Research Article
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Factors associated with obstructive sleep apnea syndrome in diabetics attending state health structures in the Mopti region in Mali

Abstract

The screening of sleep disorders and obstructive sleep apnea syndrome should be performed routinely in many patients, particularly in high-risk populations. The aim of this study was to evaluate sleep disorders and the determinants of high risk of obstructive sleep apnea among diabetics.

Methodology: This was a cross-sectional study which was conducted between March to August 2022 in state health structures in the Mopti region of Mali. This study included diabetic patients aged 18 and above who gave their consent to participate in the study. A standardized questionnaire containing both Berlin self-questionnaires was used for data collection.

Results: A total of 289 patients participated in the study. The mean age was 51.59 ± 11.39 years. Among the participants, 66.9% were Type 2 diabetics, 70.9% were women. The body mass index average was 27.62 ± 4.26 kg/m2. The mean of sleep duration was 5.76 ± 1.43 hours per day. The majority of participants (92.4%) had high risk of obstructive sleep apnea syndrome.

The variables statistically associated with the dependent variables (OSAS) were: high blood pressure (OR =52.4; 95% CI: [6.3 - 40.3]); non-smoking status (OR=0.04; 95% CI: [0.03 - 0.7]) and the body mass index ≥ 25 (OR=3; 95% CI: [3.1 - 14.9]).

Conclusion: This study reveals a high frequency of sleep disorders among diabetics in the Mopti region.

It would be necessary to conduct a national study to better estimate the prevalence of this pathology in order to implement effective control strategies.

Keywords: sleep disorder, sleep apnea syndrome, diabetes, Mopti

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Introduction

Diabetes is a major public health problem worldwide. According to the World Health Organization (WHO), the epidemic of diabetes reached 422 million people worldwide and caused more than 1.5 million deaths in 2012. The WHO indicates that in 2035, 592 million individuals will be affected by this disease.[1,2] The prevalence of diabetes in Mali was actually estimated at 1.8%.[2]

In parallel to this disease, a new epidemic emerges: "sleep disorders". According to results of the World Sleep Conference in Tokyo in October 2011, more than 20% of the general population in developed countries suffers from consequences of sleep disturbances and insufficient sleep.[3,4] In Mali, our research did not find any work on sleep disorders in the general population. However, a study carried out in 2015 among a population of drivers in Bamako reported that 12.4% of them suffered from sleep disorders.[5]

Sleep is an ancestral and primitive behavior in humans and it is considered a vital and restorative process which acts on several systems of human body. Average sleep requirements in adults are estimated between seven and eight hours per night. Nevertheless, epidemiological studies published in recent years estimate that the sleep duration decreased by about two hours in the second half of the twentieth century, especially in industrialized societies due to lifestyle, workload (night guards and irregular schedules), cultural and social activities, psychological and behavioral influences as well as access to technology (computer, television, video, telephone, etc.) with the perception that sleep time is lost time.[6,7]

The chronic deprivation of sleep has many public health and socio-economic consequences which can be; an increase in overall mortality, an increase of the prevalence of certain chronic diseases (hypertension, type 2 diabetes, depression, obesity and cancer), an increase in rates of work and road accidents and a significant decrease of the quality of life and productivity.[8]

This study, which is the first in the Mopti region aimed to estimate the frequency of sleep disorders and determine the factors associated with a high risk of sleep apnea among diabetics attending the state health facilities.

Methods

Study design

It was a cross-sectional study which conducted from March to August 2022 at the state health structures of the Mopti region in Mali.

Study siting

The Mopti region which is the 5th administrative region of Mali has 08 health districts and a regional hospital. In each health district, there is a referral health center which corresponds to the first reference level in the health pyramid of Mali. Regional hospitals are the 2nd level of health reference. In addition to these structures, the region

had 188 functional community health centers in 2022 which are the first level of contact health establishments for local populations. This study took place at the reference health centers and the Sominé DOLO regional hospital in Mopti.

Study population, inclusion and exclusion criteria

The sample population was composed of diabetics aged 18 and over who attended the selected health facilities during our study period.

The inclusion criteria were limited to age and confirmed diabetic status for all patients recruited. Patients who did not agree to participate in the study were excluded.

All interviews were conducted by two trained investigators and all items on the questionnaire as well as the study's aims were explained to the participants.

Variables

The variables collected mainly included interest variable (presence of risk / absence of sleep apnea) and certain explanatory variables such, age, sex, body mass index, income level, marital status, level of education, social security, residence, type of diabetes, diabetes duration, medical history (hypertension, cardiopathy, dyslipidemia, nephropathy), behavioral habits and lifestyle (sport practicing, tobacco and alcohol use).

Data source and collection procedure

Certain data as the medical history, the results of complementary examinations of patients included in this study were collected from consultation registers and medical records.

A standardized questionnaire containing both self-questionnaire of Berlin was used for collecting all necessary information about participants. The Berlin questionnaire is a tool for screening of sleep disorders (sleep apnea syndrome).[9] It consists of 11 questions, organized into 3 categories: snoring, somnolence, and risk factors (a known history of high blood pressure and obesity). A category is considered positive if its score is greater than or equal to 2 (≥ 2). Then, patients were classified as high-risk of sleep apnea (if 2 or 3 categories were positive) and subjects with low or no risk of sleep apnea (if 0 or 1 category was positive). The diagnosis of obstructive sleep apnea syndrome (OSAS) was proposed for any patient with a high risk of OSAS.

Sampling

The Mopti region has 8 reference health centers including 04 in the flooded area and 04 in non-flooded areas and a regional hospital.

We first randomly chose four referral heath centers among the eight, including two in the flooded areas and two in non-flooded areas and the regional hospital in order that the chosen sample met certain representativeness criteria. From the five selected structures, all subjects meeting the inclusion criteria were collected either 289 participants.

Data statistical analysis

This analysis was carried out in three steps:

I. A descriptive analysis which consisted of describing the study sample. The quantitative variables were described by their mean and standard deviations and the qualitative variables by their percentages.

II. A univariate analysis which consisted of evaluating the association between the interest variable (presence of risk/ absence of sleep apnea) and certain explanatory variables such as age, sex, type of diabetes, diabetes duration, medical history (hypertension, cardiopathy, dyslipidemia, nephropathy), behavioral habit and lifestyle (sport practicing, tobacco and alcohol use). The tests used for this purpose were the chi2 of Pearson and Fisher exact tests for percentage comparison and the ANOVA test for the averages comparison. The significance level had been set at 5%.

III. A multivariate analysis using the model of binary logistic regression has been carried out by introducing in this model all the explanatory variables which have a significance level at the bivariate analysis less or equal 0.20.

Data were entered on Excel and analyzed with SPSS software Version 20.

Ethical consideration

The oral informed consent of each participant was obtained after full explanation of the aims' study and the participants' rights before collecting any data. Questionnaires have been assigned a unique number and at any time during the analysis of the study no person had been cited in order to respect the confidentiality and privacy of participants.

Results

Socio-demographic characteristics and medical history of participants

A total of 289 patients participated in this study. The respondents ranged in age from 20 to 93 years with a mean age of 51.59± 11.39 years. Among the participants, 66.9% were type 2 diabetics, 70.9% were female, 71.8% were married, 61.4% had no formal education, 65.3% had an insurance coverage and the average income per month was 2238.46 ± 847.87 CFA francs. The majority of them (88.6%) lived in urban areas. Body Mass Index average of respondents was estimated at 27.62 ± 4.26 kg/m2.

Concerning the medical history of participants, the existence of high blood pressure were noted in 72.8%%, dyslipidemia in 39.3%%, heart disease in 12.5% % and nephropathy in 26.5% (Table 1).

Table 1 Socio-demographic characteristics and medical history of participants

Variables	Frequency (n)	Percentage (%)	Means ± SD*
Age (year) n= 196			51.59 ± 11.39
BMI* (Kg/m2) (n=191)			27.62 ± 4.26
Sex (n=196)			
Male	57	29.1	
Female	139	70.9	
Marital Status (n=195)			

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Table 1 Continued....

Single	9	4.6	
Married	140	71.8	
Divorced	4	2.1	
Widowers	42	21.5	
Level of Education (n=189)			
None	116	61.4	
Primary	47	24.9	
Secondary	18	9.5	
Tertiary	8	4.2	
Residence (n=193)			
Rural	22	11.4	
Urban	171	88.6	
Social Security (n=193)			
Yes	126	65.3	
No	67	34.7	
Income (Cfa/month) (n=52)			2238.46 ± 847.87
Type of diabetes (n= 151)			
Type 1	50	33.1	
Type 2	101	66.9	
Medical history (n=196)			
Hypertension (HTA)	142	72.8	
Dyslipidemia	77	39.3	
Heart disease	2	12.5	
Nephropathy	52	26.5	

SD*: Standard deviation; **BMI***: Body Mass Index

Data source: Field survey (Abdoul Salam Diarra)

Factors associated with sleep disorders (apnea syndromes)

In univariate analysis, factors statistically associated with high risk of sleep apnea were: age (p < 001); the duration of diabetes (p < 0.02); antecedent of high blood pressure (p <0.000); profession involving intense physical activity (p <0.01); smoking status in favor of non-consumers (< 0.03); mood disorders (p <0.01); easy irritability (p< 0.002); difficulty concentrating (p< 0.02).

Multivariate analysis by logistic regression showed a statistically significant association between the dependent variable (obstructive sleep apnea syndrome) with high blood pressure (OR =52.4; 95% CI: [6.3 - 40.3]; p <0.000); non-smoking status (OR=0.04; 95% CI: [0.03 - 0.7]; p < 0.02) and the body mass index ≥ 25 (OR=3; 95% CI: [3.1 - 14.9]; p<0.04) (Table 2).

Table 2 Distribution according the associated factors of obstructive sleep apnea syndrome

	High risk of sleep apnea						
	No		**Yes**				
	15 (7.6)		**182(92.4)**		**Univariate analysis**	**Binary Logistic regression**	
Variables	**n**	**%**	**n**	**%**	**p-value**	**OR_2**	**95% CI**
	Means± SD						
Age	42.071±13.73		52.39 ±10.88		< 0.001	1.1	[0.9-1.1]
Diabetes duration (Year)	5.65 ± 5.47		9.06 ± 5.73		< 0.02	1.1	[09-1.3]
Sex							
Male	9	6.5	51	89.5		1	
Female	6	10.5	129	93.5	0.37	0.3	[0.06-1.4]
Type of diabetes							
Type 2	3	6	47	94	1		
Type 1	8	7.9	93	92.1			
Hypertension							
No	14	26.4	39	73.6		1	
Yes	1	0.7	141	99.3	0	52.4	[6.3-40.3]
Dyslipidemia							
No	13	10.9	106	89.1		1	
Yes	2	2.6	75	97.4	0.05	1.1	[0.1-9.2]

Table 2 Continued....

Heart disease							
Yes	1	4.8	20	95.2	1	7.3	[0.3-15.0]
No	14	8	161	92		1	
Profession involving intense physical activity							
Yes	8	16	42	84		1	
No	6	4.4	130	95.6	< 0.01	14.8	[0.1-15.3]
Tobacco use							
Yes	3	37.5	5	62.5		1	
No	11	8.1	124	91.9	< 0.03	0.04	[0.03-0.7]
Existence of harmful source							
No	10	7.6	122	92.4			
Yes	3	5.3	54	94.7	0.75		
Sleep time ≤ 8 /day							
No	12	7.4	151	92.6			
Yes	2	7.1	26	92.9	1		
Regularity of sleep							
Yes	6	9.1	60	90.9			
No	9	7	120	93	0.58		
Mood disorders							
No	5	22.7	17	77.3		1	
Yes	9	5.2	165	94.8	< 0.01	0.2	[0.02-2.9]
Easy Irritability							
No	7	23.3	23	76.7		1	
Yes	7	4.2	159	95.8	< 0.002	0.7	[0.08-6.7]
Difficulty concentrating							
No	11	10.8	91	89.2		1	
Yes	2	2.2	89	97.8	< 0.02	1	[0.15-5.2]
BMI* (Kg/m2)							
< 25	12	9.3	117	90.7		1	
≥ 25	3	4.8	59	95.2	0.39	3	[3.1-14.9]

±SD*: Mean ± Standard deviation; OR_a: Odds ratio adjusted

BMI*: Body mass index

Data source: Field survey (Abdoul Salam Diarra)

Discussion

Sleep disorders constitute a major public health problem because of their frequency and the seriousness of their consequences. Indeed, there is an increase of general mortality, the prevalence of certain chronic diseases (high blood pressure, type 2 diabetes, depression, obesity and cancers), the rate of road traffic injuries and work accidents (industrial disasters, professional mistakes in various disciplines), as well as a significant decrease of the quality of life and productivity.[8,10–13]

Between March and July 2022, we conducted this study in order to evaluate the obstructive sleep apnea syndrome and associated factors among diabetics attending state health structures in the Mopti region. This study enrolled 289 diabetics, the majority of whom were type 2 and female. The frequency of high risk of obstructive sleep apnea was very high in our study sample, since 92.4% of patients were suffering it. This high prevalence could be explained by the fact that the study focused only on diabetics and most of whom had other comorbidities such as obesity and/or hypertension. This risk was higher in Type 2 diabetics than Type 1, but the difference observed was not statistically significant (94% vs. 92.1, p = 1.00). Literature reports little data on the relationship between type1 diabetes and sleep disorder (obstructive sleep apnea syndrome). Most studies have focused instead on the relationship between obstructive sleep apnea which is the most common sleep disorder and type2 diabetes.[14–17]

Moreover, several studies report that obstructive sleep apnea syndrome is an independent risk factor in the pathogenesis of diseases such as hypertension, myocardial infarction, and cerebrovascular accident (CVA).[18–21] The International Diabetes Federation (IDF) recognized in 2007 the association between type 2 diabetes and obstructive sleep apnea syndrome (OSAS) based on the results of several studies who estimate that, more than 40% of patients with OSA will develop type 2 diabetes and the prevalence of OSA in type 2 diabetics is around of 23%.[14] The majority of the literature confirms that the risk of OSAS increases with age and being of the male sex.[20,22,23]

To explain these links, several hypotheses have been advanced including morphological variations of the upper airways, pharyngeal

muscle tone, cephalometric measurements, and adipose tissue repartition in men and women.[20,24] Other hypotheses, such as age-related anatomical and biological modifications, have been advanced by some authors.[20,25] In our study, we did not have a statistically significant association between high OSAS risk and age (ORa = 1.1; 95% CI: [0.9-1.1] p = 0.09); sex (ORa = 0.3; 95% CI: [0.06-1.4], p = 0.12) even if the univariate analysis concluded to a significant association. This difference of similarity observed between our data and that of literature could be explained by a very unequal distribution observed in our series between the male and female sex, thus a lack of statistical puissance linked to low number with regards to the male sex. However, our data corroborate those in the literature on the relationship between hypertension, smoking status, and body mass index with the high risk of obstructive sleep apnea. Several studies report that being overweight, especially central obesity is one of the biggest risk factors of development of OSA.[9,15,22,23,26]

The explanatory mechanism of the link between obesity and OSAS is that obesity contributes to OSA as increased neck fat leads to obstruction of the upper airway during sleep. In addition, lying in a recumbent fashion and increased abdominal girth leads to a decrease in lung volume thus further worsening hypoxia. OSA is also characterized by neuronal dysfunction of the muscles needed to maintain the upper airway patent during sleep. It would seem that it is not clear if obesity plays a role in this.

Also, like our results, literature reports that smoking is a determinant of high risk of obstructive sleep apnea syndrome.[27,28] Indeed, tobacco causes inflammation of the airways and unstable sleep due to nicotine deprivation at night.

In our study, some characteristics as duration of diabetes, mood disorders, irritability, and difficulty in concentration were significantly associated with the high risk of obstructive sleep apnea syndrome in univariate analysis. These findings are similar to those reported by some authors.[29,30] even though the multivariate analysis did not conclude a significant association between these characteristics and the dependent variable (OSAS). It is well known that chronic diseases such as diabetes cause an emotional stress load to patients. Conversely, the prognosis of diabetes can be affected by sleep quality and psychological distress and symptoms.[31,32]

Study limits

The main limits of this study were that OSAS cases detected by the Berlin scale could not be confirmed by polysomnography even though the Berlin self-questionnaire remains a reliable tool. Also, community health centers could not be included in this study for various reasons as the difficulty of accessing these structures due to insecurity in the region and the unavailability of medical records of patients.

Conclusion

This study reveals a fairly high frequency of obstructive sleep apnea syndrome in diabetics in the Mopti region. Its factors associated were high blood pressure, smoking status and body mass index. Among the known consequences of sleep disorders are, the increase in general mortality, the increase in the prevalence of certain chronic diseases (high blood pressure, type 2 diabetes, depression, obesity and cancers), increase in road traffic accidents and work accidents (industrial disasters, professional errors in various disciplines) and the significant reduction in quality of life and productivity. It would be necessary to conduct a national study to better estimate the prevalence of this pathology in diabetics for order to implement effective control strategies.

What this study adds

This study, which is the first in Mali and the Mopti region, provides basic scientific data for subsequent studies. It confirmed the results of other previous studies in the field on several points and allowed us to bring our experience to help improve the care of patients suffering from this pathology while strengthening the literature.

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Conflicts of interest

The authors declare there is no conflict of interest.

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