



Effectiveness of Deep Breathing Exercises on Obstructive Sleep Apnea among Type 2 Diabetic Mellitus Patients

Ali N. Hussein, * Msc Nursing; Waffa Abed Ali Hattab, ** PhD

* Academic Nurse, Ministry of Health, Thi Qar Health Directorate, Iraq.

E: mail: Ali.Nasser2102m@conursing.uobaghdad.edu.iq

** Assistant Professor, Department of Nursing Adults, College of Nursing, University of Baghdad.

E: mail: Waffa.a@conursing.uobaghdad.edu.iq

ARTICLE INFO

Article history:

Received: 30/05/2023

Accepted: 04/07/2023

Published: 31/12/2023

Keywords:

Diabetes Mellitus,

Deep Breathing Exercises,

Obstructive Sleep Apnea,

Berlin Questionnaires

ABSTRACT

Objective(s): the study aims to determine the effectiveness of deep breathing exercises on obstructive sleep apnea among type II diabetic mellitus patients.

Methods: A quasi-experimental design was carried out on diabetic patients suffering from obstructive sleep apnea through application of intervention program to determine its effectiveness on their sleep apnea. A non-probability (purposive) samples was selected for the purpose of the study, the study started from the first of December 2022 to 30th May 2023. The sample included 40 patients, divided to 2 groups, study group who applied deep breathing exercises for 6 weeks, and control group with no intervention. The questionnaire and the program contents' validity was determined by a panel of (20) experts to evaluate their clarity, relevance, and appropriateness for the accomplishment of the study. The reliability of the instrument, was done through the use of a test-retest method, where the result was = (0.867) was determined which is acceptable. Data was analyzed using SPSS VERSION 23.

Results: There was a significant improvement in the study group after applying deep breathing exercises, where the percentage of improvement of sleep quality and reduce episode of sleep apnea was equal to (85%), while the percentage of risk of obstructive sleep apnea in the control group was equal to (100%).

Conclusions: The study confirmed the effectiveness of intervention program for deep breathing exercises on reduce sleep episodes and health-related quality of life.

Recommendations: The study recommends the application of current intervention program in the Iraqi hospitals and centers and the need for further studies on more representative sample.

© 2023 College of Nursing. Published by University of Baghdad.

*Corresponding author at: Ministry of Health, Thi Qar Health Directorate, Iraq. E-mail: Ali.Nasser2102m@conursing.uobaghdad.edu.iq (AN Hussein). ORCID: <https://orcid.org/0009-0001-6055-1707>. <https://doi.org/10.58897/qzv99c39>

2023 College of Nursing. Published by University of Baghdad

فاعلية تمارين التنفس العميق على انقطاع التنفس اثناء النوم لدى مرضى السكري من النوع الثاني

المستخلص

الأهداف: هدفت الدراسة الى تحديد فعالية تمارين التنفس العميق على انقطاع التنفس اثناء النوم لدى مرضى السكري من النوع الثاني.

المنهجية: تم اجراء دراسة ذات تصميم شبه تجريبي علي مرضى السكري الذين يعانون من انقطاع التنفس اثناء النوم من خلال تطبيق برنامج تداخلي لتحديد فاعليته في حالة انقطاع النفس. تم اختيار العينات بطريقة غير احتمالية (هادفة) لغاية الدراسة. بدأت الدراسة من الفترة من الأول من كانون الأول ٢٠٢٢ الى ٣٠ أيار ٢٠٢٣. تضمنت الدراسة (٤٠) مريضاً في مركز امراض السكري والغدد الصماء في محافظة ذي قار. تم تحديد صلاحية الاستبانة ومحتويات البرنامج من قبل مجموعة من (٢٠) خبير لتقييم مدى وضوحها وملائمتها وعلاقتها لإتمام الدراسة. تم تقييم موثوقية الدراسة باستخدام طريقة الاختبار وإعادة الاختبار حيث كانت النتيجة تساوي (٠.٨٧٦) وهي مقبولة. تم تحليل البيانات من خلال استخدام الحقيبة الاحصائية نسخة ٢٣.

النتائج: أظهرت الدراسة تحسناً كبيراً في مجموعة الدراسة بعد تطبيق البرنامج عليها حيث كانت نسبة التحسن تساوي (٨٥%) بينما كانت نسبة خطر انقطاع التنفس اثناء النوم لدى المجموعة الضابطة تساوي (١٠٠%).

الاستنتاجات: أكدت الدراسة فاعلية تمارين التنفس العميق على تقليل نوبة انقطاع التنفس الانسدادي اثناء النوم لدى مرضى السكري من النوع الثاني ويلعب التدريب دوراً مهماً في تعزيز صحة الجسم.

التوصيات: أوصت الدراسة بتطبيق برنامج الحالي للدراسة في مستشفيات والمراكز العراقية والحاجة الى المزيد من الدراسات على عينة أكثر تمثيلاً.

الكلمات المفتاحية: مرض السكري النوع الثاني ، تمارين التنفس العميق، توقف التنفس اثناء النوم ، استبيانات برلين

Introduction

Diabetes mellitus is one of the major problems in public health in the twenty-first century. It now affects 415 million persons worldwide, and by 2040, that number is predicted to rise to 642 million in addition, it appears that 76 billion dollars, or 14 percent of global health expenditures, are spent annually on diabetes-related therapy⁽¹⁾.

Around 1.4 millions of Iraqis have diabetes, the reported diabetes mellitus type 2 prevalence in Iraq ranged from 8.5% to 13.9%⁽²⁾.

Diabetes management is mostly behavioral and involves taking daily medications, monitoring blood sugar levels, exercising, and making dietary changes that must be constant and applied to every element of living⁽³⁾.

Diabetes affects (80%) of people in countries with low to middle incomes about 336 million individuals had diabetes in 2012, and 552 million are predicted to have it by

2030. Diabetes is the seventh cause of death in the world⁽⁴⁾.

Diabetes is one of the metabolic diseases caused by a deficiency in amount of insulin released, or the way of insulin works, or both, and seen as a worldwide health issue that should be modified to enhance the quality of life for patients⁽⁵⁾.

Obstructive sleep apnea and type 2 diabetes mellitus are strongly associated, and a sleep monitor is required for a specific diagnosis and device such as polysomnogram that act gold-standard diagnostic procedure for a challenging of sleep study⁽⁶⁾.

Patients with obstructive sleep apnea suffer from many problems that include fatigue and drowsiness during driving that lead to traffic accident and causes handicap and harm that need excessive use of healthcare services, and higher health care expenses⁽⁷⁾.

Excessive daytime drowsiness is a crucial clinical indicator of obstructive sleep apnea that greatly effect on diabetic patients

because change many functional such as reduce glucose metabolism and insulin resistances⁽⁸⁾.

Currently, there is a little research on the prevalence of obstructive sleep apnea in Iraq since the population does not view the condition as a serious health concern⁽⁹⁾.

When health care service is limited this leads to an increase health problems and mortality in the population⁽¹⁰⁾.

Positive effect of deep breathing for 20 minutes (5 breaths per minute) before bedtime improve sleep quality and reduce episode of apnea, participants' average time to fall asleep was only 10 minutes which is around three times faster from normal, after applying the exercises the participants feel relief and calmness resulting from the exercise⁽¹¹⁾.

Diabetes mellitus is one of the chronic diseases, healthcare professionals provide patients observation and superior medical treatment due to a rise blood glucose levels that causes many serious problems such as cardiovascular disease and nerve system disease⁽¹²⁾.

The current study aims to determine the effectiveness of deep breathing exercises on obstructive sleep apnea among Type 2 Diabetic Mellitus patients

Methods

Study design and setting

A quasi-experimental design carried out in diabetics and endocrine center in Thi Qar governorate. The study was conducted from 1st December, 2022 to 30th May, 2023 at diabetic and endocrine center.

Samples and sampling

A non-probability (purposive) sample of (40) patients they suffer from obstructive sleep apnea and divided for two group study and control. Study group undergone to instruction program for 6 weeks. Patients were selected according to the following criteria;

(1) Patient with Diabetes mellitus type 2 age above 18 years' old

(2) Patient agree to participation in the study and accept to complete the deep berating exercises

(3) Patient without mental or physical disability in medical record.

Data collection and study instrument

The patients have signed a consent form to acknowledge their voluntary participation with no coercion and the confidence that their data will be used for research purposes only. Direct interview was used in data collection from the study sample through the use of a questionnaire composed of three parts:

Part I: Patients' socio-demographic data which included 6 items; age, gender, marital status, educational level, occupation, address.

Part II: Patients Clinical and behavioral characteristics that includes: body mass index (BMI), duration of diabetes mellitus type 2, comorbidities other diabetes mellitus, smoker, medication that help to relax before sleep, eat heavy meals before sleep, does anyone in your family suffer from obstructive sleep apnea.

Part III: Berlin Questionnaire⁽¹³⁾ that used to measure patients' knowledge about education program for obstructive sleep apnea it contains 10 questions, which are divided into three categories. In the first category, there are five questions about snoring and breathing during sleep. In the second category, there are three questions about increased daily fatigue and drowsiness. In the last, third category, there are questions about hypertension and body mass index. Each category is evaluated separately; positive scores in 2 or more categories suggest that the respondent has a high risk for obstructive sleep apnea.

Validity and Reliability of the study Instrument

The questionnaire and the program contents' validity was determined by a panel of (20) experts. These experts were with at least ten years of expertise in the research area, they evaluated their clarity, relevance, and appropriateness for the accomplishment of the study. The reliability of the questionnaire was assessed using person correlation coefficient to estimate its internal consistency. Correlation coefficient of (0.876) was determined which is acceptable. All participants were asked to fill the questionnaires before applying the intervention program (pre-test), then just the study group give the deep breathing exercises that continue for 6 weeks.

Data analysis

The statistical software (SPSS) ver. 23 was used for data analysis of the study. A p value ≤ 0.05 was counted as statistically significant.

Ethical considerations

Ethical approval has been secured from the Ethics Committee of the College of Nursing/Baghdad University. The researcher is committed to maintaining patient record confidentiality, and the collected data will be strictly used for the designated analysis. Participants' verbal consent is sought only after a clear explanation of the purpose of their involvement.

Results

Table 1. Demographic Characteristics of Study and Control Groups

Variables	Classification	Study Group		Control Group		Total	
		F	%	F	%	F	%
Age/years	20-30 years	2	10.0	2	10.0	4	10.0
	31-40 years	3	15.0	3	15.0	6	15.0
	41-50 years	8	40.0	8	40.0	16	40.0
	51-60 years	6	30.0	5	25.0	11	27.5
	61 years and more	1	5.0	2	10.0	3	7.5
	Total	20	100.0	20	100.0	40	100.0
	$\bar{x} \pm S.D.$		30.5 \pm 1.050		31.0 \pm 1.119		30.7 \pm 1.071
Gender	Male	15	75.0	15	75.0	30	75.0
	Female	5	25.0	5	25.0	10	25.0
	Total	20	100.0	15	75.0	40	100.0
Educational level	Illiterate	9	45.0	3	15.0	12	30.0
	Read and write	2	10.0	4	20.0	6	15.0
	Primary	2	10.0	5	25.0	7	17.5
	Secondary	3	15.0	5	25.0	8	20.0
	College degree	4	20.0	3	15.0	7	17.5
	Total	20	100.0	20	100.0	40	100.0

F=Frequencies, %=Percentages, $\bar{x} \pm S.D$ =Arithmetic Mean and Std. Dev. (S.D.).

The results of table (1) showed that the highest percentage of the patients were within the age group (41- 50) years (40%), the majority of patients were male (75%), most of them were married (77%), with an educational level of Illiterate (45%). The majority of patients' lives in the city center (55.0%).

Table (2): Clinical and Behavioral Characteristics for Both the Study and Control Group

Variables	Classification	Study Group		Control Group		Total	
		F	%	F	%	F	%
Body Mass Index (BMI)	Normal weight = 18.5 - 24.9	3	15.0	3	15.0	6	15.0
	Overweight= 25 - 29.9	5	25.0	5	25.0	10	25.0
	Obese =30 - 34.5	12	60.0	12	60.0	24	60.0
	Total	20	100.0	20	100.0	40	100.0
Do you smoker	Currently	10	50.0	13	65.0	23	61.0
	Never	8	40.0	6	30.0	14	35.0
	Previous	2	10.0	1	5.00	3	4.00
	Total	20	100.0	20	100.0	40	100.0
Do you have another disease?	No	8	35.0	8	40.0	16	34.5
	Hypertension	11	55.0	12	60.0	23	57.5
	Asthma	1	5.0	0	0.00	1	8.0
	Total	20	100.0	20	100.0	40	100.0

F=Frequencies, %=Percentages, $\bar{x} \pm S.D$ =Arithmetic Mean and Std. Dev. (S.D.)

The results of table (2) showed that the highest percentage of the patients were within the body mass index (BMI= 30-34.5), representing (60%) of the patients. More half of patients were smokers (60%).The majority of comorbidities it hypertension (55%) in the study sample.

Table 3. Statistically Distribution Between the Two Period (Pre and Post Tests) of Berlin Questionnaire for the Diagnosis and Severity of Obstructive Sleep Apnea in the Study Sample (Study Group)

No.	Items of Berlin questionnaire	Positive Responses	Pre – test		Post –test	
			Frequency	Percent	Frequency	Percent
1	Do you snore?	I know	20	100.0	18	90.9
		Not sure			2	9.1
		I don't know				
2	Snore is	Slightly louder than breathing			16	72.7
		speech volume			3	18.2
		Louder than the voice of speech	11	55.0	1	9.1
		So loud it could be heard in the next room	9	45.0		
3	How often do you snore?	almost everyday	15	75.0		
		3-4 times a week	5	25.0		
		1-2 times a week				
		1-2 times a month			10	50.0
		Never or almost never			10	50.0
4	Does the sound of your snoring or snoring bother your husband or wife?	Yes	20	100.0	3	22.7
		No			17	77.3
		I don't know				
5	How often have	almost everyday				

	you or someone noticed that you stopped breathing in your sleep?	3-4 times a week	7	35.0		
		1-2 times a week	9	45.0		
		1-2 times a month	4	20.0	4	27.3
		Never or almost never			16	72.7
6	How often do you feel tired or fatigued after you sleep?	almost everyday	20	100.0		
		3-4 times a week			1	13.6
		1-2 times a week				
		1-2 times a month			9	40.9
		Never or almost never			10	45.5
7	Do you feel drowsy while driving?	Yes	8	40.0	3	22.7
		No	8	40.0	17	77.3
		I don't know	4	20.0		
8	If yes, how often does this happen?	almost everyday				
		3-4 times a week	6	30.0		
		1-2 times a week	2	10.0		
		1-2 times a month			3	22.7
		Never or almost never	12	60.0	17	77.3
9	Do you suffer from high blood pressure?	Yes	14	70.0	16	72.7
		No	6	30.0	4	27.3
		I don't know				
10	A BMI of more than 30 kg/m2	Yes	12	60.0	10	50.0
		No	8	40.0	10	50.0

The results of table (3) show the positive effect of deep breathing exercises on the patients, as snoring was improving by (90%) for the study group, and the number of times obstructive sleep apnea was reducing to (76%), and the state of feeling of fatigue when waking up improved by (77%), while hypertension changed by a slight percentage (10%), and the majority of patients lost weight. Therefore, the rate of BMI improving by (60%).

Table 4. Statistically Distribution Between The Two Period (Pre And Post Tests) of Berlin Questionnaire for The Diagnosis and Severity Of Obstructive Sleep Apnea in The Study Sample (Control Group)

No.	Items of Berlin questionnaire	Positive Responses	Pre – test		Post -test	
			Frequency	Percent	Frequency	Percent
1	Do you snore?	I know	20	100.0	20	100.0
		No sure				
		I don't know				
2	Snore is	Slightly louder than breathing	3	15.0	3	15.0
		speech volume	1	5.0	1	5.0
		Louder than the voice of speech	9	45.0	9	45.0
		So loud it could be heard in the next room	7	35.0	7	35.0
3	How often do you snore?	almost everyday	13	65.0	13	65.0
		3-4 times a week	7	35.0	7	35.0
		1-2 times a week				

		1-2 times a month				
		Never or almost never				
4	Does the sound of your snoring or snoring bother your husband or wife?	Yes	20	100.0	20	100.0
		No				
		I don't know				
5	How often have you or someone noticed that you stopped breathing in your sleep?	almost everyday	1	5.0	3	15.0
		3-4 times a week	10	50.0	10	50.0
		1-2 times a week	6	30.0	6	30.0
		1-2 times a month	1	5.0	1	5.0
		Never or almost never	2	10.0		
6	How often do you feel tired or fatigued after you sleep?	almost everyday	12	60.0	12	60.0
		3-4 times a week	5	25.0	5	25.0
		Never or almost never				
7	Do you feel drowsy while driving?	Yes	11	55.0	10	50.0
		No	9	45.0	10	50.0
		I don't know				
8	If yes, how often does this happen?	almost everyday				
		3-4 times a week			4	20.0
		1-2 times a week	4	20.0	7	35.0
		1-2 times a month	7	35.0		
		Never or almost never	9	45.0	9	45.0
9	Do you suffer from high blood pressure?	Yes	14	70.0	14	70.0
		No	6	30.0	6	30.0
		I don't know				
10	A BMI of more than 30 kg/m2	Yes	13	65.0	12	60.0
		No	7	35.0	8	40.0
		1-2 times a week	3	15.0	3	15.0
		1-2 times a month				

The results of table (4) show that there was no change in the results of the control group pre and posttest, they were not given the instruction program, in contrast to the study group, which showed the positive effect and significant improvement of obstructive sleep apnea, and the occurrence of sleep apnea showed (100%) in the control group.

Table 5. Statistically Distribution of Study and Control Group According to Berlin Questionnaire for The Diagnosis and Severity of Obstructive Sleep Apnea in Patients with Diabetes Mellitus Type 2 by Positives Responses of Scale Categories

Groups	Classification	Pre test		Post Test	
		Frequency	Percent	Frequency	Percent
Study Group	High Risk	20	100.0	3	15.0
	Low Risk	0	0.00	17	85.0
Control Group	High Risk	20	100.0	20	100.0
	Low Risk	0	0.00	0	0.00

The results of table (5) show good effect (85%) in the study group after applying the deep breathing exercises. While the control group show high risk of obstructive sleep apnea (100%).

Discussion

The study findings concerning patient's socio - demographic characteristics revealed that majority of patients were males and married, these findings were supported by a study on adult patients which aimed to knowing patients about therapeutic measures for diabetic foot in patients with type 2 diabetes, high percentage of age was from (40-49) years that equal to (46.7%) from study sample⁽¹⁴⁾.

Majority of patients from men (75%). Similar studies reflected that such results where most patients from men (40%) while for women (14%)⁽¹⁵⁾.

Concerning the educational level and occupation, the results showed that majority of patients were Illiterate and only third of them were employed, this result agrees with a multi-site study among diabetic foot patients in Iraq, in which about majority of sample were graduated from Illiterate and were employees⁽¹⁶⁾.

Most of patient were within age group (41-50) years, half of them were smokers and obesity class I ranging from (30-34.9 kg/m²) according to BMI classification. These results are similar to another study that discussed the patients with obesity and sleep apnea, which revealed that most of sample were smokers and obesity that act risk factor for type 2 diabetes (89%), because it makes the body more susceptible to insulin resistance⁽¹⁷⁾⁽¹⁸⁾.

The widespread misdiagnosis the symptoms of obstructive sleep apnea in older people these lead to undetected OSA in these patients. Older men and women more than 60 years are more likely than younger people to have OSA⁽¹⁹⁾.

Study which aimed to demonstrate the effectiveness of the educational program regarding diabetic foot care for diabetic patients, as the percentage of males was the highest percentage in the study sample and was equal to (60%)⁽²⁰⁾.

As for the marital status, most of the participants were married and their percentage was (80%) because of their advanced age and because of the customs and traditions that exist in our country, the majority of the population gets married at the age of at most 24 years, and the second reason is that most of the participants are men and similar the results of this study where the percentage of married person in the study sample was equal to (94%) of the total research sample⁽²¹⁾.

The percentage of smokers in the study sample and the control group was (60%, 65%) respectively, according to studies smoking is considered one of the risk factors for sleep apnea, as well as heart disease, diabetes, and blood vessels.

As the results of table 3,4 show there is a high risk of obstructive sleep apnea (100%) of the participants suffered from snoring, as well as feeling tired when waking up. The sound of snoring was very loud and could be heard in the next room, and this causes inconvenience to the partner or people sleeping in the same room. The participants also felt sleepy while driving the car (40%) and most of the participants had high blood pressure and weight gain (60%).

When deep breathing exercises were applied to the study group, there was a significant improvement and positive effect in the results, as the rate of snoring among patients (9%) feeling tired when waking up (13%) and feeling sleepy when driving a car (22%) and there was also an improvement in hypertension and obesity (27%).

As for the control group, it did not receive any intervention, so the results were almost equal before and after the study.

Study conducted by Alwan show positive effect of deep breathing exercises on participants' oxygen saturation levels, increasing it from (83%) on the first day before an applies of these programs to (95%) on the fifth day afterward in participants with Covid 19 at (P 0.05)⁽²²⁾.

As the results of table 5, show before applying the intervention program the risk rate was (100%) in both groups, after applying the exercises, present improvement in the results, as the risk rate was equal to (15%) meaning that the improvement rate was equal to (85%).

Conclusions

The study confirmed the effectiveness of intervention program for deep breathing exercises on reducing sleep apnea episodes and health-related quality of life.

Recommendation

The study recommends the application of current intervention program in the Iraqi hospitals and centers and the need for further studies on more representative sample.

Conflict of Interest

None.

Funding

This research received no specific fund from any funding agency in the public, commercial or not-for-profit sectors.

References

1. Cho NH, Shaw JE, Karuranga S, Huang Y, da Rocha Fernandes JD, Ohlrogge AW, Malanda BI. IDF Diabetes Atlas: Global estimates of diabetes prevalence for 2017 and projections for 2045. *Diabetes research and clinical practice*. 2018 Apr 1; 138:271-81.
2. Abusaib M, Ahmed M, Nwayyir HA, Alidrisi HA, Al-Abbood M, Al-Bayati A, Al-Ibrahimi S, Al-Kharasani A, Al-Rubaye H, Mahwi T, Ashor A. Iraqi experts consensus on the management of type 2 diabetes/prediabetes in adults. *Clinical Medicine Insights: Endocrinology and Diabetes*.(2020);13:1179551420942232.
3. Ahmmad SR, Abdulwahid HS. Assessment of Food Frequency Intake and Dietary Habits for Diabetic Pregnant Women. *Iraqi National Journal of Nursing Specialties*. 2015;28(1).
4. Khalifa AH. Evaluation of diabetes self-management among patients in Baghdad City: A comparative study. *Iraqi National Journal of Nursing Specialties*. 2018 Dec 14;1(31):101-9.
5. Faraj RK. Parents' Knowledge about Type I Diabetes Mellitus at Diabetes and Endocrine Treatment Centers in Baghdad City. *Iraqi National Journal of Nursing Specialties*. 2016;29(2).
6. Soltis ME, Spector AR. A Concise Review of Polysomnography and Obstructive Sleep Apnea for the Neurophysiologist. *Journal of Clinical Neurophysiology*. 2023 Mar 29;40(3):191-7.
7. Gabric K, Matetic A, Vilovic M, Ticinovic Kurir T, Rusic D, Galic T, Jonjic I, Bozic J. Health-related quality of life in type 2 diabetes mellitus patients with different risk for obstructive sleep apnea. Patient preference and adherence. 2018 May 9:765-73.
8. Simpamba K, May JL, Waghat A, Attarian H, Mateyo K. Obstructive sleep apnea and excessive daytime sleepiness among commercial motor vehicle drivers in Lusaka, Zambia. *Journal of clinical sleep medicine*. 2023 Mar 1;jcsm-10538.
9. Hashim HT. Assessment of Obstructive Sleep Apnea Among Iraqi People in 2019 by Using (STOP-BANG) Model. *SN Comprehensive Clinical Medicine*. 2020 Nov;2(11):2260-4.
10. Jerath R, Beveridge C, Barnes VA. Self-regulation of breathing as an adjunctive treatment of insomnia. *Frontiers in psychiatry*. 2019:780.
11. Khudhair SS, Ahmed SA. Type 2 Diabetic Patients' Knowledge Regarding Preventive Measures of Diabetic Foot. *Iraqi National Journal of Nursing Specialties*. 2022;35(2).
12. Genta PR, Sands SA, Butler JP, Loring SH, Katz ES, Demko BG, Kezirian EJ, White DP, Wellman A. Airflow shape is

- associated with the pharyngeal structure causing OSA. *Chest*. 2017 Sep 1;152(3):537-46.
13. Netzer, N. C., Stoohs, R. A., Netzer, C. M., Clark, K., & Strohl, K. P. (1999). Using the Berlin Questionnaire to identify patients at risk for the sleep apnea syndrome. *Annals of internal medicine*, 131(7), 485-491.
 14. Gabish AM, Mohammed WK. Effectiveness of health education program for type 2 diabetes mellitus patient's self-efficacy toward managing feet at Endocrinology and Diabetes Center in Al-Rusafa Sector. *Iraqi National Journal of Nursing Specialties*. 2018;31(1).
 15. Kassar AK, Khudur KM. Evaluation of Nurses' Knowledge Regards Diabetic Foot Care Management at Teaching Hospital in Al-Nasiriya city. *Annals of the Romanian Society for Cell Biology*. 2021 Apr 30:12500-6.
 16. Salman, A., & Bakey, S. (2021). Determination of the Level of Depression among Diabetic Foot Patients at Al-Najaf Al-Ashraf Teaching Hospitals. *Kufa Journal for Nursing Sciences*, 11(2), 154-164.
 17. Aljuaid MO, Almutairi AM, Assiri MA, Almalki DM, Alswat K. Diabetes-related distress assessment among type 2 diabetes patients. *Journal of Diabetes Research*. 2018 Mar 26;2018.
 18. Almendros, I., Martinez-Garcia, M. A., Farré, R., & Gozal, D. (2020). Obesity, sleep apnea, and cancer. *International Journal of Obesity*, 44(8), 1653-1667.
 19. Al-Saadi SF, Moonaghi HK, Sadeq AF, Bakhshi M. Effect of near-infrared vein finder technology on success rate of cannulation in obese diabetic patients. *Shiraz E-Medical Journal*. 2022 Dec 31(In Press).
 20. Dong Z, Xu X, Wang C, Cartledge S, Maddison R, Islam SM. Association of overweight and obesity with obstructive sleep apnoea: a systematic review and meta-analysis. *Obesity Medicine*. 2020 Mar 1; 17:100185.
 21. Alwan MK, Abd Mohsen RI. The effect of Deep Breathing Exercise on Oxygen Saturation of Patients with COVID-19. *Mosul Journal of Nursing*. 2022 Aug 21;10(3):51-5.
 22. Mashaqi S, Gozal D. The impact of obstructive sleep apnea and PAP therapy on all-cause and cardiovascular mortality based on age and gender—a literature review. *Respiratory investigation*. 2020 Jan 1;58(1):7-20.
 23. Ali BH, Abdulwahhab MM. Nurses' Knowledge Toward Continuous Positive Airway Pressure Machine at Respiratory Isolation Unit. *Pakistan Journal of Medical & Health Sciences*. 2022 Jun 24;16(05):783.