Factors influencing hypertension and diabetes mellitus control among Syrian refugees in Zaatari refugee camp

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Abstract. – OBJECTIVE: Syrian refugees in Zaatari Refugee Camp are in dire need of investigations of the control status of different chronic diseases. The current study aims to evaluate hypertension (HTN) and diabetes (DM) control among Syrian refugees in the Zaatari Refugee Camp.

PATIENTS AND METHODS: This is a retrospective cross-sectional study. Patients' files were collected from the Zaatari camp database. Participants who had an HbA1c of less than 7 were considered to have controlled DM and a cut-off point of 130/80 was used for HTN. A *p*-value of <0.05 was considered statistically significant.

RESULTS: A total of 418 patients (276 females) were included in the study. None of the patients-controlled blood pressure and only 25 controlled DM. Univariate analysis showed an association of smoking status with HbA1c and mean arterial pressure (MAP) (*p*-value=0.007 and <0.001 respectively), while taking insulin and Triglyceride (TyG) index had an association with HbA1c alone (*p*-value<0.001). Significant in the MANCOVA analysis were smoking status, taking insulin, and TyG index (*p*-value<0.001).

CONCLUSIONS: This study demonstrates that refugees in Zaatari Refugee Camp have uncontrollable DM and HTN. More focus should be highlighted on controlling these diseases in order to prevent future complications.

Key Words:
HTN, DM, Control, Syrian refugees, Zaatari refugee camp.

Introduction

The Zaatari Refugee Camp in Jordan is home to about 76,892 Syrian refugees, approximately 42.6% of whom are aged between 18 and 59[1]. The existence of a substantial immigrant population has resulted in a tremendous strain and demand on essential services, such as the healthcare system[2]. As the refugees are mostly confined to shantytowns and slums, they are subject to living conditions that encourage inactivity, inadequate nutrition, and tobacco use – all of which are well-known risk factors for chronic diseases. Chronic diseases are common among urban refugees in the Middle East, with rates ranging from 9% to 50% depending on the refugees' country of origin[3]. Hypertension (HTN) and diabetes mellitus (DM) are among the more common chronic diseases that cause morbidity and mortality in this group[3]. In Jordan, the United Nations High Commissioner for Refugees (UNHCR) now funds 100% of the primary and the secondary health services for refugees in camps in collaboration with several international non-governmental organizations[1].

HTN is defined as an increase in blood pressure caused by unknown reasons, which increases the risk of cerebral, cardiovascular, and kidney disorders. Indeed, HTN is commonly associated with other cardiovascular risk factors, such as age, obesity, insulin resistance, and dyslipidemia[4]. Similarly, DM is a chronic disorder caused by persistently elevated blood sugar levels, which can lead to many health problems, including cardiovascular and kidney disease, ophthalmology complications, and neurological complications which impair quality of life. DM has a poor prognosis, which is worsened by HTN; DM patients have three times the prevalence of HTN as non-diabetic patients of the same age and gender[5]. However, HTN and DM both impact the same main organs, with the vascular tree being the basic denominator of HTN and DM target organ-disease[6].

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Poor HTN and DM control are largely to blame for the development of complications and high expenditure associated with hypertensive and diabetic patients. Despite evidence from large, randomized controlled trials that comprehensive diabetes and hypertensive management reduces numerous complications, many people remain poorly managed and do not receive the required care[7].

The severity of the combination of DM and HTN is clearly reflected in the European Society of Hypertension and the European Society of Cardiology guidelines, which advise a much more forceful therapeutic approach in people with DM and HTN[8]. Moreover, HTN and DM are also associated with increases in cardiovascular morbidity and mortality. Results suggest that cardiovascular risk factors cluster, and their impacts are not only cumulative but synergistic[9,10]. In contrast, the presence of HTN and DM increases the probability of mortality and cardiovascular complications by 44%, compared to a 7% risk from DM alone[11]. As DM and HTN are both important risk factors for cardiovascular disease, efforts should be made to manage and control blood pressure and glucose levels in order to reduce the risk of cardiovascular disease and mortality[1,6]. In this current study, we investigated the prevalence of HTN and DM and the factors influencing their control among Syrian refugees in the Zaatari Refugee Camp.

Patients and Methods

This is a retrospective cross-sectional study. Patients' files were retrieved from Zaatari camp database. The following patients' data were collected: age, sex, body mass index (BMI), smoking status, chronic diseases, medications history, blood pressure, and laboratory tests including lipid profile, fasting blood glucose, Glycosylated Hemoglobin (HbA1c%), thyroid stimulating hormone, thyroxin, liver function tests, uric acid, and glomerular filtration rate.

Data for patients who fulfilled the following criteria were included in the study: adults who have both hypertension and diabetes and had at least one recent documented HbA1c% level and two recent blood pressure readings. Exclusion criteria consisted of age below 18 years old and adults not diagnosed with hypertension and/or diabetes.

The average of the two most recent blood pressure readings was calculated. Participants with HbA1c% of less than 7% were considered to have controlled diabetes[11]. To determine blood pressure control, an upper cut-off point of 130/80 was used[12]. Mean arterial pressure (MAP), pulse pressure (PP), and Triglyceride (TyG) index were calculated. Factors that were significantly associated with MAP and PP were statistically evaluated. MAP was selected as a previous study found it a useful predictor of cardiovascular risk for adverse events[13]. Ethical approval was obtained from Al-Zaytoonah University Ethical Committee (#22/23/2019-2020). This is a retrospective study, in which patients' files were obtained from Zaatari Refugee Camp clinic and data were anonymized prior to analysis.

Statistical Analysis

SPSS version 27 was used to analyze the data (SPSS Corp., Armonk, NY, USA). Categorical variables were presented as frequencies and percentages. Continuous variables were presented as mean ± standard deviation (SD). MAP was calculated based on the following equation: MAP=1/3 Systolic blood pressure (SBP) 2/3 Diastolic blood pressure (DBP)[14]. PP was calculated as the difference between SBP and DBP. TyG index was calculated as TyG index = ln (fasting TG [mg/dL] × fasting glucose [mg/dL]/2)[15]. Multivariate analysis of covariance (MANCOVA) was conducted to evaluate the association between MAP and HbA1c% as dependent variables and different sample characteristics and medical profile as independent variables. The independent variables included age, sex, BMI, smoking status, chronic diseases, medications that the patient was taking, and TyG index.

Results

Data from 1577 patients were collected. Of these, 418 patients (276 females) fulfilled the inclusion criteria for the study. The demographics and health status of the included patients are presented in Table I. The mean age of the sample was 57.8 (±11.2). The majority of the sample (78.7%) were non-smokers. The most common comorbidity among the participants was IHD (14.4%), followed by thyroid conditions (6.5%). The most taken medication was metformin (92.8%), followed by simvastatin (89.7%), enalapril (79.7%), and aspirin (59.3%). None of the patients had controlled blood pressure and only 25 patients (6.15%) had controlled diabetes according to the cut-off point of 7% for HbA1c%.

Table II shows the results of univariate and multivariate analysis of variables associated with

Table I. Demographic data of the participants (n = 418).

	Frequency (%) or Mean (±SD)
Age	57.8 (±11.2)
Sex	
Female	276 (66.0)
Male	142 (34.0)
BMI	27.34 (±4.01)
Smoking status	
Smoker	89 (21.3)
Non-smoker	329 (78.7)
Participants' health status	
Asthma	10 (2.4)
COPD	5 (1.2)
IHD	60 (14.4)
Thyroid conditions	27 (6.5)
Medications	
Amlodipine	162 (38.8)
Aspirin	248 (59.3)
Atenolol	41 (9.8)
Beclomethasone	15 (3.6)
Bisoprolol	123 (29.4)
Candesartan	7 (1.7)
Clopidogrel	3 (0.7)
Digoxin	6 (1.4)
Doxazosin	17 (4.1)
Enalapril	333 (79.7)
Furosemide	71 (17.0)
Gemfibrozil	1 (0.2)
Glibenclamide	111 (26.6)
Gliclazide	2 (0.5)
Glimepride	125 (29.9)
Hydrochlorothiazide	56 (13.4)
Insulin	67 (16.0)
ISDN	44 (10.5)
Metformin	388 (92.8)
Methyldopa	2 (0.5)
Propranolol	3 (0.7)
Salbutamol	21 (5.0)
Simvastatin	375 (89.7)
Spironolactone	9 (2.2)
Verapamil	1 (0.2)
Warfarin	6 (1.4)
Vitals and laboratory tests	
Systolic blood pressure	139.43 (±6.40)
Diastolic blood pressure	89.54 (±6.40)
Mean blood pressure	106.17 (±5.41)
Pulse pressure	49.89 (±7.26)
Fasting blood glucose	157.16 (±16.57)
Thyroid stimulating hormone	10.51 (±12.28)
Thyroxin	6.16 (±9.42)
AST	36.22 (±14.36)
ALT	40.96 (±17.21)
HbA1c%	8.47 (±1.13)
GFR	69.88 (±17.82)
Total cholesterol	174 (±13.09)
Triglycerides	180.08 (±26.64)
LDL	103.76 (±11.68)
HDL	34.22 (±3.81)
Triglyceride index	9.45 (±0.20)

HbA1c% and MAP. A significant difference in MAP values was found between non-smokers and smokers (B= -7.51, p <0.001). Participants who did not take insulin had significantly lower HbA1c% levels compared to those who were taking insulin (B=-1.26, p <0.001). TyG index had positive significant association with HbA1c% levels (B=2.21, p <0.001). The values that were significant in the multivariate analysis were smoking status, taking insulin, and TyG index.

Discussion

The majority of the participants in this study had an uncontrolled HTN and DM, indicated by SBP/DBP and HbA1c%, respectively. This may raise the risk of cardiovascular diseases (CVD) and poor health outcomes in hypertensive and diabetic patients among Syrian refugees in Zaatari Camp.

The impact of smoking on glycemic regulation in diabetics has been poorly researched, with sometimes conflicting findings. In patients with diabetes, cigarette smoking worsens insulin resistance, therefore, stopping smoking should improve glycemic regulation[16]. Smoking cessation, on the other hand, often leads to worsened glycemic regulation, likely to be a consequence of the weight gain that often happens after quitting. A Japanese study[17] of 25 diabetic patients found that those who quit smoking had worse glycemic control than those who continued to smoke. The Health Improvement Network (THIN) cohort study in England also found a connection between quitting smoking and worse glycemic control in T2DM patients. HbA1c% levels gradually increase with the number of cigarettes smoked each day, according to data from the Fukuoka Diabetes Registry[18] and the Swedish National Diabetes Registry[19]. Despite this, other studies have found no connection between smoking and glycemic regulation. In a cohort study of 10,551 men and 15,297 Chinese women with diabetes, smoking was linked to an increased odds ratios of 1.49 in men and 1.56 in women for poor glycemic control (defined as HbA1c > 7.0%), particularly in the elderly[20]. Common confounding variables, such as sociodemographic and lifestyle factors, have no impact on the relationship. The increased risk of inadequate glycemic regulation in smokers relative to nonsmokers was only normalized after at least 10 years of smoking cessation. Another study[20] on 7763 male T2DM patients in China found that cigarette smoking was linked to high-

Table II. Univariate and Multivariate analysis of HbA1c and MAP.

	HbA1c %				MAP				MANCOVA
	B	*p*-value	Lower	Upper	B	*p*-value	Lower	Upper	*p*-value
Smoking (Non-smokers *vs*. smokers)	0.48	0.007	0.134	0.83	-7.51	<0.001	-9.11	-5.91	<0.001
Insulin (Do not take *vs*. take)	-1.26	<0.001	-1.53	-0.98	0.24	0.71	-1.03	1.50	<0.001
Triglyceride index	2.21	<0.001	1.65	2.76	0.76	0.56	-1.79	3.31	<0.001

er levels of fasting plasma glucose and HbA1c%, particularly in those with the longest smoking history and pack-years. In comparison to non-smokers, current smokers with a 30-year smoking history increased their HbA1c% by 0.27 percent, and smokers with 40 pack-years increased their HbA1c% by 0.38 percent. Variations in the sample populations may explain the contradictory findings. Confounding factors, such as established lifestyle risk factors, which were not investigated in some of the studies, may be to blame for the differences observed in these studies. In the current study, glycemic control had a positive correlation with smoking: nonsmokers had higher HbA1c% than smokers. This might be due to different confounding factors and /or weight gain after smoking cessation.

Cross-sectional research on the relationship between smoking and blood pressure (BP) is inconsistent, with some finding a positive and others finding an inverse relationship. Only a few studies have looked into the potential predictive effect of smoking status on the risk of HTN, and their findings underline an association only in a small subset of people. After smoking cessation, some scholars[21] found a rise in BP values and HTN prevalence in both men and women. Furthermore, an epidemiological study[22] shows that former and current smokers have a similar low risk of developing HTN as people who have never smoked. When the waist girth increments after smoking cessation were taken into account, quitting smoking was linked to a lower risk of HTN[23]. Indeed, in a 14-year longitudinal study of Japanese men, smoking was independently linked to the onset of hypertension and systolic hypertension[24]. Cigarette smoking causes hypertension in the short term, mostly by stimulating the sympathetic nervous system. In terms of the effect of chronic smoking on blood pressure, available data do not explicitly establish a direct causal association between these two cardiovascular risk factors, a theory backed up by the fact that pressure does not reduce after cessation of smoking[21]. Nonetheless, smoking can have a greater negative impact on central blood pressure, which is more closely linked to target organ damage than brachial blood pressure, due to its effects on arterial stiffness and wave reflection[25]. In the current study, we found a negative impact of smoking on HTN indicated by MAP. Nonsmokers had a lower MAP than smokers among Syrian refugees in Zaatari Refugee Camp.

An association of glycemic control but not MAP was found with insulin intake and triglyceride index. Refugees taking insulin had higher HbA1c% than those not taking insulin. This result might be due to lower patient adherence to drug regimens. Poor adherence, restricted access to healthcare, low socioeconomic conditions, poor attitudes toward health and health-providers, and personal preferences are all patient-related problems[26]. Patient adherence is crucial in disease management programs, and especially critical for diabetic patients to improve glucose control[27]. Previous research on patient self-care strategies, such as involvement in diabetic education programs, has found promising results. Lifestyle changes, such as to food and physical activity, and skill development, such as home glucose monitoring, have shown only equivocal improvements in HbA1C levels[28]. Despite a previous meta-analysis[29] of self-management therapies showing they can produce small but long-term improvements in glycemic control, other indicators of patient adherence, such as appointment keeping and medication adherence, received less attention. Missed appointments jeopardize continuity of care, which is critical for providing preventive screenings, maintaining health stability, and making appropriate drug therapy modifications. Several prior studies[30-32] have attempted to identify risk variables that predispose to missed appointments, as well as assess the efficacy of interventions aimed at reducing missed visits. Importantly, HbA1c% levels were found to be 0.7% higher in diabetic patients in a managed care system who missed more than 30% of their scheduled sessions within a year compared to those who kept all their appointments[32].

Lack of glycemic control might be due to refugees' inability to access healthcare in Jordan, due to funding and structural hurdles, such as a lack of civil documents and/or the ability to pay for out-of-pocket fees to receive essential services, as well as lack of sufficient services and follow-up provided to the refugees. While healthcare provision is improving in Zaatari Camp, the huge number of refugees and lack of sufficient full-time clinicians and community health volunteers make it hard to provide a sufficient health care service. Previous work[33] reported that 75% of the refugees in Zaatari camp indicated that they received insufficient healthcare. Furthermore, 43% of residents expected that their health status would drastically worsen, possibly showing the severity of the camp's health problems. Another reason for lack of glycemic control might be because of depression. A previous study[34] showed that about a third of the refugees who took part in the study showed signs of depression. Depression is a serious psychiatric health issue that affects about 15% of persons with T2DM and is twice as common in people with diabetes than in the general population[35]. Depression is connected to poor health outcomes, which can lead to glycemic control issues. Depression, for example, is linked to harmful lifestyle choices including inactivity and a poor diet, both of which can lead to poor glycemic control[36].

Study Limitations

This study is based on retrospective data, which were collected for other services provided to refugees and not primarily for research or epidemiological purposes. Importantly, authors cannot control exposure or outcome assessment, and instead must rely on a third party (Zaatari Refugee Camp Clinic) for accurate recordkeeping.

Conclusions

The current study clearly demonstrates that many refugees in Zaatari camp have uncontrollable DM and HTN. More focus should be on controlling these diseases in order to prevent future complications associated with them. Future intervention programs on disease management should focus on improving medication adherence by stressing the importance of DM and HTN medications and simplifying the prescribed dosage regimen, especially in smokers and patients taking insulin as well as patients with uncontrolled TyG index.

Conflict of Interest

The authors declare no conflicts of interest.

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