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RESEARCH ARTICLE

KNOWLEDGE AND ATTITUDE OF PRIMARY HEALTH CARE PHYSICIANS REGARDING OBSTRUCTIVE SLEEP APNEA IN TABUK CITY

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Abstract

Obstructive sleep apnea is the most common type of sleep disorder breathing and is characterized by repeated brief episodes of upper airway obstruction during sleep for more than 10 seconds. It is a growing public health challenge with most of the cases remaining unidentified. The study aims to evaluate the general knowledge and attitude of primary health care physicians toward OSA in Tabuk city, Saudi Arabia during 2023. It is a cross-sectional study. The estimated sample size is based on comprehensive data collection in which all primary healthcare physicians are invited to participate in our research. The validated "Obstructive Sleep Apnea Knowledge and Attitudes Questionnaire" (OSAKA) was used. The data analysis was done by using SPSS for Windows version 21 and GraphPad Prism version 8.4.2. The level of significance is 0.05. The present study found that 65.7% of the participants (N=94) had good knowledge regarding OSA. The majority of participants had a positive attitude towards OSA. Additionally, results showed gender, nationality, and years of graduation had an association with knowledge regarding OSA ($p=0.043$, 0.047 , 0.03 respectively). There was a statistically significant positive correlation between knowledge and attitude (Spearman's $\rho = 0.29$, $p = 0.001$). Logistic regression analysis showed that females have good knowledge as compared to males ($p=0.047^*$).

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Introduction:-

Obstructive sleep apnea (OSA) is one of the chronic health problems with critical outcomes¹. It is the most common type of sleep disorder breathing (SDB) and is characterized by repeated brief episodes of upper airway obstruction (UAO) during sleep for more than 10 seconds²⁻⁴. In addition, it is in the form of apnea (complete cessation of breathing) and hypopnea (partial obstruction of breathing)²⁻⁴. Clinical manifestations of OSA are fatigue, tiredness, excessive daytime sleepiness, loud snoring, observed apneas, sleep fragmentation, early morning headache, dry mouth, sore throat, drowsiness, and crowded pharyngeal space⁵. Moreover, frequent sleep disruption leads to further consequences of fatigue, headache, and cognitive impairment⁶. The alterations in gas exchange lead to sleep alterations, hypoxemia, hypercapnia, and long-term cardiovascular sequelae⁷. Furthermore, cardiovascular disruptions, oxyhemoglobin desaturation, and cortical arousals are among the side effects of OSA that might eventually result in cardiovascular morbidity and mortality. It is clearly apparent from epidemiological evidence that OSA serves as a separate risk factor for a poor cardiometabolic profile².

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High-risk factors of OSA are male patients who are ≥ 40 years old, obese, and have a neck size of more than 18 inches⁶. The frequency of apnea during sleep increases with age⁸. In fact, the prevalence among males is higher than females. Males tend to have higher neck fat deposition which leads to a higher risk of upper airway collapse compared to females⁵. The gold standard diagnostic test for OSA is a polysomnogram, which should be performed on any patient exhibiting unexplained excessive daytime sleepiness¹. Additionally, the apnea-hypopnea index (AHI) is a rating scale to assess the severity of OSA⁶. It accounts for the number of apnea or hypopnea events per hour of sleep^{6,9}. A score of >15 denotes clinically severe OSA⁶.

Untreated cases of OSA are associated with reduced quality of life, increased incidence of cardiovascular diseases, diabetes, stroke, and increased risk of death¹⁰. Moreover, patients with OSA are at significantly greater risk of having a road traffic accident than other individuals¹¹. The risk of OSA is higher to be involved in occupational accidents due to reduced wakefulness, vigilance, and attention¹¹. Undiagnosed cases of OSA in children can be associated with impaired growth, learning, and behavioral problems with consequent poor school performance¹².

Globally, OSA is a growing public health challenge. Approximately 3 to 7% of men and 2 to 5% of women are suffering from this disorder². Furthermore, the male predominance could be attributed to multiple variables, such as hormonal influences on the muscles of the upper respiratory tract, variations in the distribution of adipose tissue based on gender, changes in the form, size, and collapsibility of the pharynx, and variations in ventilation patterns¹³.

Interestingly, 75% to 80% of cases remain unidentified^{14,15}. The prevalence of OSA is increasing in the next 30 years; parallel with the rise of obesity and longer life span^{5,16}. In addition, a 10% increase in weight can increase the risk of having OSA by six-fold¹⁷. OSA is more severe in obese people^{4,18,19}. According to previous studies, women with OSA are significantly more obese than men³. In fact, a greater risk of OSA is in affected people with hypertension, congestive heart failure, coronary artery disease, heart transplants, stroke, hypothyroidism, alcoholism, gastroesophageal reflux, primary open-angle glaucoma and autonomic neuropathy secondary to diabetes⁴. A recent meta-analysis revealed that in individuals with OSA, the combined prevalence of depressive and anxious symptoms was 35.0% and 32.0%, respectively²⁰. There may be confusion in the diagnosis of both depression and OSA due to the symptoms that are shared by both conditions, including weight gain, irritability, loss of energy, lack of concentration, and daytime sleepiness²⁰.

In Saudi Arabia, previous studies observed approximately 9% prevalence of OSA among the general population which correlates with an increasing prevalence of obesity of about 35.6% in Saudi Arabia²¹. In addition, the peak age at which OSA prevalence occurs is approximately 55 years for males and 65 years for women and the postmenopausal state may be related to it³. Clinically diagnosed OSA affects about 8.5% of the population²¹.

Sleepy driving and OSA are a major risk factor for motor vehicle accidents among truck drivers²². Therefore, OSA has been shown to dramatically raise the risk of auto accidents seven times higher than average¹. Near-miss accidents are a significant risk factor for auto accidents and should be considered as a red flag for more accidents²³. In general, motor vehicle accidents (MVAs) are expected to be the fourth leading cause of death by 2030³. Diagnosed or undiagnosed OSA is linked to an increased incidence of motor vehicle accidents²⁴.

Primary health care physicians (PHCPs) are in the front line of the health care system. In our country, the health services depend on the referral system. So, the patient is first seen by PHCPs. Several studies show insufficient knowledge of PHCPs towards OSA. In fact, early detection and management of OSA is cost-effective and reduces complications¹. In addition to helping the patient, appropriate management of OSA will have a positive impact on society as a whole²⁰. Additionally, routine screening is a critical tool for identifying OSA risks early in the primary care setting and minimizing its impact on cardiovascular morbidity and mortality^{10,14}. Improving the knowledge of PHCPs can improve the recognition of OSA.

Numerous studies have been conducted to evaluate PHCPs' knowledge, attitudes, and practices (KAP) addressing OSA. Interestingly, the results have been inconsistent, indicating a range of knowledge and attitudes from good to poor. Knowledge levels differed based on specialization, with PHCPs receiving the lowest score of 64% and otolaryngology-head and neck surgery trainees receiving the highest score of 88.9%²¹. A study was carried out in 2008 to assess the knowledge and attitudes of cardiologists in the United States on OSA showed that cardiologists and PHCPs have similar levels of knowledge regarding OSA and the low percentage of OSA reporting among cardiologists may be due to their lack of confidence in diagnosing and treating patients with the

condition²⁵. Moreover, a similar study (2013) of primary care physicians in Latin America regarding OSA revealed the mean total knowledge was 60%. In 2015, a study conducted in Riyadh to evaluate primary health care physicians' (PHCPs) knowledge and attitudes regarding sleep disorders by using a combination of pre-designed validated questionnaires; concluded that poor knowledge and low level of awareness of sleep medicine and sleep disorders among primary care physicians²⁶. Furthermore, in 2019, a study was conducted in Jeddah to assess the association between body mass index (BMI) and obstructive sleep apnea (OSA) to determine the impact of obesity on the severity of OSA¹⁸. It showed that compared to non-obese patients (22.3%), patients who were obese had a greater prevalence of OSA (77.7%)¹⁸. Another study conducted in Al-Hasa primary health care centers, Alhodibi et al., 2020, using the OSAKA questionnaire showed 52% of participants had poor knowledge and concluded that the vast majority of Al-Hasa PHCPs have insufficient knowledge of obstructive sleep apnea¹. Moreover, a study was conducted in 2020 to assess the knowledge and attitudes towards OSA among practicing primary care physicians in the Middle East and North Africa (MENA) region²⁷. Compared to general/family medicine specialists and other specialties, internal medicine specialists had a better mean knowledge score²⁷. In a previous study conducted in the Northern Regions of Saudi Arabia, Al-Rasheedi et al., 2022, estimated the knowledge and attitude levels of participants achieved low scores of 43.9% and 45.1%, respectively²¹.

The objectives of our study were to describe the level of knowledge of primary health care physicians toward obstructive sleep apnea by using the obstructive sleep apnea knowledge and attitude questionnaire (OSAKA questionnaire) and to increase awareness of complications of obstructive sleep apnea among primary health care physicians. A validated questionnaire known as the OSAKA questionnaire was used to evaluate physicians' knowledge and attitudes on OSA²⁸.

Materials and Methods:-

It was a cross-sectional descriptive survey carried out at primary healthcare centers in Tabuk city, Saudi Arabia. Tabuk is the capital city of the Tabuk Region in northwestern Saudi Arabia. It is bordered by Jordan and the Gulf of Aqaba and has a significant coastline along the Red Sea. NEOM is a new urban area planned to be built in its northwestern Tabuk Province. Several areas are planned for the city, such as a floating industrial complex, a hub for international trade, a global trade hub, and tourist resorts run entirely on renewable energy sources. Tabuk city has 33 primary healthcare centers distributed among 2 sectors. All Primary health care physicians in Tabuk city who working at the Ministry of Health invited to participate in our study were the study population. This study was carried out from 1 June 2023 to 30 October 2023.

The inclusion criteria were primary healthcare physicians who work in a general outpatient clinic and introduce therapeutic and preventive measures. PHCPs who were on vacation and unwilling to participate were excluded from the study. The sample size was a convenience sampling in which all primary healthcare physicians were invited to participate in our study. The total number was 143. The data was collected in outpatient clinics of primary health care centers in Tabuk city after obtaining an ethical approval letter from Tabuk Institutional Review Board (TU-077/023/194). All the PHCPs agreed to participate in our study through informed consent.

This study was conducted using a self-administered questionnaire comprising two parts. The first part of the questionnaire contains sociodemographic data, including nationality, gender, age, degree, year of medical school graduation, years in practice, any residency training, specification of residency training, and subspecialty training, specification of subspecialty training and board certification (Table 1. Demographic characteristics). The second part assesses PHCPs' knowledge and attitudes towards OSA. This questionnaire is valid as a means of evaluating physicians' attitudes and knowledge about OSA²⁸. It takes a few minutes to complete, and we used the English version. The knowledge component of the questionnaire covered the following essential domains: (1) pathophysiology, (2) epidemiology, (3) symptoms, (4) diagnosis, and (5) treatment; presented in 18 true/false statements²⁸. To reduce the impact of respondents' guessing, "Don't know" was added as a third response option and scored as an incorrect score. To assess attitude, respondents were asked to score how much they agree with five statements on the significance of OSA and their ability to recognize and treat patients with OSA on a 5-point Likert scale. Additionally, data on demographics is also collected²⁸.

For statistical analysis, two software SPSS for Windows version 21 (SPSS Inc., Chicago, Illinois, USA) and GraphPad Prism version 8.4.2 (GraphPad Software, San Diego, CA, USA) were used. Kolmogorov Smirnov test was performed for normality checks of variables. Descriptive statistics were expressed into mean, standard deviation, number, and percentage according to the type of data. Chi-square test and independent sample t-test were conducted

for the bivariate data to assess the relationship between knowledge/attitude and demographic parameters. P-value <0.05 was considered statistically significant.

Results:-

Total 143 physicians were included in the present study. Demographic characteristics of physicians were analyzed. The ratio of females was higher(69.9%) as compared to males (30.2%). The mean age of participants was 38 years and 73.4% were non-Saudi and 26.6% were Saudi. The majority (69.7%) of the participants had graduated more than 10 years before followed by 8.6% who had graduated 7-10 years before followed by 19.6% who graduated 4-6 years before the present day and only 2.1% who graduated 1-3 years back. Almost 62.9% of participants were general practitioners, 11.9% were residents, 19.6% were specialists, and the rest 5.6% were consultants. Among these participants, 37% did residency training and only 3.5% did subspecialty training. Approximately half of the participants (53.1%) had >10 years of work experience, 22.3% had 7-10 years, 13.9% had 3-6 years and just 10.5% had 1-3 years of work experience. Despite extensive work experience, 79.9% were not board-certified. The details about demographic characteristics are shown in table 1.

Table 1:- Demographic characteristics.

Parameters	Number of students	Percentages
Gender		
Male	43	30.2%
Female	100	69.9%
Age (years) (M ± SD)	38.12 ± 6.104	
Nationality		
Saudi	38	26.6%
Non-Saudi	105	73.4%
Years of graduation		
1-3 years	3	2.1%
4-6 years	28	19.6%
7-10 years	12	8.6%
>10 years	100	69.7%
Ranking		
GP	90	62.9%
Resident	17	11.9%
Specialist	28	19.6%
Consultant	8	5.6%
Residency training		
Yes	53	37%
No	90	62.9%
Specification of residency training		
Family medicine	49	34.3%
Internal medicine	3	2.1%
Pediatric	1	0.7%
Subspecialty training		
Yes	5	3.5%
No	138	96.5%
Specification of subspecialty training		
Addiction medicine	3	2.1%
Pediatric nephrology	1	0.7%
Diabetes mellitus	1	0.7%
Years in practice		
1-3 years	15	10.5%
4-6 years	20	13.9%

7-10 years	32	22.3%
>10 years	76	53.1%
Board certificate		
Yes	29	20.3%
No	114	79.7%

Data are presented as a number, percentage, mean, and standard deviation (mean \pm SD).

There are 18 item questionnaires to assess the knowledge regarding obstructive sleep apnea. 69.9% of the physicians gave the correct answer that 'Women with obstructive sleep apnea may present with fatigue only' but only 39.9% of physicians were able to give the right answer for 'uvulopalatopharyngoplasty is curative for a majority of people with OSA'. Similarly, a very low ratio (32.2%) of physicians answered correctly that 'The estimated prevalence of obstructive sleep apnea among adults is between 2% and 10%', on the other hand, for the question 'The majority of patients with obstructive sleep apnea snore' 89.5% participants were able to answer this question correctly. 83.2% agreed with the statement that 'Obstructive sleep apnea is associated with hypertension', 87.4% also agreed that 'An overnight sleep study is a gold standard for diagnosing obstructive sleep apnea', but only 43.4% agreed with 'CPAP (continuous positive airway pressure) therapy may cause nasal obstruction'. For the question 'Laser-assisted uvuloplasty is an appropriate treatment for severe obstructive sleep apnea' surprisingly very less number of participants answered it correctly, i.e., 26.6%, but a higher ratio of participants (82.5%) answered correctly that 'The loss of upper airway muscle tone during sleep contributes to obstructive sleep apnea', and the highest ratio (90.2%) of correctly answered question among all questions is this, 'The most common cause of obstructive sleep apnea in children is the presence of large tonsils and adenoids', when participants were asked that 'A craniofacial and oropharyngeal examination is useful or not in the assessment of patients with suspected obstructive sleep apnea' 72% gave the right answer, but when they were asked a question that if alcohol consumption at bedtime improves OSA, only 61% were able to answer this question correctly. For the next items, the ratio of correct answers for these: 'Untreated obstructive sleep apnea is associated with a higher incidence of automobile crashes', 'In men, collar size 17 inches or greater is associated with obstructive sleep apnea', 'Obstructive sleep apnea is more common in women than in men', 'CPAP is the first-line therapy for severe obstructive sleep apnea', 'Less than 5 apneas or hypopneas per hour is normal in adults', 'Cardiac arrhythmias may be associated with untreated obstructive sleep apnea' was 69.9%, 39.2%, 67.1%, 74.8%, 35%, and 79.7% respectively. The details of the response to the knowledge section are shown in Table 2.

Table 2:- Knowledge of physicians regarding OSA.

Questions	Correct answer	Incorrect answer
1. Women with obstructive sleep apnea may present with fatigue only.	100 (69.9%)	43(30.1%)
2. Uvulopalatopharyngoplasty is curative for a majority of people with obstructive sleep apnea.	57 (39.9%)	86 (60.1%)
3. The estimated prevalence of obstructive sleep apnea among adults is between 2% and 10%.	46 (32.2%)	96 (67.1%)
4. The majority of patients with obstructive sleep apnea snore.	128 (89.5%)	15 (10.5%)
5. Obstructive sleep apnea is associated with hypertension.	119 (83.2%)	24 (16.8%)
6. An overnight sleep study is the gold standard for diagnosing obstructive sleep apnea.	125 (87.4%)	18 (12.6%)
7. CPAP (continuous positive airway pressure) therapy may cause nasal obstruction.	62 (43.4%)	81 (56.6%)
8. Laser-assisted uvuloplasty is an appropriate treatment for severe obstructive sleep apnea.	38 (26.6%)	105 (73.4%)
9. The loss of upper airway muscle tone during sleep contributes to obstructive sleep apnea.	118 (82.5%)	25 (17.5%)
10. The most common cause of obstructive sleep apnea in children is the presence of large tonsils and adenoids.	129 (90.2%)	14 (9.8%)
11. A craniofacial and oropharyngeal examination is useful in the assessment of patients with suspected obstructive sleep apnea.	103 (72%)	40 (27.9%)
12. Alcohol at bedtime improves obstructive sleep apnea.	88 (61.5%)	55 (38.5%)
13. Untreated obstructive sleep apnea is associated with a higher	100 (69.9%)	43 (30.1%)

incidence of automobile crashes.		
14. In men, collar size 17 inches or greater is associated with obstructive sleep apnea.	56 (39.2%)	87 (60.8%)
15. Obstructive sleep apnea is more common in women than in men.	96 (67.1%)	47 (32.9%)
16. CPAP is the first-line therapy for severe obstructive sleep apnea.	107 (74.8%)	36 (25.2%)
17. Less than 5 apneas or hypopneas per hour is normal in adults.	50 (35%)	93 (65%)
18. Cardiac arrhythmias may be associated with untreated obstructive sleep apnea.	114 (79.7%)	29 (20.3%)

Data are presented as numbers and percentages.

Table 3 shows the level of knowledge among 143 physicians. It was taken on the base of a median of 10, a knowledge median less than 10 was assessed as poor/average knowledge, and a knowledge median of more than 10 was assessed as good knowledge. 65.7% of the participants (N=94) had good knowledge of OSA and 34.3% had poor knowledge regarding OSA.

Table 3:- Level of knowledge.

Level of knowledge	N	Percentage
Poor/ average knowledge	49	34.3%
Good knowledge	94	65.7%

Data are presented as numbers and percentages.

The attitude of participants toward OSA was assessed and it was analyzed that the majority of participants had a positive attitude towards OSA. Forty-five percent of participants agreed that yes OSA is a clinical disorder followed by 46.2% of participants said it is extremely important to identify patients with OSA. For identifying the at-risk patients with OSA, 43.3% said that they are confident about it. 28.7% felt extremely confident to manage the patients with OSA followed by 25.2% who felt EI to manage patients on CPAP. The details of the percentage distribution of items of attitude towards OSA are shown in Table 4.

Table 4:- Percentage distribution of items of attitude towards OSA.

Questions	NI	SWI	I	VI	EI
A. As a clinical disorder, obstructive sleep apnea is:	0	0	31 (21.7%)	47 (32.9%)	65 (45.5%)
B. Identifying patients with possible obstructive sleep apnea is:	0	2 (1.4%)	30 (21%)	45 (31.5%)	66 (46.2%)
C. I feel confident identifying patients at-risk for obstructive sleep apnea:	0	2 (1.4%)	49 (43.3%)	56 (39.2%)	36 (25.2%)
D. I am confident in my ability to manage patients with obstructive sleep apnea:	0	13 (9.1%)	48 (33.65)	41 (28.7%)	41 (28.7%)
E. I am confident in my ability to manage patients on CPAP therapy:	4 (2.8%)	28 (19.6%)	50 (35%)	25 (17.5%)	36 (25.2%)

Data are presented as numbers and percentages.

NI: not important, SWI: somewhat important, I: important, VI: very important, EI: extremely important

Table 5 shows the level of attitude among 143 physicians. 17.5% of the participants (N=25) had a poor attitude toward OSA, and the majority 82.5% had a good attitude towards OSA.

Table 5:- Level of attitude.

Level of attitude	N	Percentage
Poor/ average attitude	25	17.5%
Good attitude	118	82.5%

Data are presented as numbers and percentages.

The association between demographic characteristics and level of knowledge was also analyzed. Results showed gender, nationality, and years of graduation had an association with knowledge regarding OSA ($p=0.043, 0.047,$

0.03 respectively). Age, years in practice, and ranking had no association with knowledge regarding OSA. Logistic regression analysis showed that females have good knowledge as compared to males ($p=0.047^*$). The details about the association between demographic characteristics and level of knowledge are shown in Table 6.

Table 6:- Comparison of demographics and knowledge.

Characteristics	Good knowledge	Poor knowledge	p-value
Gender			
Male	23	20	0.043*
Female	71	29	
Age (years) (M \pm SD)	38.6 \pm 5.3	37.06 \pm 7.2	0.13
Nationality			
Saudi	20	18	0.047*
Non-Saudi	74	31	
Years of graduation			
1-3 years	0	3	0.03*
4-6 years	15	12	
7-10 years	7	5	
>10 years	72	29	
Years in practice			
1-3 years	10	5	0.28
4-6 years	11	9	
7-10 years	18	14	
>10 years	55	21	
Ranking			
GP	64	26	0.067
Resident	9	8	
Specialist	14	14	
Consultant	7	1	

Data were presented as numbers and percentages. Chi-square test and independent sample t test were performed. * $p<0.05$ are considered statistically significant.

The association between demographic characteristics and level of attitude was also analyzed. Results showed gender and age had an association with attitude toward OSA ($p=0.03$, 0.047 respectively). While all other parameters had no association with knowledge regarding OSA. The details about the association between demographic characteristics and level of attitude are shown in Table 7.

Table 7:-Comparison between characteristics and attitude.

Characteristics	Good attitude	Poor attitude	p-value
Gender			
Male	31	12	0.031*
Female	87	13	
Age (years) (M \pm SD)	38.6 \pm 6.16	35.9 \pm 5.43	0.047*
Nationality			
Saudi	29	9	0.24
Non-Saudi	89	16	
Years of graduation			
1-3 years	2	1	0.35
4-6 years	20	7	
7-10 years	9	3	
>10 years	87	14	
Years in practice			
1-3 years	12	3	0.78

4-6 years	15	5	
7-10 years	27	5	
>10 years	64	12	
Ranking			
GP	72	18	0.33
Resident	13	4	
Specialist	25	3	
Consultant	8	0	

Data were presented as number and percentage. Chi-square test and independent sample t test were performed. *p<0.05 are considered statistically significant.

The correlation between knowledge and attitude was analyzed by Spearman correlation rank test. There was a statistically significant positive correlation. See table 8 and figure 1.

Table 8:- Correlation between knowledge and attitude.

Parameters	Spearman r-value	p-value
Knowledge- attitude	0.29	0.001**

Spearman correlation rank test was used. R-value: correlation coefficient value. **P<0.01 was considered statistically significant.

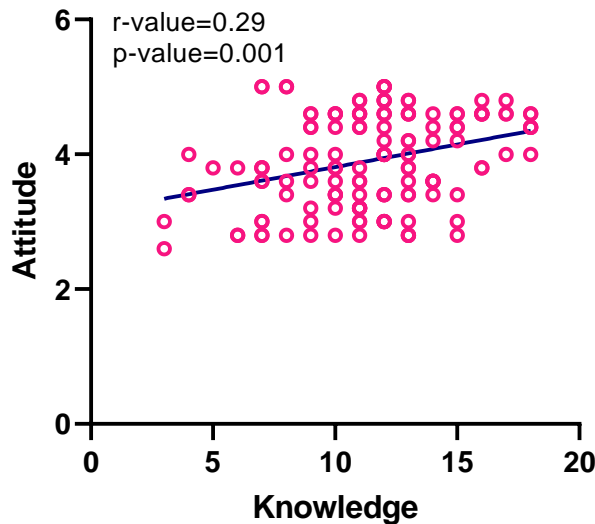


Figure 1:- Positive significant correlation between attitude and knowledge.

Discussion:-

Several studies have been conducted previously to measure the knowledge and attitude of primary health care physicians toward OSA^{1,2,16,21,27}. This study is the first survey to explore the knowledge and attitude of primary healthcare physicians regarding OSA in Tabuk city. Our study showed that 65.7% of the participants had a good knowledge in alignment with the knowledge score reported by Devaraj et al. which had a correct mean knowledge score of 64%². However, some other studies have reported lower knowledge mean scores among participants. The studies of AL-HASA District, Northern Regions of KSA, Kuala Lumpur, and Latin America reported mean knowledge scores of 48%, 43.9%, 55 and 60%, respectively^{1,2,16,21}. This may be because primary healthcare physicians frequently neglect to diagnose or recognize OSA as an illness that develops as a consequence of other disorders, e.g., obesity²⁹.

The present study reported that there is a wide variation in the knowledge score, ranging from 26.6% to 90.2% in alignment with the study performed by Alhodibi et al. which had a range from 26% to 96%¹. Furthermore, even with the (I don't know) option on the questionnaire, there is still a chance that the participant may guess the response, which could result in a higher score. The highest proportion of correct answers, found in item 10 'The most common

cause of obstructive sleep apnea in children is the presence of large tonsils and adenoids', in accordance with previous studies performed by Alhodibi et al., Al-Rasheedi et al. and Devaraj^{1,2,21}.

The lowest correct response was observed for item 8(26.6%), which stated that 'Laser-assisted uvuloplasty is an appropriate treatment for severe obstructive sleep apnea'. Another response that answered in large part incorrectly was item 3(67.1%), which stated that 'The estimated prevalence of obstructive sleep apnea among adults is between 2% and 10%'. These results support the necessity of intervention in the form of ongoing medical education for primary care practitioners. Our study outlined that 69.9% of participants answered correctly that 'Untreated obstructive sleep apnea is associated with a higher incidence of automobile crashes', in accordance with Al-Hasa study (71%)¹.

The current study found that 83.2% of PHCPs correctly answered the statement, 'Obstructive sleep apnea is associated with hypertension'. As compared to the original research of OSAKA questionnaire, the proportion of correct answers was 68.8 for family practice residents, 62.2 for pediatrics, and 89.1 for medicine²⁸. A cross-sectional survey of general practice physicians in Ecuador, Peru, and Venezuela by Ojeda et al. found that less than half of physicians correctly answered hypertension question¹⁶.

Knowledge regarding the association between cardiac arrhythmias and untreated obstructive sleep apnea, the proportion of correct answers in our study was 79.7%. A recent study conducted in Al-Hasa was also in alignment with our study and their results found that seventy-five of the participants correctly answered the above statement¹.

In our study, 45.5% of participants agreed that obstructive sleep apnea is extremely important and 32.9% agreed that statement is very important. However, lower attitude scores regarding confidence in the ability to manage patients on CPAP therapy. This is in accordance with a previous cross-sectional study conducted in the Middle East and North Africa region which showed that there is a gap in knowledge that is translated upon practice²⁷. In our study, the majority of participants (82.5%) had a good attitude towards OSA.

The present study reported that the knowledge of OSA was correlated with years of graduation, gender, and nationality ($p=0.043$, 0.047 , and 0.03 , respectively). However, there was no correlation found between OSA knowledge and age, years of experience, or ranking. Nevertheless, the original research of OSAKA questionnaire concluded a negative correlation between age and knowledge ($r = -0.361$, $P<0:001$) and a significant negative correlation between number of years in practice and knowledge ($r = -0.381$, $P<0:001$)²⁸. Surprisingly, the results of a logistic regression analysis in our study indicated that females have good knowledge as compared to males ($p=0.047^*$). The Spearman correlation rank test was utilized to examine the relationship between attitude and knowledge. A statistically significant positive (weak) connection was observed (Spearman's $\rho = 0.29$, $p = 0.001$). Similar to the present study's result, Al-Rasheedi et al., in 2022, revealed a positive (weak) result (Spearman's $\rho = 0.151$, $p = 0.014$)²¹.

Expected limitations of the study must be considered in order to ensure proper interpretation of the data: Self-administered questionnaire problem: the study is based completely on self-reported answers that may increase measurement errors. As our study was conducted in Tabuk city, the generalization over the kingdom is not appropriate, because there are many differences around the provinces of Saudi Arabia.

Conclusion:-

The present study reported that 65.7% of the participants had good knowledge regarding OSA. Furthermore, a statistically significant positive correlation was observed between knowledge and attitude among PHCPs. The majority of participants had a positive attitude towards OSA. We recommend implementing a validated screening instrument into the electronic medical record and taking sleep history as a mandatory step for high-risk patients in primary health care centers; in order to enhance diagnosis of OSA and reduce the impact of OSA complications, especially on cardiovascular morbidity and mortality.

Conflict of interest

The author declares that he has no conflict of interest.

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Ethical approval

The ethical approval letter was obtained from Tabuk Institutional Review Board (TU-077/023/194).

Informed consent

Informed consent was obtained from all individual participants included in the study.

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