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Original Article

Community pharmacists role in the evaluation of therapeutic regimens for hypertension and diabetes in Iraqi patients

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ABSTRACT

Uncontrolled hypertension and diabetes are associated with cardiovascular diseases, cerebrovascular disease, and kidney disease. This study was conducted for the evaluation of hypertensive and diabetic patients at the target-controlled level and to find factors that affect uncontrollable cases. This prospective cross-section clinical trial included 242 Iraqi patients (114 males and 128 females) aged between 21-91 years who suffered from hypertension, diabetes, or both chronic diseases at different pharmacies. Blood pressure and blood glucose levels were checked for all patients as primary care in pharmacies. In the hypertensive patient group, treatment of hypertension as guided played an important factor in controlling blood pressure. The main causes of uncontrolled hypertension were age, higher body mass index (obesity), non-adherence, and treatment not being as guided. As for uncontrolled diabetes, the main factors are adherence, a lack of physical activity, and treatment not being as guided. Furthermore, uncontrolled diabetic and hypertensive patients were not treated as guided. Prevention methods should focus on more lifestyle modifications by spreading awareness and educating Iraqi citizens on the outcomes of their everyday behaviors. This is where community pharmacists come to play a critical role in improving the healthcare system in Iraq and should not be limited to dispensing medications only. Iraqi pharmacists need to be more involved in the evaluation of patients' treatment by counseling patients on nutrition and activity, following up on medication adherence, and building trust through a connected patient-pharmacist relationship and training in specialty pharmacy programs.

Keywords: Community pharmacist, Hypertension, Diabetes mellitus, Uncontrolled, Treatment as guided, Iraqi patients

Introduction

Hypertension is defined as a chronic disorder specified by persistent elevated blood pressure to 130/80 mm Hg; it is a modifiable risk factor for cardiovascular, cerebrovascular, and renal diseases and an important public health issue [1]. Most major guidelines recommend that an elevated AOBP (automated office blood pressure) is considered as an average SBP (systolic blood pressure) of > 135 mm Hg or an average DBP (diastolic blood pressure) of > 85 mm Hg or both with the best available method [2].

Many risk factors for hypertension are classified as non-modifiable and modifiable risk factors. The modifiable risk factors include overweight or obesity, smoking, alcohol use, diabetes mellitus, and physical inactivity, whereas the non-modifiable risk factors include a family history of hypertension and increasing age [3, 4]. Uncontrolled hypertension is related to cardiovascular disease, cerebrovascular disease, and renal disease [3]. The normal interventions for aiding patients in decreasing blood pressure include lifestyle reforms (i.e., increased physical activity, dietary changes, and weight loss) and antihypertensive medications [5, 6]. The most usual pharmacological treatments for hypertension include inhibitors of angiotensin-converting enzymes, blockers of angiotensin receptors, beta blockers, calcium channel blockers, and thiazide diuretics [7, 8]. The

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choice of these medications for controlling hypertension should depend on comorbid conditions according to guidelines, adverse effect profiles, cost, and ease of use [7, 9].

Diabetes mellitus (DM) is a type of chronic metabolic disorder specified by persistent elevation of blood glucose levels [10]. Many risk factors predispose to type 2 DM, such as overweight or obesity, family history, impaired daily physical activity, and dyslipidemia [11]. Uncontrolled DM can lead to acute complications such as diabetic ketoacidosis (DKA) for type 1 DM and hyperosmolar hyperglycemic syndrome (HHS) for type 2 DM, whereas optimal management of diabetes can decrease the complications risk and improve life quality [12, 13]. According to the guidelines for type 2 DM management, various groups of medications are used for controlling glucose levels, such as metformin, sulfonylureas, sodium-glucose transporter inhibitors, dipeptidyl peptidase-4 inhibitors, meglitinides, and thiazolidinediones [14, 15]. In Iraq, there are few randomized controlled trials and epidemiological studies about hypertension and diabetes, so it remains hard to fully understand both diseases' prevalence in Iraq for the evaluation of the most effective therapies for the Iraqi population [16].

The aim of the study

This research was conducted for the evaluation of hypertensive and diabetic patients within the target level and to find factors that affect uncontrollable cases.

Patients and methods

Patients

Inclusion criteria

The patients were included in this study as follows:

1. Patients with hypertension
2. Patients with diabetes mellitus
3. Patients with hypertension and diabetes

Exclusion criteria

Any diabetic patient didn't have an HbA1c test for the previous three-month period.

Study design

This prospective cross-section clinical trial included 242 Iraqi patients (114 males and 128 females) aged between 21 and 91 years who suffered from hypertension, diabetes, or both chronic diseases at different pharmacies within multi-regions in Al-Karkh/Baghdad city. The study was performed from October 2022 to June 2023. Baseline demographic characteristics and clinical features of the enrolled participants (gender, age, weight, smoking, and alcohol drinking status, family history, education status, physical activity, chronic disease history and duration, medication history, and adherence to medications) were recorded. Moreover, blood pressure and blood glucose levels were checked for all patients as primary care in pharmacies.

The participants were divided into three groups, as follows:

1. The hypertensive patient group included 104 patients and was then subdivided into two subgroups (controlled n = 74 and uncontrolled n =30).
2. The diabetic patient group, which included 58 patients, was then subdivided into two subgroups (controlled n = 36 and uncontrolled n =22).
3. The diabetic-hypertensive patient group included 80 patients and was then subdivided into two subgroups (controlled n = 34 and uncontrolled n =46).

Materials and Methods

Each patient's blood pressure was checked three times over 30 minutes using a calibrated electronic sphygmomanometer, and random blood glucose levels in diabetic patients were checked using the ACCU-Check device. Treated hypertensive patients with blood pressure <140/90 mmHg were considered to have controlled hypertension, whereas patients with blood pressure ≥140/90 mmHg were considered to have uncontrolled hypertension. In addition, patients with treated diabetes who had random blood glucose levels <200 mg/dl were defined as patients with controlled diabetes. Diabetics with random blood glucose levels ≥200 mg/dl were considered uncontrolled.

Statistical analyses

Statistical analyses were done by IBM SPSS version 28.0.0. Data with a normal distribution were expressed as mean and SD (standard deviation) and analyzed with a Student t-test. Categorical variables were presented as numbers and percentages, which were analyzed with the Chi-square test. The correlation between two variables was performed with Pearson correlation by calculation of the correlation coefficient. The association of more appropriate risk factors that affect uncontrolled cases was evaluated through the calculation of the odd ratio (OR) by using binary logistic regression. A *P*-value < 0.05 is considered to show a statistically significant difference.

Results and Discussion

Patient demographics and disease characteristics of three groups

Two hundred forty-two (242 patients) were enrolled to represent the sample size of this study, including 114 males (47.1%) and 128 females (52.9%). Descriptive demographic characteristics for all patients are shown in **Table 1**.

Table 1. Descriptive demographic specifications of three groups (hypertension, DM, and hypertension with DM)

Descriptive demographic characteristics		N	%
Gender	Male	114	47.1
	Female	128	52.9

Education status	Primary	26	10.7
	Secondary	64	26.4
	Graduate	116	47.9
	Postgraduate	36	14.9
Physical Activity	Yes	180	74.4
	No	62	25.6
Family history	Yes	160	66.1
	No	82	33.9
Smoking	Yes	38	15.7
	No	204	84.3
Duration of diseases	< 5 years	28	11.6
	5-10 years	64	26.4
	>11 years	70	28.9
Treatment as guided	Yes	170	70.2
	No	72	29.8

All patients were divided into three groups: hypertensive patients were 104 (43%), diabetic patients were 58 (24%), and diabetic patients with hypertension were 80 patients (33%), as shown in the **Figure 1**.

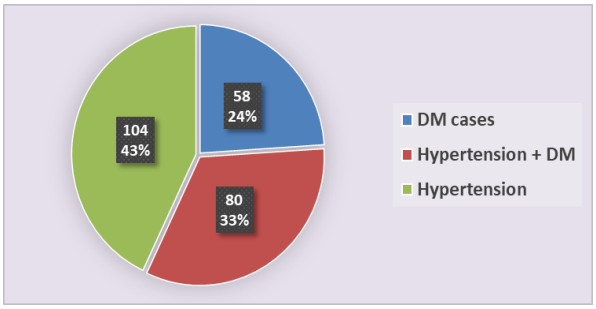

Figure 1. Percentage of three groups of hypertensive patients: diabetic patients and diabetic-hypertensive patients in the study.

Demographic characteristics and factors between controlled and uncontrolled hypertensive patient groups

In the hypertensive patient group, there was no significant difference after statistical analysis (*P*-value ≥ 0.05) in gender, smoking, family history, education status, physical activity, or duration of hypertension when comparing the controlled hypertensive patients subgroup with the uncontrolled hypertensive patients subgroup. Interestingly, treatment or management of hypertension as guided played an important factor in controlling blood pressure after statistical analysis between two subgroups (*P*-value < 0.05), as shown in **Table 2**.

Table 2. Demographic characteristics and factors between controlled and uncontrolled hypertensive patient groups

Demographic characteristics/ Factors		Hypertensive patient group		*P*-Value [a]
		Controlled	Uncontrolled	
		N	%	N	%	
Gender	**Male**	28	26.9	10	9.6	**0.754** [NS]
	Female	46	44.2	20	19.2	
Smoking	**Yes**	12	11.5	4	3.8	**0.866** [NS]
	No	62	59.6	26	25.0	
Family history	**Yes**	48	46.2	22	21.2	**0.747** [NS]
	No	26	25.0	8	7.7	
Physical Activity	**Yes**	56	53.8	22	21.2	**0.824** [NS]
	No	18	17.3	8	7.7	
Education status	**Primary**	10	9.6	6	5.8	**0.687** [NS]
	Secondary	20	19.2	10	9.6	
	Graduate	30	28.8	12	11.5	
	Post gradates	14	13.5	2	1.9	
Duration of HT (Years)	**< 5**	10	9.6	10	9.6	**0.248** [NS]
	5-10	22	21.2	8	7.7	
	>11	42	40.4	12	11.5	
Treatment as guided	**Yes**	70	67.3	16	15.4	**0.001***
	No	4	3.8	14	13.5	
Age		60.3±12.2		54.1±10.7		**0.047***
BMI		29.4±5.0		32.6±5.4		**0.049***
Adherence %		94.9±13.6		72.0±31.2		**< 0.001***

Data expresses as (N): Number of patients, (%) Percentage, and mean ± SD. Fisher's Exact test, Chi-square test ($\chi 2$) and T Test used for at least one expected value is < 5, NS: No significant changes ($P \geq 0.05$), (*) significant changes ($P < 0.05$).

The mean age in the controlled hypertensive patients' subgroup was 60.3±12.2, whereas the mean age in the uncontrolled hypertensive patients' subgroup was 54.1±10.7, with significant differences between the two subgroups. Furthermore, the mean body mass index of controlled hypertensive patients' subgroup was 29.4±5, whereas the mean body mass index of uncontrolled hypertensive patients' subgroup was 32.6±5.4, with significant differences between the two subgroups (*P*-value < 0.05). There was a highly significant difference in adherence when compared between the controlled and uncontrolled hypertensive patient groups after statistical analysis, as shown in **Table 2**.

The percentage of uncontrolled cases was 28.8% in the hypertensive patient group. From these results, many factors affect controlling blood pressure in hypertensive patients within the target level, such as body mass index, age, and adherence. In other words, the increasing number of hypertensive patients with controlled blood pressure is related to their increasing age, which can reflect on increased adherence to medications. A previous study discussed the effect of the medications and age number on adherence to antihypertensive medications and concluded that adherence to antihypertensive medications improved when the age of the patient was increased [17]. Another study reported that age plays an important role in medication adherence among elderly hypertensive patients [18, 19].

Furthermore, uncontrollable blood pressure in hypertensive patients is associated with an increase in the index of body mass to an obesity value > 30. Recent studies revealed that obesity is

a risk factor for uncontrolled hypertension and concluded that weight loss interventions reduced blood pressure in hypertensive patients [20]. A Farhadi F. (2023) study revealed that non-adherence plays an important role in controlling hypertension [21]. Other studies concluded that poor adherence, smoking, and obesity were more appropriate factors that affect and increase the incidence of uncontrollable hypertensive cases [22-27].

Demographic characteristics and factors between controlled and uncontrolled diabetic patient groups

In the diabetic patient group, when comparing the controlled diabetic patient subgroup with the uncontrolled diabetic patients subgroup, there was no significant difference after statistical analysis (*P*-value ≥ 0.05) in gender, smoking, family history, education status, or diabetes duration.

The percentage of physical activity in patients with controlled diabetes was 58.6% versus 24.1% when compared to patients with uncontrolled diabetes, with a significant difference between them (*P*-value = 0.033). Another review study demonstrated the beneficial impacts of physical activity in diabetic patients through the achievement and optimization of metabolic control by non-pharmacological therapy including diet, lifestyle modification, and physical activity [28]. Furthermore, the percentage of controlled diabetic patients who were treated or managed as guided was 55.2%, whereas the percentage of uncontrolled diabetic patients who were treated as guided was 13.8%, with a significant difference between them (*P*-value = 0.01), as revealed in **Table 3**.

Table 3. Demographic characteristics and factors between controlled and uncontrolled diabetic patient groups

Demographic characteristics/ Factors		Diabetic patient group				*P*-Value [a]
		Controlled		Uncontrolled		
		N	%	N	%	
Gender	Male	20	34.5	12	20.7	0.958 [NS]
	Female	16	27.6	10	17.2	
Smoking	Yes	4	6.9	6	10.3	0.339 [NS]
	No	32	55.2	16	27.6	
Family history	Yes	24	41.4	14	24.1	1.000 [NS]
	No	12	20.7	8	13.8	
Physical Activity	Yes	34	58.6	14	24.1	0.033*
	No	2	3.4	8	13.8	
Education status	Primary	0	.0	4	6.9	0.109 [NS]
	Secondary	8	13.8	8	13.8	
	Graduate	24	41.4	6	10.3	
	Post gradates	4	6.9	4	6.9	
Duration of DM (Years)	< 5	2	3.4	6	10.3	0.239 [NS]
	5-10	24	41.4	10	17.2	
	>11	10	17.2	6	10.3	
Treatment as guided	Yes	32	55.2	8	13.8	0.010*
	No	4	6.9	14	24.1	
Age		51.5±15.3		41.5±17.6		0.117 [NS]
BMI		26.0±3.4		25.4±6.1		0.753 [NS]
Adherence %		99.2±2.6		80.0±26.8		0.005*

Data expresses as (N): Number of patients, (%) Percentage, and mean ± SD. Fisher's Exact test, Chi-square test ($\chi 2$) and T Test used for at least one expected value is < 5, NS: No significant changes ($P \geq 0.05$), **(*)** significant changes ($P < 0.05$).

Moreover,the mean age of the controlled diabetic patients was 51.5±15.3, whereas the mean age of the uncontrolled diabetic patients was 41.5±17.6, with a significant difference between them. Furthermore, the mean body mass index of controlled diabetic patients was 26.0 ±3.4, whereas the mean body mass index of uncontrolled diabetic patients was 25.4 ±6.1, with non-significant differences between the two groups (*P*-value ≥ 0.05). Interestingly, there was a remarkable difference in adherence when comparing the controlled and uncontrolled diabetic patient groups after statistical analysis (*P*-value = 0.005), as shown in **Table 3**.

The percentage of uncontrolled cases was 38% in diabetic patient groups.

Regarding diabetic patients, the treatment or management of diabetes as guided and physical activity plays a vital role in controlling blood glucose levels in diabetic patients. The study results for the diabetic patients group show a positive aspect in that the demographic variables including gender, body mass index, and age were similar between controlled and uncontrolled diabetic patients, indicating no significant differences (p > 0.05). This helps to emphasize the specific factors that affect uncontrolled diabetic patients the most, which include physical activity, adherence, and treatment with either effective or ineffective medications based on the guidance provided. On the other hand, another study that focuses on this topic revealed that age, gender, smoking, obesity, adherence, and duration of disease influence controlling blood glucose levels among patients with type 2 diabetes mellitus [29].

Demographic characteristics and factors between uncontrolled and controlled diabetic-hypertensive patient groups

In the diabetic-hypertensive patient group, when comparing the controlled diabetic-hypertensive patients' subgroup with the uncontrolled subgroup, there was no significant difference after statistical analysis (*P*-value > 0.05) in gender, family history, education status, or physical activity. The percentage of smoking in patients with controlled diseases was 0% versus 15% when compared to patients with uncontrolled chronic diseases (DM+HT), with a significant difference between them (*P*-value < 0.05). Furthermore, the percentage of the controlled diabetic-hypertensive patients who were treated or managed as guided was 32.5%, whereas the percentage of the uncontrolled diabetic-hypertensive patients who were treated as guided was 22.5%, with a significant difference between them (*P*-value = 0.027), as shown in **Table 4**.

Table 4. Demographic characteristics and factors between controlled and uncontrolled diabetic-hypertensive patient group

Demographic characteristics/ Factors		Diabetic-hypertensive patient group				*P*-Value [a]
		Controlled		Uncontrolled		
		N	%	N	%	
Gender	Male	14	17.5	30	37.5	**0.200** [NS]
	Female	20	25.0	16	20.0	
Smoking	Yes	0	0.0	12	15.0	**0.030***
	No	34	42.5	34	42.5	
Family history	Yes	22	27.5	30	37.5	**1.000** [NS]
	No	12	15.0	16	20.0	
Physical Activity	Yes	28	35.0	26	32.5	**0.103** [NS]
	No	6	7.5	20	25.0	
Education status	Primary	2	2.5	4	5.0	**0.520** [NS]
	Secondary	4	5.0	14	17.5	
	Graduate	22	27.5	22	27.5	
	Post gradates	6	7.5	6	7.5	
Treatment as guided	Yes	26	32.5	18	22.5	**0.027***
	No	8	10.0	28	35.0	
Age		65.5±11.7		63.4±11.4		**0.576** [NS]
BMI		30.6±5.1		28.3±3.9		**0.125** [NS]
Adherence %		95.6±9.3		87.2±20.9		**0.131** [NS]

Data expresses as (N): Number of patients, (%) Percentage, and mean ± SD. Fisher's Exact test, Chi-square test ($\chi 2$) and T Test used for at least one expected value is < 5, NS: No significant changes ($P \geq 0.05$), **(*)** significant changes ($P < 0.05$).

In diabetic-hypertensive patient groups, the mean age of the controlled diabetic-hypertensive patients was 65.5±11.7, whereas the mean age of the uncontrolled diabetic-hypertensive patients was 63.4±11.4, with no significant differences between them. Furthermore, the mean body mass index of the controlled diabetic-hypertensive patients was 30.6 ±5.1, whereas the mean body mass index of the uncontrolled patients was 28.3 ±3.9, with non-significant differences between the two groups (*P*-value ≥ 0.05). However, there was no significant difference in adherence when comparing the controlled and uncontrolled patient groups after statistical analysis, as shown in **Table 4**.

In the diabetic-hypertensive patient group, the percentage of uncontrolled cases was 57.5%. The study's positive finding for diabetic patients with hypertension is that the demographic variables, including gender, body mass index, and age were well-matched between controlled and uncontrolled patients, showing no significant differences ($p > 0.05$). This emphasizes the specific factors that affect uncontrolled diabetic patients with hypertension, which include smoking and the suitability and effectiveness of treatment medications according to guidelines. A recent study discussed the factors affecting uncontrolled blood pressure with type 2 diabetes mellitus, which were obesity, adherence, and ineffective medications [30, 31]. Other studies found that obesity, age, and adherence play a vital role in controlling blood pressure and glucose levels in diabetic hypertensive patients [32-38].

Binary logistic regression was utilized for the observation of specific factors that affect the diabetic-hypertensive patient group control, as shown in **Table 5**.

Table 5. Binary Logistic Regression for factors affecting uncontrolled Diabetic-Hypertensive Patients' Subgroup

Binary Logistic Regression			
		P-Value	Odd ratio
Step 1	Smoking	0.999	0.000
	Treatment as guided	**0.009**	**7.8**

The odd ratio value OR =7.8 indicates that patients who received guided treatment had 7.8 times greater odds of having controlled blood pressure and glucose levels when compared to patients who did not receive guided treatment. Therefore, patients who received guided treatment are approximately 7.8 times more likely to have controlled blood pressure and glucose levels compared to patients who did not receive guided treatment for the control of diabetes and hypertension status.

Correlation between age and adherence in diabetic-hypertensive patients

A Pearson correlation coefficient of 0.411 and a *P*-value of 0.008 between age and adherence in diabetic-hypertensive patients suggest that there is a significant positive linear relationship between age and adherence in this specific group, as shown in **Table 6**.

Table 6. Correlation between age and adherence in the diabetic-hypertensive patient group

		% Adherence
Age	Pearson Correlation	0.411
	N	80
	P-Value	**0.008**

Therefore, increasing patient age can lead to increased medication adherence.

Conclusion

Hypertension and diabetes are two of the major health problems that are highly prevalent in Iraqi patients due to many factors, including lifestyle and societal restrictions. The main causes of uncontrolled hypertension were age, higher body mass index (obesity), non-adherence, and treatment not being as guided. As for uncontrolled diabetes, the main factors are adherence, a lack of physical activity, and treatment not being as guided. Furthermore, uncontrolled diabetic-hypertensive patients were not treated as guided.

Recommendations

Prevention methods should focus on more lifestyle modifications by spreading awareness and educating Iraqi citizens on the outcomes of their everyday behaviors. This is where community pharmacists come to play a critical role in improving the healthcare system in Iraq and should not be limited to dispensing medications only. Iraqi pharmacists need to be more involved in the evaluation of patients' treatment by counseling patients on nutrition and activity, following up on medication adherence, and building trust through a connected patient-pharmacist relationship and training in specialty pharmacy programs. This, of course, needs to be done with the help of the government to finally implement electronic health records (EHRs) in Iraq to improve the quality and efficiency of health care and help pharmacists practice their essential role in patients' treatment through follow-up and evaluation.

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