

Correlation Between Epworth Score and Neck Circumference in Pakistani Adults: A Cross-Sectional Study

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ABSTRACT

Background: Obstructive sleep apnea (OSA) is a sleep disorder that causes airflow to stop or significantly decrease when breathing is being performed. Although neck circumference (NC) measurements are recognised as markers of obesity, they are rarely investigated as a component of OSA scoring systems. The Epworth sleepiness scale (EPSS) is a way of measuring how likely a person is to fall asleep during the daytime. **Objective:** To determine the correlation between Epworth score and neck circumference in Pakistani adults, in terms of an increase in neck circumference indicates a significant risk of OSA. **Study Design:** Cross-sectional study. **Settings:** Pulmonary Vascular and Sleep Disorders department of Dow University Hospital, Karachi Pakistan. **Duration:** The study duration was 6 months from June 2021 to December 2021. **Methods:** All the cases suspected of having obstructed sleep apnoea (OSA) aged between 18 and 60 years of either gender were included. Information about obstructed sleep apnoea was collected from the patient's family members, and some patients were interrogated with questioning. In ESS, the proforma is calculated for each individual with obstructed sleep apnoea in accordance with the proforma's requirements. Neck circumference was assessed in the middle of the neck, between the mid-cervical spine and the mid-anterior neck by using non-stretchable plastic tape. All the data was collected via study proforma. SPSS version 26 was used for the data analysis. **Results:** A total of 184 cases were studied suspected of OSA, their mean age was 51.84 ± 12.24 years. Males were in the majority, 57.6%. Overall neck circumference was 43.39 ± 3.58 cm and the mean Epworth score was 13.83 ± 4.93 . There was a positive correlation between neck circumference and Epworth score in the Pakistani population. Raised neck circumference was found to be significantly associated with the high degree Epworth score ($p=0.007$) in males, and raised neck circumference was found to be statistically insignificant ($p=0.119$) in females. **Conclusion:** According to the findings of the study, an increasing neck circumference was found to have a positive correlation with an increasing severity of Epworth score in the population of Pakistan. This suggests that a population with an increased neck circumference is at a high risk, particularly males, who have an increased risk in comparison to females.

Keywords: OSA, NC, EPSS, High risk, Individuals.

INTRODUCTION

Obstructive sleep apnea (OSA) is a type of sleep breathing condition marked by recurrent episodes of partial or whole upper airway collapse during sleep, which can cause apnea and/or hypopnea, sleep disturbances, desaturations, and cardiovascular abnormalities. Airway difficulty is frequently caused by OSA, particularly when

the mask is ventilated.¹ According to epidemiological data, OSA diagnosed among 49.7% of men and 23.4% of women.² Neck circumference, Mallam Pati score, and size of the tonsils, are all indicators of the likelihood of having obstructive apnoeic sleep.³ Older age, male gender, and high blood pressure all seem to be OSA possible causes. NC was demonstrated to be very high in both males and females, NC demonstrated a direct relationship with BMI.

When both men and women have the same BMI, the NC is thought to be a crucial factor in OSA diagnosis.³ Because there are more individuals suspecting that the importance of the screening techniques has increased as more people with OSA are being sent to sleep clinics. To improve life quality and reduce morbidity and death, OSA must be identified and managed as early as possible.³ Many screening questions have been created in light of PSG's massive expense and availability issues. The Epworth Sleepiness Scale is the most frequently used questionnaires.⁴

ESS seems to be a self-administered questionnaire with eight items that asks about eight circumstances that people frequently experience on a daily basis.⁴ The individual is asked to rate the likelihood that he or she would sleep off in each of those scenarios on a scale of 0 to 3. The ESS's overall score so goes between 0 to 24. The better the score, the more likely it is that a person will doze off throughout the day.⁴

For the English-language version of ESS, high dependability and predictability have also been demonstrated.^{4,5} On the other hand, it is reported that the assessment of neck circumference (NC) seems to have become standard procedure in the modern medical evaluation whenever there is a concern of sleep problems since neck thickening is a significant indication of OSA.⁶⁻⁸ More than 16 or 17 inches around the neck is typically a symptom of extra fat in the neck region. This may result in crowding and constriction of the breathing tube, increasing the likelihood that the airway might become blocked or obstructed as during sleep. Furthermore, epidemiological data suggests that an NC of 43 cm is a more accurate predictor of the probability of obstructive episodes than BMI. Almost all prior studies have found that NC is a standard diagnostic indication of OSA.⁸ However, this study has been conducted to determine the correlation between Epworth score and neck circumference in Pakistani adults.

METHODS

This cross-sectional study was done at the Pulmonary, Vascular, and sleep disorders department of Dow University Hospital Karachi. The study duration was 6 months, from January 2022 to June 2022. All the cases having obstructed sleep apnoea (OSA), aged between 18 and 60 years of either gender were included. All the cases having other pulmonary diseases, any psychological disorder or neurological disorder, COPD, uncontrolled disease, hypertension, CLD, stroke, and any other cardiovascular disease were excluded. Informed consent was obtained from every subject, and approval was obtained from the hospital's ethical review board. There was information about obstructed sleep apnoea was collected from the patient's family members, and some

patients were interrogated with questioning. In ESS, calculated for each individual with obstructed sleep apnoea in accordance with the proforma's requirements. Neck circumference was assessed in the middle of the neck, between the mid-cervical spine and the mid-anterior neck by using non-stretchable plastic tape while the subjects were standing straight. It was measured right below the prominence in men who had a laryngeal prominence. The participant was instructed to keep their shoulders down but not slumped while undergoing this reading. The Epworth sleeplessness Scale (ESS), whose values ranged from 0 to 24, was used to measure daytime sleepiness. The total score is 0-24. Every item is rated from 0-3, as per proforma indications. Furthermore, every participant's ESS has been determined first, and then they were divided into three categories as:⁹ Normal: ≤ 10 , Mild: 11-14, Moderate: 15-18 and Severe: >18 . All the data was collected via a study proforma. SPSS version 26 was used for the data analysis. Descriptive statistics were calculated for demographic variables in the form of mean and frequency percentage. Pearson correlation was applied to correlate the neck circumference with an Epworth score. A p-value ≤ 0.05 was considered as significant.

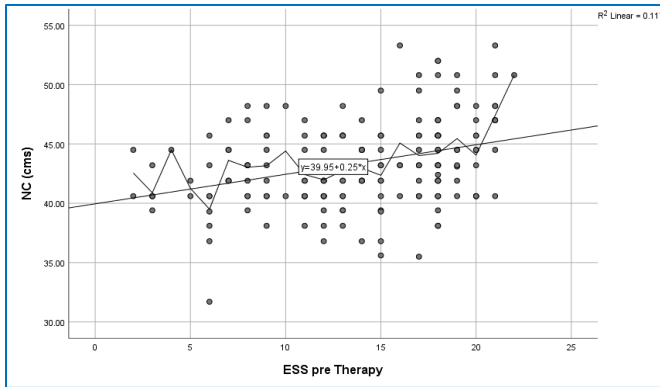
RESULTS

A total of 184 cases were studied, suspected of OSA, their mean age was 51.84 ± 12.24 years. Males were in the majority 57.6%, and females were 42.4%. As per ethnicity, Urdu-speaking and Sindhi populations were the most common 54.9% and 23.4%, respectively. Most of the participants 50.5% were employees; 38.0% were unemployed; and 11.4% were retired persons. Overall neck circumference was 43.39 ± 3.58 cm and the mean Epworth score was 13.83 ± 4.93 . Table. 1

Table 1: Descriptive statistics of demographic characteristics (n= 184)

Variables		Statistics	
Age (mean)		51.84 \pm 12.24 years	
Gender	Male	106	57.6
	Female	78	42.4
Ethnicity	Urdu speaking	101	54.9
	Sindhi	43	23.4
	Punjabi	17	9.2
	Balochi	6	3.3
	Pathan	17	9.2
Employment status	Employee	93	50.5
	Un-employee	70	38.0
	Retired	21	11.4
Neck circumference (mean)		43.39 \pm 3.58 cm	
Epworth score (mean)		13.83 \pm 4.93	

There was a positive correlation between neck circumference and Epworth score in the Pakistani population. Figure 1

Figure 1: Correlation of neck circumference with Epworth score (n=184)

Raised neck circumference was found to be significantly associated with the high degree Epworth score ($p=0.007$) in males and raised neck circumference was found to be statistically insignificant ($p=0.119$) in females, indicating that males with raised neck circumference are at higher risk of OSA than females. Table 2

Table 2: Mean of neck circumference association with Epworth score in males and females (n= 184)

Epworth score		Neck circumference			95% Confidence Interval for Mean		p-value
		N	Mean (cm)	Std. Deviation (cm)	Lower Bound	Upper Bound	
Males (n=106)	<10	25	43.00	2.82	.56421	41.8435	0.007
	11-14	20	43.61	2.86	.64129	42.2678	
	15-18	40	44.71	3.85	.60913	43.4804	
	>18	21	46.42	3.62	.79106	44.7785	
	Overall	106	44.44	3.57	.34698	43.7545	
Females (n=78)	<10	19	41.24	3.55	0.81454	39.5308	0.119
	11-14	29	41.68	2.52	0.46934	40.7283	
	15-18	21	42.07	3.27	0.71484	40.5851	
	>18	9	44.16	2.82	0.94325	41.9915	
	Overall	78	41s.97	3.10	0.35112	41.2713	

Anova test applied (F-value 7.794 for males and 2.019 for females)

DISCUSSION

Individuals having OSA may display a number of common symptoms. Between the ages of 30 and 60, 24% of males and 9% of women report having OSA.^{8,10} With a drop after the age of 65, sleep disordered breathing has a substantial prevalence in middle-aged people.¹⁰ In this study observed the correlation between Epworth score and neck circumference in Pakistani adults to assess OSA patients with elevated neck circumference who are at high risk, and we found a positive correlation between neck circumference and Epworth score in the Pakistani population. Consistently, Basak H *et al*¹¹ reported that the

average ESSp score and average ESSd core as well as the average body mass index (BMI) and neck circumference measurements all showed positive correlations, and these obesity-related characteristics might be thought of as having a significant impact on the identification and assessment of OSA. On other hand Tunçel Ü *et al*¹² found correlated findings as the body mass index and neck circumference have been found to be significantly correlated with Epworth drowsiness scale scores ($p=0.05$). However, no more studies have been found on such a correlation. Furthermore, in this study, raised neck circumference was significantly associated with the high degree of Epworth score in males ($p=0.007$), while statistically insignificant in females ($p=0.119$), which indicated that the males have a higher risk of developing OSA. On other hand it is stated that compared to general obesity, OSA is more significantly linked to an raised size of the neck or waist circumference and the risk seems to be proportional after females are peri- and postmenopausal,¹³ OSA is around two to three fold greater frequent in males than women.¹³ However, the exact pathophysiology of male predominance is unknown, while it is suspected that the male tendency has been linked to a number of reasons, including hormonal abnormalities, higher fatty deposition surrounding the pharyngeal airway among males in contrast to the females, and underlying structural and physiological differences between both genders in the upper respiratory tract during sleep.¹⁴ Furthermore, a previous study conducted to look at how obesity affects pharyngeal size in both males and females revealed no relationship between the size of the pharynx and the BMI size in either gender.^{14,15} However, it appears that there might be additional innate characteristics of the person in addition to gender that will influence the prevalence and severity of OSA. To properly understand such a gender imbalance in OSA diagnosis, more research is required.^{14,15}

In this study, the mean age was 51.84 ± 12.24 years and males were in the majority 57.6%, while females were 42.4%. These findings were parallel with the study of Ullah MU *et al*¹⁶ as the mean age of the individuals was 53 ± 12.1 years and out of all their study subjects, males were 58% and females were 42%. In the line of this study, Parveen N *et al*⁹ reported that the average age of the cases was 38.16 ± 7.18 years, with 76.8% men and 23.2% women. Inconsistently, Giannetti M *et al*¹⁷ reported that out of all 101 participants, females were in the majority 68, and males were 33, while they also reported some lower average age of the participants as 49.2 ± 13.2 years, and this difference may be because of cultural changes and study selection criteria, and study sample sizes. In the line of this study, it is stated that sleep apnea has a higher prevalence rate than in women, and it affects men more severely and the occurrence and complexity of sleep

apnea fluctuate depending on gender for a wide range of reasons, with changes in body fat distribution being one of the most significant ones.¹⁸ The size of the neck is a key sign of how subcutaneous fat is distributed across the upper body. It has been established that fat deposits in the upper body, particularly in obese individuals, is a significant source of free fatty acid releases in the systemic circulation.¹⁹ Enhanced production of inflammatory factors may result from an increase in free fatty acid content.¹⁹ However, it was revealed that normal males and females had similar amounts of total parapharyngeal fat, while males had more total neck soft tissue volume than women.¹⁸ There must be additional significant factors, in addition to gender, that modify upper airway caliber and raise the risk for sleep apnea, according to current uncertainty variations in upper airway anatomy and function amongst males and females.^{18,20} Our work has various limitations that should be taken into consideration in future studies.

CONCLUSION

According to the findings of the study, an increasing neck circumference was found to have a positive correlation with an increasing severity of Epworth score in the population of Pakistan. This suggests that a population with an increased neck circumference is at a high risk, particularly males have an increased risk in comparison to females.

LIMITATIONS

This was a limited sample size and single centre study.

SUGGESTIONS / RECOMMENDATIONS

Further large-scale studies are recommended on such correlation to rule out the increases in neck circumference is a significant risk factor of OSA.

CONFLICT OF INTEREST / DISCLOSURE

None.

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