having good sleep quality. Overall, the mean global PSQI score was  $7.90 \pm 3.71$ . According to WHO QOL BREF scale, the perception of QOL and health as stated by individuals was  $2.74 \pm 1.50$  and  $2.73 \pm 1.02$ , respectively. The domains of quality of life and sleep quality in different stages of hypertension are summarized in Table 2. A significant association was also found between sleep quality and different stages of hypertension ( $P$  value = .039) [Table 2]. A significant negative correlation has been found between sleep quality (PSQI score) and QOL domains in different stages of hypertension as discussed in Table 3 and univariate and multivariate linear regression analysis done for significant results is represented in Tables 4 and 5, respectively.

### Discussion

This is the first study conducted in Uttarakhand, India which has tried to assess the sleep quality and quality

**Table 1: General characteristics of study subjects**

Parameters	Total subjects	Stage 1 hypertension	Stage 2 hypertension	P
Number of subjects	168	31	131	--
Mean age in years (mean±SD)	51.55±10.06	47.0±10.94	52.82±9.45	0.004 <sup>*c</sup>
Gender				
Male	73 (43.5)	12 (32.4)	61 (46.6)	0.126 <sup>b</sup>
Female	95 (56.5)	25 (67.6)	70 (53.4)	
Mean duration of hypertension in years (mean±SD)	4.44±4.87	4.08±5.06	4.55±4.84	0.505 <sup>c</sup>
Family history of hypertension	34 (20.2)	9 (24.3)	25 (19.9)	0.484 <sup>b</sup>
No family history of hypertension	134 (79.8)	28 (75.7)	106 (80.9)	
Vegetarian	101 (60.1)	22 (59.5)	79 (60.3)	0.926 <sup>b</sup>
Non-vegetarian	67 (39.9)	15 (40.5)	52 (39.7)	
Smoking status				
Smoker	22 (13.1)	4 (10.8)	18 (13.7)	--
Ex-smoker	20 (11.9)	3 (8.1)	17 (13.0)	
Non-smoker	126 (75.0)	30 (81.8)	96 (73.3)	
Mean number of pack years (mean±SD)	20.18±24.57	14.5±10.85	21.3±26.44	0.813 <sup>c</sup>
Alcoholic status				
Alcoholic	22 (13.1)	5 (13.5)	17 (13.0)	--
Ex-alcoholic	16 (9.5)	0 (0)	16 (12.2)	
Non-alcoholic	130 (77.4)	32 (86.5)	98 (74.8)	
Anthropometric measurements				
BMI	26.96±4.98	26.80±4.69	27.00±5.08	0.831 <sup>a</sup>
Waist circumference (inch)	38.73±4.68	38.89±4.13	38.68±4.84	0.808 <sup>a</sup>
Hip circumference (inch)	40.60±4.43	40.19±3.97	40.72±4.56	0.743 <sup>c</sup>
Waist hip ratio	0.95±0.06	0.96±0.05	0.95±0.06	0.104 <sup>a</sup>

\*(significant at level of 0.05), <sup>a</sup>(independent *t*-test), <sup>b</sup>(Chi square test), <sup>c</sup>(Mann Whitney test)

**Table 2: Comparison of various components in different stages of hypertension**

Parameter	Total subjects	Stage 1 hypertension	Stage 2 hypertension	P
Total sample size	168	37	131	
Sleep quality <sup>1</sup>				
Good sleep quality	38 (22.6%)	13 (35.1%)	25 (19.1%)	0.039 <sup>*</sup>
Poor sleep quality	130 (77.4%)	24 (64.9%)	106 (80.9%)	
Quality of life <sup>2</sup>				
Physical domain	12.68±3.13	12.70±3.03	12.67±3.16	0.983
Psychological domain	13.79±2.67	13.68±2.50	13.82±2.71	0.807
Social relationship domain	14.7±2.65	15.03±2.44	14.18±2.68	0.061
Environment domain	15.43±2.39	15.57 (2.04)	15.39 (2.48)	0.797

\*(significant at level of 0.05), <sup>1</sup>(Chi square test), <sup>2</sup>(Mann-whitney test)

**Table 3: Correlation between sleep quality (PSQI score) and quality of life**

Spearman's rho Quality of life domains	PSQI score			
	Stage 1 hypertension		Stage 2 hypertension	
	Correlation Coefficient	P	Correlation Coefficient	P
Physical Domain	-0.697 <sup>*</sup>	<.001	-0.497 <sup>*</sup>	<.001
Psychological domain	-0.591 <sup>*</sup>	<.001	-0.440 <sup>*</sup>	<.001
Social relationship domain	-0.477 <sup>*</sup>	0.003	-0.113	0.198
Environment domain	-0.248	0.140	-0.273 <sup>*</sup>	0.002

\*(significant at level of 0.05)

of life in hypertensive subjects and has tried to correlate them with the stages of hypertension. The findings are very relevant and highlight the importance of having good sleep and good quality of life in hypertensive subjects.

The mean BMI observed was 26.96 ± 4.98 kg/m<sup>2</sup> which is in the range of obesity (BMI for obese in Indian population is >25 kg/m<sup>2</sup>) and studies have proved

that high BMI is associated with an increased risk of hypertension.<sup>[14]</sup> The mean waist hip ratio was 0.954 ± 0.06 which indicates obesity and this also leads to increased risk of hypertension.<sup>[15]</sup> A study in Maharashtra, India also showed that 37.8% of hypertensive subjects were obese whereas in this study, 66.07% of subjects were categorized as obese.<sup>[16]</sup> The prevalence rate of general obesity and abdominal obesity in India varies from 11.8%-31.3% and

**Table 4: Univariate linear Regression analysis between sleep quality (PSQI score) and quality of life**

Quality of life domains	PSQI score							
	Stage 1 hypertension				Stage 2 hypertension			
	Coefficient (B)	P	95% CI (lower)	95% CI (upper)	Coefficient (B)	P	95% CI (lower)	95% CI (upper)
Physical Domain	-0.496*	<.001	-0.684	-0.307	-0.468*	<.001	-0.597	-0.338
Psychological domain	-0.341*	<.001	-0.515	-0.167	-0.322*	<.001	-0.441	-0.203
Social relationship domain	-0.250*	0.010	-0.436	-0.065	--	--	--	--
Environment domain	--	--	--	--	-0.181*	0.002	-0.297	-0.065

\*(significant at level of 0.05)

**Table 5: Multivariate linear Regression analysis between sleep quality (PSQI score) and quality of life**

Quality of life domains	PSQI score							
	Stage 1 hypertension				Stage 2 hypertension			
	Coefficient (B)	P	95% CI (lower)	95% CI (upper)	Coefficient (B)	P	95% CI (lower)	95% CI (upper)
Physical Domain	-0.817*	0.008	-1.405	-0.229	-0.867*	0.004	-1.446	-0.289
Psychological domain	-0.002	0.995	-0.745	0.740	-0.336	0.389	-1.120	0.448
Social relationship domain	-0.227	0.377	-0.744	0.289	--	--	--	--
Environment domain	--	--	--	--	0.471	0.183	-0.234	1.177

\*(significant at level of 0.05)

16.9%-36.3% respectively according to ICMR-INDIAB study 2015.<sup>[17]</sup>

In the current study, the poor sleep quality was reported in 77.4% of hypertensive subjects which is quite high as compared to other studies in India (47.2%)<sup>[4]</sup> and Nigeria (42.4%)<sup>[18]</sup> in hypertensive population. The percentage of individuals with poor sleep quality was higher in our study because majority of them belong to stage 2 hypertension and a significant relationship had been found between sleep quality and stages of hypertension in our study and other studies too.<sup>[19]</sup> The mean global PSQI score in our study was  $7.90 \pm 3.71$  which is also quite high as compared to another study done in Nigeria where it was  $5.03 \pm 3.28$ .<sup>[18]</sup>

A study by Bathgate CJ *et al.* showed that there exists a stronger association between stage 1 and stage 2 hypertension with chronic insomnia than subjects with isolated insomnia symptoms.<sup>[19]</sup> Similarly in our study, a significant association was found between sleep quality and different stages of hypertension. However, in our study, number of subjects in different stages of hypertension was unequal, so more studies need to be done with equal number of participants in different stages to establish a strong relationship.

In our study, it was found that the average assessment of the QOL measured by the WHOQOL-BREF questionnaire was 2.74 points (SD = 1.5), which shows QOL between poor and average levels which corroborates with another study where QOL was reported to be 3.36 points (SD = 0.84).<sup>[6]</sup> Similar results were found when subjects assessed their own perception of health with 2.73 points (SD = 1.01). In our study, it has been found that subjects perceived best

QOL in environmental domain ( $15.43 \pm 2.39$ ), followed by social relationship ( $14.37 \pm 2.64$ ) and psychological domains ( $13.79 \pm 2.66$ ) and they reported worst QOL in physical domain ( $12.68 \pm 3.12$ ). However, another study done in Poland in elderly hypertensive subjects reported that subjects considered their QOL to be best in the psychological domain (14.6); slightly worse in the environmental (14.46) and social domain (14.38), and the worst in the physical domain (13.01).<sup>[6]</sup> A study in Vietnam reported that hypertensive subjects experienced best quality of life in social relationship domain and worst in psychological domain.<sup>[20]</sup>

This discrepancy in different domains of QOL may be due to different factors affecting QOL; such as environment, lifestyle, occupation, stress, workplace conditions, socioeconomic status, mental health, and family relations which vary according to region. QOL in physical domain is reported to be poor by most of the studies and our study also reveals the same results. But in our study, QOL in environmental domain is quite good compared to other studies; this may be because Uttarakhand has been known for its natural environment of the Himalayas and a study by Kazuo T *et al.* also reported that industrialization in Uttarakhand is still in ongoing phase.<sup>[21]</sup>

In our study, no significant relationship was found between quality of life and stages of hypertension [Table 2] which also corroborates with another study done by Katsi *et al.*<sup>[22]</sup> Although, researchers have stated that awareness regarding hypertension significantly affects the quality of life.<sup>[23]</sup>

In this study, in stage 1 hypertensive subjects, a negative correlation was found between sleep quality and physical, psychological, and social relationship domain. However,



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no association was present with environmental domain. In stage 2 hypertensive subjects, a negative correlation was found between sleep quality and physical, psychological, and environmental domain. However, no association was present with social relationship domain. [Table 3] This indicates that as the sleep quality of an individual is affected, it adversely affects the quality of life. Similar results have been found by another study which reported that insomnia affects all domains of QOL, mainly physical ( $r = -0.582$ ,  $P < 0.001$ ) and psychological domains ( $r = -0.520$ ,  $P < 0.001$ ).<sup>[6]</sup> This study reported that sleep quality affects quality of life mainly in physical domain in both stage 1 ( $B = -.817$ ,  $P = 0.008$ ) and stage 2 ( $B = -.867$ ,  $P = 0.004$ ) hypertension. [Table 5]

Although this research was carefully planned, but there are some limitations and shortcomings. Firstly, there was a small sample size of the study, taken from single outpatient source; therefore we need to do studies on larger populations from multi-centers to extrapolate our results to entire population. Secondly, the number of study participants in different stages of hypertension was not comparative. So, we need to do studies with equal number of participants in different stages to find better correlation with sleep quality and quality of life. Thirdly, there was a lack of healthy population group to compare the outcomes. Therefore we recommend studies with large sample size, multi-centric population based setting and with inclusion of normotensive control group in future.

## Conclusions

This study found that there is a high prevalence of poor sleep quality in hypertensive subjects. Their quality of life is also affected, especially in physical domain. A significant relationship was found between sleep quality and stages of hypertension which indicates that as the disease worsens from stage 1 to stage 2, sleep quality degrades too. A significant negative correlation was also found between quality of life and sleep quality in hypertensive subjects. Thus, all three components; sleep quality, quality of life and blood pressure are interrelated.

Hence, this is the time clinicians should start focusing towards non-pharmacological interventions in management of hypertension along with pharmacological measures. Physicians should focus on knowing quality of life of their patients and advice measures to improve it. They should also focus on improving sleep quality of their patients by advising them to sleep for adequate duration at adequate time and maintain sleep hygiene. This will contribute significantly to overall well being of hypertensive subjects and will lead to reduced mortality and morbidity due to hypertension and its complications in future.

## Acknowledgments

This is a STS ICMR approved research article with reference ID: 2019-0347.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

**Received:** 13 Aug 20 **Accepted:** 21 Jan 21

**Published:** 30 Nov 21

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