An-Najah National University
Faculty of Graduate Studies

Cardiovascular Diseases and Risk Factors Among Diabetic Patients in Nablus District, West Bank, Palestine: case-control study

By
Huda Nimer Mohammad Lahham

Supervisor
Prof. Hisham Darwish

Co-supervisor
Dr. Samer Hamidi

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This thesis was defended successfully on 11/10/2009 and approved by:

Committee members	Signature
Prof. Hisham Darwish (Supervisor)	----------
Dr. Samer Hamidi (Co-Supervisor)	----------
Dr. Ayman Hussein (Internal Examiner)	----------
Dr. Nuha Shareif (External Examiner)	----------

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إقرار

أنا الموقع أدناه مقدم الرسالة التي تحمل العنوان:

أمراض القلب الوعائية و عوامل الخطر القلبيية الوعائية بين مرضى السكري, منطقة نابلس,الضفة الغربية,فلسطين: دراسة الحالة المراقبة

Cardiovascular Diseases and Risk Factors in Diabetic Patients in Nablus District, West Bank, Palestine: case-control study

أقر بأن ما اشتملت عليه هذه الرسالة إنما هي نتاج جهدي الخاص، باستثناء من تمت الإشارة إليه حيثما ورد، وأن هذه الرسالة ككل، أو أي جزء منها لم يقدم من قبل لنيل أية درجة أو لقب علمي أو بحثي لدى أية مؤسسة تعليمية أو بحثية أخرى.

Declaration

The work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification.

Student's Name: Huda Nimer Lahham **إسم الطالب:**

Signature ..... :التوقيع

Date: ..... التاريخ:

LIST OF ABBREVIATIONS

ADA	American Diabetes Association
BMI	Body Mass Index
CHD	Coronary Heart Disease
CVD	Cardiovascular Disease
DBP	Diastolic Blood Pressure
DM	Diabetes Mellitus
FBG	Fasting Blood Glucose
FHD	Family History of Diabetes
HDL-C	High-density lipoprotein- Cholesterol
HTN	Hypertension
IFG	Impaired Fasting Glucose
IGT	Impaired Glucose Tolerance
IHD	Ischemic Heart Disease
LDL-C	Low-density Lipoprotein- Cholesterol
MI	Myocardial Infarction
MoH	Ministry of Health
NGOs	Non-governmental Organizations
OHA	Oral Hypoglycemic Agent
OR	Odd Ratio

LIST OF ABBREVIATIONS

PAD	Peripheral Arterial Disease
PCBS	Palestinian central bureau of statistics
RR	Relative Risk
SBP	Systolic Blood Pressure
TC	Total Cholesterol
TG	Triglyceride
WC	Waist Circumference
WHO	World Health Organization
WHR	Waist Hip Ratio

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Abstract

Aim of the study

The study aimed to compare cardiovascular diseases and risk factors among diabetic patients and nondiabetic individuals living in Nablus district.

Methods

This case control study was carried out in 7 diabetes clinics of MoH and UNRWA in Nablus district. The 299 diabetic patients and 159 nondiabetic controls were included in the study. Body mass index, waist circumference, waist hip ratio and blood pressure were measured after conducting face to face interview for each participant. Blood sample was collected to measure fasting blood glucose, total cholesterol and triglyceride.

Results

All cardiovascular risk factors, except systolic blood pressure, diastolic blood pressure and smoking, were significantly higher in diabetic patients than nondiabetic controls. The best predictors of diabetes using logistic regression analysis were total cholesterol, family history of diabetes, waist

circumference and triglyceride. About 78 % of diabetic patients had at least one diabetes complications; hypertension was in diabetic patients as twice as nondiabetics (55.2% vs 27.0%). Diabetic females were more obese and less physically active. But diabetic males were more ex- and current smokers than diabetic females. Frequencies of diabetes complications were more in diabetic male than diabetic females. Diabetic patients living in the city showed higher prevalence of almost all cardiovascular risk factors. Similarly, the diabetic complications were higher in diabetics living in the city except systolic blood pressure and body mass index which were higher in diabetics living in the refugee camps. Awareness of cardiovascular complications was comparable and low in both diabetic patients 56.9% and nondiabetic controls 57.2%, (p=1.000).

Conclusion

As urbanization and obesity especially are high in Palestine and awareness is low, more risk factors and complications of diabetes are expected in the next years. So effective interventions must be developed and implemented in the national level.

CHAPTER I

INTRODUCTION

1.1 Chronic diseases

Chronic diseases such as cardiovascular diseases, diabetes mellitus and cancer are increasing worldwide and they are associated with poor quality of life and increased economical burden; therefore, development of preventive measures against chronic diseases is imperative. For the prevention process, it is important to identify the risk factors of these chronic diseases. In Sweden, the cardiovascular risk factors which are detected, treated and done follow up visits for it are hypertension, dyslipidaemia, LDL-C, hyperglycemia and smoking[1]. Chronic diseases may arise either as an accumulation of risks or as exposure to risk factors at critical periods in life, thus a person with more risk factors has a greater chance of developing coronary heart disease. Also the greater the level of this risk factors, the greater the risk[2].

1.2 Cardiovascular diseases

Cardiovascular disease (CVD) is a critical public health issue, nationally and internationally. It was responsible for less than 10% of all global deaths at the beginning of the 20th century[3], but in 2005 that number was 30%. About 80% of these deaths were in low- and middle-income countries[4].

Of these cardiovascular diseases coronary heart disease (CHD) and stroke are the first and second most common causes of death worldwide[5]. In developed countries like the United Kingdom, it was found that 39% of

deaths to be related to CVD in 2002[6]. In Comparison, Arab countries like Jordan has mortality rate as high as 38.2% associated with CVD[7]. Similarly, CVD has been found to be the leading cause of death among adults in Palestine in 2005[8], 21 % of deaths were due to heart diseases and 11 % to cerebrovascular diseases[9].

There are many risk factors for cardiovascular diseases that lead to enhanced risk of developing CVD. For example, there are more than 200 risk factors for CHD but the most significant risk factor is abnormal lipid values[5]. However, the main CVD risk factors are smoking, diet, obesity, hypertension, physical inactivity, dyslipidaemia, genetic influences, family history and diabetes.

Type 2 diabetes is recognized to be associated with a number of specific adverse cardiovascular risk factors as hypertension; obesity; central obesity; hyperinsulinemia; elevated serum triglycerides and elevated total cholesterol[10]. In addition, the present of these cardiovascular risk factors in people can predict the development of diabetes.

These risk factors, in addition to other important cardiovascular risk factors as family history; smoking and physical inactivity will be studied in this research among diabetic patients and nondiabetic controls in Nablus district.

1.3 Cardiovascular risk Factors

In the last years, prevention and treatment of CVD risk factors have resulted in lowering CVD-related mortality. However, many patients identify these factors but they do not have them adequately controlled[11].

- **Physical Inactivity**

Despite the debate about the amount, intensity, frequency and duration of activity for optimal health, researchers concur that physical activity is necessary for the metabolic and cardiovascular benefits. Physical activity can slow the initiation and development of diabetes and the sequence of CVD through its effect on body weight, insulin sensitivity, glycemic control, blood pressure, fibrinolysis, endothelial function and inflammatory defense systems[12]. Moreover, physical activity can lessen triglycerides and have an effect on both low-density lipoprotein (LDL) and HDL particle sizes[13]

- **Obesity**

Obesity leads to the development of type 2 diabetes. Studies and mice models demonstrate that obesity cause endoplasmic reticulum ER stress. This stress leads to the suppression of insulin receptor signaling through hyperactivation of c-Jun N-terminal kinase (JNR) and subsequent serine phosphorylation of insulin receptor substrate -1 (IRS-1)[14].

- Waist circumference: an easy and convenient measure of abdominal obesity and an indicator of the hidden fat in the abdomen. This fat in a large amount can interfere with normal metabolic function causing high blood sugar, harmful cholesterol levels and increase the risk of heart disease and diabetes[15].

- Waist to hip ratio: calculated by dividing the waist measurement by the hip measurement. A higher ratio means more risk. Larger waist measure is harmful as it reflects the amount of abdominal fat, but larger hip measure is protective as it may reflect the amount of lower body muscle[16]. According to WHO the cut off point for cardiovascular risk factors is >0.90 in men and >0.85 in women.

- Body mass index (BMI)**:** one of the most commonly used indicators of obesity, but it is not an ideal one as it does not take into account the body fat distribution. BMI is calculated as weight/height2 (Kg/m2). According to the World Health Organization (WHO) definition "overweight" is a BMI equal to or more than 25, and "obesity" is a BMI equal to or more than 30[17].

- **Lipid profile (total cholesterol (TC), triglycerides (TG))**

Quantitative and qualitative changes occur in diabetic dyslipidaemia. Quantitative changes occur due to the increase of glucose for VLDL synthesis and decrease in lipoprotein lipase activity leading to decrease of VLDL from peripheral circulation, increase in LDL-C levels and decrease in HDL-C levels due to increase in hepatic lipase activity decrease in

VLDL clearance. Qualitative changes consist of increase amount of triglycerides, LDL-C and HDL-C, non enzymatic glycation of LDL and non enzymatic glycation of HDL, so rising risk of heart diseases[18].

- **Family history of diabetes**

It is a recognized risk factor for CVD which represents genetic, environmental and behavioral elements, in addition to the interactions among them[19]. As DNA analysis for susceptible genes is not yet necessary, family history can be a helpful public health tool for the prevention of disease as it can reflect gene susceptibility and other risk factors[20]. The American Diabetes Association, the American Heart Association and the National Cholesterol Education Program included family history in their guidelines and considered family history as a factor to be assessed and made decision about treatment[21]. In this study the first degree relatives are: father, mother, brother, sister.

- **Smoking**

Smoking is assumed to cause coronary thrombosis by increasing the formation of coronary plaques, destabilizing coronary plaques, promoting plaque split, increasing platelet activation and causing endothelial dysfunction. In addition, smoking causes coronary spasms by increasing catecholamine release[22]. In developing countries about 2.41 million premature deaths from cardiovascular causes were attributed to smoking in 2000[23].

1.3.1 Epidemiological transition of cardiovascular risk factors

According to the International Obesity Task Force, more than 1.1 billion adults worldwide are overweight 16.6%), and 312 million of them are obese (4.7%)[23]. In 2005, the prevalence of obesity in U.S adults (older than 18 years old) was 23.9%[24]. As well obesity is a growing challenge because of the high rate of obese people (about 40%) in Palestine[8]. A study was conducted in the urban Palestinian population to investigate the prevalence of obesity; the results indicated that 41% of urban population is obese (49% for women and 30% for men)[25].

The world health organization indicated that more than 60% of global populations are physically inactive[26] which causes 2 million deaths worldwide annually. In addition, physical inactivity causes 10-16% of diabetes cases and 22% of ischemic heart disease[27]. According to WHO, prevalence of physical inactivity in the Eastern Mediterranean Region was 77% among population above 20 years in 2005[28].

The reported prevalence of hypertension is wide-ranging around the world, the lowest in rural India (3.4% in men and 6.8% in women) and the highest in Poland (68.9% in men and 72.5% in women)[29]. According to the sixty-first world health assembly report the prevalence of hypertension was 35.2% among people aged 60 years or more in Palestine in 2004-2006[8], but the prevalence in the whole population was 3.3% in 2006[30]. Hypertension was the eight-leading cause of deaths in Palestine (4.8%) in 2005[44].

According to the WHO report in 2003, there are about 1.3 billion smokers in the world. This represents about one third of the global population aged 15 and over. About 84% or 1 billion people of the world smokers live in developing countries. The smoking geography is shifting from the developed to the developing world. In 1995, more smokers lived in low- and middle income countries (933 million) while in high-income countries (209 million). In China, there are about 350 million smokers (60% men and 3% women[31]. In Palestine the prevalence rate of smoking decreased from 22.1% in 2000 to 19.8% in 2006. But there was a wide gap between male smokers (37%) and female smokers (2.2%) in 2006[32].

1.4 Diabetes Mellitus

Diabetes Mellitus is a heterogeneous group of metabolic diseases characterized by chronic hyperglycemia and disturbances in carbohydrate, lipid and protein metabolism which is resulting from defects in insulin secretion and/or insulin action. Fasting (chronic) and postprandial hyperglycemia are mainly responsible for the acute, short-term, and late complications affecting all organs and systems in the body[33]. WHO has defined DM as having fasting plasma glucose ≥ 126 mg/dl or random plasma glucose > 200 mg/dl such that for symptomatic individuals one abnormal value is diagnostic, but for asymptomatic individuals two values are required[34].

Types of diabetes mellitus

- **Type 1 Diabetes**

The pathologic process in nearly all patients with T1DM (5% to 10% of people with diabetes) is autoimmune destruction of the pancreatic islet β cells with absolute loss of insulin secretion[34].

- **Type 2 Diabetes**

T2DM (90% to 95% of people with diabetes) resulting from variable combinations of insulin resistance and insulin secretory defects (β-cell dysfunction), with one or other abnormality predominating in a given patient[34].

- **Gestational Diabetes**

Gestational diabetes is hyperglycemia which is recognized firstly during pregnancy. It has the same symptoms as in type 2 diabetes. Usually diagnosed through prenatal screening, rather than reported symptoms[35].

- **Impaired Glucose Tolerance (IGT) and Impaired Fasting Glycemia (IFG)**

These are intermediate conditions between normality and diabetes. People with IGT or IFG are at high risk of developing type 2 diabetes, although this is not predictable[34].

1.4.1 Epidemiological transition of diabetes mellitus

Diabetes mellitus (DM) is a serious disease and a cause for a rising public health concern in developed and developing countries.

- **Incidence and prevalence of diabetes mellitus.**

Diabetes incidence and prevalence worldwide are increasing. The World Health Organization (WHO) projects that there will be about 300 million diabetic patients worldwide by the year 2025, appreciably that about half the affected patients remains undiagnosed[36].

In 2003, the prevalence of diabetes worldwide was 5.1 % for people aged 20-79 years old [37]. The highest prevalence of diabetes is in high-income countries at 7.8 %, and in developing countries ranges from 2.4 - 7.6%[38]. Prevalence of DM is about 3.7% in the United Kingdom (2006)[39], and 7.5% in Jordan (2004)[7]. The prevalence of diabetes in United Arab Emirates, Bahrain, Kuwait, Saudi Arabia, Egypt and Oman is among the world's 10 highest[40]. In Palestine, until recently, there has been an absence of data on diabetes prevalence in the Palestinian population. A study on the prevalence of DM in Palestine was conducted by Al-Quds university in which the prevalence was about 9%[41]. But in 2000 a study was conducted in a rural Palestinian population (Kober village) by Birzeit University, the prevalence of diabetes was 9.6% and 10.0% in females and males respectively[42]. Another cross sectional survey was conducted in old Rammallah city for 492 men and women aged (30-65) years. Diabetes was

found in 12.0% of the survey population (including 9.4% previously diagnosed)[43].

The number of new cases reported in the governmental clinics of the West Bank in 2005 was about 2 741 cases, 28.2% of them was among age group (55-64), 41.0% was among (35-54), 6.3% among age group below 35 years, 24.4% among age group 65 years and older[44]. In Nablus governorate, the total number of diabetic patients registered and received treatment in MoH and UNRWA primary health care centers is 7825 patients (at the beginning of March 2008). Of these patients 5413 are registered in MoH and 2412 in UNRWA diabetes health clinics.

- **Mortality of diabetes mellitus**

Diabetes mellitus in many countries is a leading cause of death, disability and a significant contributor for rising health care cost. In USA, diabetes was the sixth leading cause of death in 2003[45]. Diabetes was not found to be among the ten leading causes of death in Palestine, it caused only 3.1% of total population deaths (2005)[46]. In the West Bank, the cause specific mortality rate of diabetes (1999-2003) was 4.9 per 100,000 populations[47]. In Lebanon, diabetes mellitus was the tenth leading cause of death, causing 2% of all deaths in 2002[48]. However, diabetes is associated with a variety of long-term complications that can cause death. So it is important to consider deaths in which diabetes is a contributing factor. The most prevalent and harmful complications of diabetes mellitus are CVD. The cardiovascular complications of type 2 diabetes include coronary heart

disease, cerebrovascular disease and peripheral arterial disease[49]. In Australia, data indicated that diabetes was the associated cause of death in 24% of coronary heart disease deaths, 8% of stroke deaths[50]. Uncontrolled diabetic patients are more likely to experience rapid progression of CVD and eventually the clinical implications.

Table 1.1: Estimated deaths of diabetes per 100.000 populations in 2002[51].

Country	Mortality rate	Country	Mortality rate
Canada	23.0	Iraq	7.0
United Kingdom	11.7	Egypt	12.7
USA	26.4	Syria	9.0
Israel	44.6	Lebanon	11.2
India	14.9	Jordan	5.1
Iran	7.7	Palestine	4.9

1.4.2 Macro- and Microvascular complications of diabetes mellitus.

The adequate control of DM can reduce the mortality and morbidity related to complications. DM can cause many pathological changes that cause macrovascular and microvascular diseases which may be dependent on the complications that DM can cause (dyslipidaemia, hypertension…). On the other side, some of the risk factors associated with DM are associated with CVD (central obesity, obesity, inactivity, diet, smoking, dyslipidaemia, genetics….). So perhaps early detection of cardiovascular risk factors and intervention in diabetic patients can reduce consequential morbidity, mortality and improve the quality of life.

- **Macrovascular complications**

The central pathological mechanism in macrovascular diseases is the process of atherosclerosis. Atherosclerosis is thought to result from inflammation or injury on the arterial wall in the peripheral or coronary vascular system. This leads to the formation of atheroma, rupture of it leads to acute vascular infarction. In diabetic patients, there is a strong evidence of increased platelet adhesion and hypercoagulability. Platelet aggregation may be promoted by impaired nitric oxide generation, increased free radical formation in platelets and altered calcium regulation. Diabetic patients have elevated levels of plasminogin activator inhibitor type 1 which may also impair fibrinolysis. So platelet aggregation and impaired fibrinolysis increase the risk of vascular occulation and cardiovascular

events in type 2 diabetes which include Ischemic heart disease (IHD), stroke and peripheral arterial disease[52].

It is estimated that the incidence of death from cardiovascular disease in diabetic patients without clinical history of cardiovascular events is as high as the incidence in nondiabetic patients with a history of myocardial infarction[53]. It is anticipated that if the risk factors of diabetic patients are summed, their risk often approximate that of patients with coronary heart diseases[54]. About 26 to 36 % of diabetic patients have cardiovascular disease according to WHO[55]and about 70-80% of diabetic patients die of macrovascular complications[56]. When a diabetic patient develops CVD; he will have a poorer prognosis for survival than nondiabetic patients with CVD[57].

- **Microvascular complications**

Microvascular complication is developed through aldose reductase mechanism. Aldose reductase is the first enzyme in the intracellular polyol pathway. This pathway includes the conversion of glucose into sorbitol (glucose alcohol). It has been suggested that osmotic stress from sorbitol accumulation as a result of high level of glucose is the mechanism by which diabetic microvascular complications developed. Moreover, cells are also thought to be injured by glycoprotein. Oxidative stress may also play a critical role in cellular injury. Free radical production and reactive oxygen species formation can be stimulated by high level of glucose. Microvascular

complications include retinopathy, nephropathy, neuropathy and amputation[52].

Epidemiological study provided insight into the relation of hyperglycemia and diabetic complications (macrovascular, microvascular) in individuals with type1 and type2 DM. This relation was demonstrated by WESDR as a strong relation between hyperglycemia and complications[58].

1.5 Hypertension

Hypertension is present when the blood pressure exceeds 140/90 mm Hg, based on at least two readings on separate occasions. Several factors may play an etiological role: genetic factors[59].

Hypertension is about double as frequent in diabetic patients compared with nondiabetics. On the other hand, latest data suggest that hypertensive persons are more prone to the development of diabetes than are persons without hypertension. In a recent large prospective cohort study suggested that hypertension and diabetes frequently coexist, and each work to exacerbate the other in spite of independent pathophysiological nature history of each disease. In addition, hypertension in diabetic person may cause 75% of CVD in diabetics[60]. It is known that hypertension hasten the occurrence of microvascular and macrovascular complications of diabetes[61]. This led to new recommendations (ADA) in 2003 guidelines of reducing hypertension to <130/80 in diabetic patients[62].

1.6 Gender differences

In general, women usually develop CVD about 10 years later than men. This is due to the estrogen protective effect[63]. On the other hand, the development of diabetes in women increases their risk of CVD to amount higher than in men[64].

1.7 Place of residency

The prevalence of cardiovascular risk factors is increasing as a result of increasing urbanization. In developing countries, urbanization occurs in a situation of excessive poverty and lack of resources for public health responses. Many studies demonstrated that chronic disease risk factors are more prevalent in urban than rural areas[65].

1.8.1 Situation in Palestine

Palestine as many other developing countries is going through an epidemiological transition with its associated rise in chronic diseases which increased by 31.1% in 2004-2006. At the same time the health system is facing the challenges of controlling the incidence of some communicable diseases. In 2007, the health system was able to reduce the mortality rates of infectious disease to 27.8 per 100 000 population[8].

Patients with chronic diseases in Palestine experience increasing difficulties in receiving treatment and referral for tertiary services[66]. Chronic diseases are estimated to account for the largest proportion of all deaths in Palestine.

Therefore, the Palestinian health system needs to be supported and strengthened in respect of prevention of chronic diseases and their complications, especially for high-impact diseases such as diabetes, cardiovascular diseases and cancer[67].

1.8.2 Health care system

The Palestinian health care system is complex and fragmented. It consists of four major providers: Ministry of Health (MoH), United Nation Relief and Work Agency (UNRWA), Non Governmental Organizations (NGOs) and for profit private sector[68]. The main provider MoH is operating 24 hospitals and 413 Primary Health Care (PHC) facilities[69]. Another main component UNRWA is operating one hospital and 53 PHC facilities[70].

Palestinian health system is facing escalating crisis resulting from funding crisis and the political situation. The health transition is speeded up by the demographic and socioeconomic factors, with high increase of chronic disease burdens which is projected over the next 20 years[71].

1.8.3 Demographic and socioeconomic status.

According to the Palestinian authority population census on December 2007, the Palestinian population increased 30% in the last ten years (from 1997 to 2007) which reached a total of 3.760.000 people (1.460.000 in Gaza Strip and 2.300.000 in West Bank including East Jerusalem)[72].

The Palestinians are undergoing a demographic transition, the crude death rate declined from 4.9 deaths per 1000 population in 1997 to 3.9 in 2006, which led to longer life expectancy. In addition to relatively low infant mortality and under 5-year-old-mortality rates and a high fertility rate[73] all cause demographic transition.

The socioeconomic crisis which results from Intifada distresses the Palestinian economy; unemployment and poverty reach 24% and 44% respectively[73]. It is estimated that the health expenditure is about 8-9% of the Gross Domestic Product (GDP), which is higher than other developing countries (the health expenditure per capita is about 135$)[74]. This socioeconomic status has adversely affected the health care services provided to the Palestinians.

1.8.4 Significance of the study in Palestine

In Palestine, few studies were conducted about diabetes, metabolic syndrome, obesity and other CVD risk factors. Most of these studies were conducted at Ramallah district. In Nablus, there is only one study conducted in 2000. Although the study included 323 diabetic patients and 49 nondiabetic individuals, but it was not considered as case control study.

The main findings of this study showed no significant differences in the means of BMI among diabetic and nondiabetic individuals (30.8±0.7 vs 30.6±0.3), respectively. On the contrary, means of TC and TG are significantly higher among diabetic than nondiabetic individuals. The mean

of TC in diabetics and nondiabetics (220±2.6 vs 206.8±5.3), respectively. Similarly, the mean of TG in diabetics and nondiabetics (166.8±5.9 vs 123.7±10.7), respectively. BMI was significantly higher in diabetic females than diabetic males. Moreover, diabetic patients living in the refugee camps showed higher BMI and SBP than patients in the city or village. About 81% of diabetic patients in this study were with positive family history of diabetes[75] . In addition to the fact that no more studies have been carried out since the conduction of this study in Nablus, but this study lacked an adequate amount of comparing nondiabetic individuals.

In 2000, the total number of type2 DM, receiving treatment at primary health care clinics administered by MoH and UNRWA at Nablus district, was about 3000 patients[75]. On Feb 2008, the number of type2 DM increased (more than 60%) and reached 7825 patients.

Prevention process for chronic disease is imperative in Palestine, First: to improve the quality of life among the Palestinians. Second: the economic burden of these diseases. In Palestine, there is no data about health expenditure due to diabetes. The only available data is about the costs of direct diabetes medications.

More data about DM is needed to apply better strategies for the prevention and control of diabetes and its sequences in Palestine. So further studies are required to identify the associated cardiovascular diseases and risk factors in type 2DM and detect the CVD risk factors that can predict the development of DM in individuals in Nablus district.

1.8.5 Geography of Nablus and general features

The Nablus governorate is an administrate district under the Palestinian National Authority. Nablus is 63 Km north of Jerusalem, with a total area of 615 sq.Km,. The Nablus district is the home to 336,380 inhabitants, including three refugee camps and several surrounding villages. The estimated population of the city in 2006 is 134 thousands according to Palestinian Central Bureau of Statistics[76].

Table 1.2: Population for Nablus district by locality, 2006.

Locality	Population
Nablus District (Total)	336.380
Nablus city	134.116
Askar refugee camp	12.706
Balata refugee camp	17.645
No.1 refugee camp	5.036
Surrounding Villages	166.877

*Source: PCBS website

1.9 Research Problem

Worldwide the prevalence of cardiovascular diseases and risk factors are increasing, especially among diabetic patients. This research asks these questions:

- How is the profile in Palestine (prevalence of CVD and cardiovascular risk factors among diabetic patients)?

- Which of the cardiovascular risk factors are predictors of diabetes?

1.10 Research hypothesis

1. There is no association in the significant level (0.05), between the occurrence of diabetes and cardiovascular risk factors.

2. There are no differences in the significant level (0.05) between the occurrence of cardiovascular risk factors and diseases in different sex, place of residency and family history of diabetes.

CHAPTER II

LITERATURE REVIEW

2 International and Local studies

2.1 Cardiovascular risk factors

Praeford Study was carried out to assess the prevalence of cardiovascular risk factors in middle-aged automobile employees with type 2 diabetes in Germany (2007). Seven patients of 91 (8%) diabetic employees achieved all the recommended target values of the following cardiovascular risk factors [Glycated hemoglobin (HbA1c), SBP and LDL-C]. Blood pressure target was achieved by 26%[77]

In Tunis, a multicenteric study (375 women and 333 men) in 7 departments confirmed that type 2 diabetic patients have many associated cardiovascular risk factors. The frequencies of cardiovascular risk factors in these diabetic patients were (Obesity 32.8%, fat android distribution 92.5%, smoking 68.5%, hypertension 59.1%, hypertriglyceridemia 31.9% and hypercholesterolemia 26.8%)[78].

A random-digit dialing telephone survey- for the civilian population of the US population in 1999- determined the prevalence of modifiable CVD risk factors. These cardiovascular risk factors were more prevalent in adults with DM and differed by ethnicity, sex, and age. For hypertension (56% vs 22%), high cholesterol (41% vs 20%), obesity (78% vs 57%), and insufficient physical activity (66% vs 56%) in diabetic patients and nondiabetic controls, respectively. Prevalence of Physicians' counseling about lifestyle modification is higher in diabetic than nondiabetic people[79].

In Jordan, a study was conducted to investigate the prevalence of DM, IGT and their risk factors. By using stepwise logistic regression, the factors independently associated with DM were sex, age, FHD, HTN, hypercholesterolemia and hypertriglyceridaemia[80].

In Palestine, a cross-sectional study was conducted to identify the risk factors associated with diabetes in a semi-rural village (500 adults, aged 30-65 year). The results showed that four factors were significantly associated with diabetes: age (OR=1.08, 95% CI=1.05-1.12), positive family history (OR=3.09, 95% CI=1.53-6.24), TG ((OR=1.006, 95% CI=1.002-1.009) and WHR (OR=2.13, 95% CI=1.31-3.45)[81].

2.1.1 Physical inactivity and obesity

New South Wales health survey in 2004 and 2005 indicated that inadequate physical activity was significantly higher in diabetic patients (54.1%) than nondiabetic people (47.3%). In addition, 70.9% of diabetic patients were overweight or obese compared with 46.5% of nondiabetic patients[82].

In Tahren, a follow up study for 4728 subjects for 3.6 years conducted to quantify the impact of overweight and obesity on developing diabetes. The ORs for incident diabetes was (1.76, CI95% 1.07-2.89) for overweight and (3.54 CI 95% 2.16-5.78) for obesity. The PAR % was 23.3% for overweight and 37.1% for obesity[83].

A cross-sectional study was conducted (1999-2004) for 5882 adults in Canada. The results indicated that WC was independent predictor for

diabetes[84]. Another study carried out in USA in 2004 by Wake Forest University Baptist Medical Center to compare the body mass index (BMI) to other general cardiovascular risk factors in diabetic patients: high blood pressure, low-density lipoprotein cholesterol and high blood sugar. Researchers showed that the higher the BMI, the poorer the controls of the studied risk factors which lead to heart disease[85].

In Sweden, a cross-sectional study (2003) of 44 042 type 2 diabetic patients was conducted to compare obese with normal and overweight diabetic patients regarding BMI and cardiovascular risk factors. In the cross-sectional study, 36.9% of all patients are obese. These obese patients showed higher frequencies of hypertension 88%, hyperlipidaemia 81% ($p<0.001$). In addition, these patients had higher mean systolic BP, diastolic BP levels, and TG[86].

In USA, a cohort study (1986-2002) was conducted for 68 907 female nurses with no history of diabetes, CVD or cancer at the baseline. This research indicated that type 2 diabetes increased progressively with increasing BMI ($p<0.001$) and waist circumference ($p<0.001$) and with decreasing physical activity ($p<0.001$). The analysis of joint effect of BMI and physical inactivity showed that both of them are independent risk to the development of type 2 diabetes, but the risk of obesity is much greater than physical inactivity[87].

In 2003-2005, a study conducted in Australia to attain more information about diabetes and CVD risk factors in 861 indigenous Australians. The

results showed that WHR was the most strongly associated with diabetes than WC and BMI, especially for women[88]

2.1.2 Lipid profile (total cholesterol (TC), triglycerides (TG))

As a result of several scientific studies, the American Diabetes Association (ADA) made its update guidelines for diabetes treatment (2004). These studies found that even in diabetic patients with normal cholesterol, using statin (cholesterol modifying treatment) could reduce the risk of heart attack or stroke. So the ADA guidelines included using statin for diabetic patients over the age of 40 year with TC ≥ 135mg\dl[62].

In Tahran, a cross sectional study was conducted for 10 136 people (aged 20-69 years) between Sep 2004 and Mar 2005. This study to assess the role of diabetes in the lipid profile. The study included evaluating the following risk factors: blood sugar, TG, TC, HDL-C, LDL-C, medical history, physical inactivity, smoking and obesity. The prevalence of diabetes was 11%. For any type of dyslipidemia the prevalence was 68.8% in the whole group and 88.9% in diabetic patients. The association was strong between diabetes and dyslipidemia ($p<0.05$). In addition, the results of regression analysis indicated that diabetes was the most important factor after obesity in secondary dyslipidemia[89].

Another cross sectional study conducted in Saudi Arabia to study the lipid profile for Saudi diabetic patients. Researchers had the following results 56.6, 23.6, 77.1 and 48.9 percent of diabetic subjects had borderline to high

risk levels of TC, TG, LDL-C and HDL-C respectively. These high frequencies of dyslipidemia increase their risk of cardiovascular diseases. The results indicated the need of control not only to glycemic levels in diabetic patients but also to their TC, TG, LDLC and HDL-C[90].

2.1.3 Family history of diabetes

A report published in the New England Journal of medicine in Nov, 2008 about a study conducted by a multi-institutional research team in USA. This study was about genetic screening for predicting type 2 DM. Genotyping for 18 diabetes –associated variants was conducted from more than 2700 participants blood samples, in addition to collect data about diabetes associated risk factors and outcomes. 255 of participants developed type 2 diabetes during 28 years of follow up. According to the number of risk associated gene copies inherited, each participant was given a genotype score. By comparing the predictive value of genotype score to that of family history alone or of physiological risk factors, genotype score was not able significantly to discriminate participants who did not develop diabetes from those who did in a way better than family history or individual risk factors[91]. Another study conducted on 4989 nondiabetic people in 1987 in Italy to evaluate the effect of the first degree family history of diabetes on other cardiovascular risk factors (body mass index, diastolic blood pressure, blood glucose levels, triglyceride and cholesterol levels). The differences on these risk factors between subjects of negative

and positive family histories were significantly higher in subjects with positive family history[92].

2.1.4 Smoking

New South Wales health survey in 2004 and 2005 indicated that 17.1% of diabetic patients are current smokers; while 20.3% of nondiabetic people are smokers (difference is not statistically significant)[82].

A prospective follow up study (16.8 years) for 7 735 men (40-54 years old) was conducted in 29 British towns. This research to identify if cigarette smoking has an effect on the development of type 2 diabetes. During this period there were 290 incident cases of diabetes in 7124 men with known smoking status. The results indicated that cigarette smoking was significantly an independent modifiable risk factor for type 2 diabetes[93].

2.2 Diabetes complications

Data from Framingham study in 1979 indicated the increased risk of myocardial infarction among diabetic patients. 5209 people were followed for 20 years in this study (cohort study) and then assessed for clinical CVD. They concluded that diabetes mellitus twofolded the risk of coronary heart disease, including myocardial infarction (MI)[94]. A case – control study (Interheart study) conducted in 52 countries for 12.461 MI patients showed that diabetes mellitus was the major risk factor for heart attacks[95] .

A cohort study carried out by the University of Alberta indicated that type2 diabetic patients have double the risk of having stroke compared to nondiabetic patients[96]. On the contrary, the results of a case control study about stroke risk factors, (Al Quds university,2000), indicated that diabetes did not play a significant role in the development of stroke (37.5% vs 32.5%) for cases and controls, respectively in Hebron city[97].

In Finland, a 7 year follow up study of 1059 type 2 DM patients was conducted to investigate risk factors for coronary heart disease. During this period 158 patients died of CHD and 256 patients had serious CHD events. The results of the study indicated that the simultaneous presence of high FBG and dyslipidemia increased the risk for CHD up to threefold[98].

In Iran, a cross-sectional study was conducted to assess the prevalence of diabetes complications in diabetic patients attending diabetes center in Imam Hospital. HTN was in more than half of diabetic patients (67%).

Other complications were existing in high rates: IHD in 39%, diabetic foot 75.8%, neuropathy 63.2%, retinopathy 63.2% and microalbumin in 39% of diabetic patients[99].

In UK, a study was conducted to determine whether diabetic complications can be reduced by controlling glucose level in diabetic patients. 4209 patients were assigned to different diabetic therapies. After 9 years of follow up, for any type of treatment, fasting blood glucose and hemoglobin A1c increased. In addition, macrovascular complications reported in 20% of patients and microvascular complications in 9%[100].

In Sweden, a study conducted to investigate complications of diabetes in a representative diabetic population. The results indicated that, even in diabetic patients with control glycemic level, retinopathy was found in 29% of patients, nephropathy in 22%, cardiovascular disease in 62%, cerebrovascular lesions in 11%, peripheral vascular disease in 26% and the most common peripheral neuropathy in 67%. They found that improvement of glucose control and ß cell function achieved by intensified insulin treatment, but this improvement could not achieved by prolongation[101].

In Saudi Arabia, they studied the prevalence of diabetic complications in 2001. The prevalence of complications was: retinopathy in 30.1% of diabetic patients, neuropathy 34.9%, nephropathy 11%, and for peripheral vascular disease 1.9%[102].

In United Arab Emirate, a study was conducted to assess the prevalence of diabetes complications. The results showed that the most prevalence in diabetic patients was retinopathy 54.2%. The prevalence of other complications was: for nephropathy 40.8%, neuropathy 34.7%, peripheral vascular disease 11.1%[103].

2.2.1 Hypertension

A survey conducted by the Third National Health and Nutrition Evaluation (1988-1994) in America found that 71% of diabetic individuals had hypertension[104] .

An epidemiological study conducted in Taiwan for Chinese adult to study the link between hypertension and diabetes mellitus (1991). The age- and sex-adjusted prevalence of hypertension among diabetic and nondiabetic subjects (30.6 vs 16.5%, $P< 0.0005$). By including sex, age, BMI and other risk factors as independent variables in the multiple regression analysis, the results showed that there was significant association between diabetes and hypertension. But other risk factors as family history of diabetes, diabetes duration, diabetes regimen, control of blood glucose and the presence of nephropathy did not contribute to the risk of hypertension[105].

Prospective observational study in England, Scotland and Northern Ireland studied the relation between systolic blood pressure over time in diabetic patients and the risk of macrovascular and microvascular complications. This study found that reduction 12% in risk of complications of diabetes,

15% for deaths, 11% for myocardial infarction, and 10% for microvascular complications can be achieved with each 10-mmHg reduction in mean systolic blood pressure[106].

In Islamabad, a study conducted to investigate the prevalence of microvascular complications in 200 indoor hospitalized diabetic patients and to compare these complications in diabetics with and without hypertension. The results indicated that the prevalence of retinopathy was significantly higher in diabetics with hypertension than diabetics without hypertension (58% vs 43%, $P<0.01$). Similarly, the results in nephropathy (75% vs 58%, $P<0.05$) and neuropathy (77% vs 59%, $P<0.05$) for diabetic with and without hypertension, respectively[107].

In USA, a follow up study for 14.1 years was conducted to assess the association between TC, HDL-C, non HDL-C and the risk of developing HTN in 3110 men free of HTN, CVD and cancer. The results indicated that 1019 men developed HTN. Moreover, men in the highest quintile of TC, non HDL-C and TC/HDL-C ratio were at increased risk of developing HTN compared with the lowest quintile[108]. Another follow up study for 7 years was conducted in Finland. This study was done to assess the association of dyslipidemia with incident hypertension. The results of the logistic regression model showed that the concentrations of LDL-C (OR= 1.3) and triglyceride (OR= 1.5) were positively associated with hypertension[109]. Additionally, the results of the Framingham study showed

that blood pressure and cholesterol level are strongly correlated, the higher the blood pressure in patient, the higher the serum cholesterol level[110].

In Utah, a prospective study conducted for 1482 adult members to investigate the variables associated with hypertension incidence. From all studied variables (anthropometrics, clinical chemistry measurements of blood and urine, socioeconomic and lifestyle variables), only age (RR=3.52), SBP (RR=3.55) and DBP (RR=3.52) showed the strongest association with HTN incidence[111].

2.3 Gender Differences

A study was conducted in Yugoslavia to examine and compare the relationship between cardiovascular risk factors and the prevalence of CHD in 152 diabetic patients and in 105 healthy control subjects. CHD was 1.2 time higher in male and 2.4 time higher in female diabetic patients than in the healthy control subjects. The analysis of CVD risk factors (diabetes, age, BMI, TG, HDL-C, non-HDL-C and hypertension) by the logistic regression, diabetes showed an independent, significant association to CHD in women and hypertension in men[112].

A cohort study was carried out for 889 aboriginal people in Australia to determine the incidence rate of coronary heart disease (CHD) in patients with type2 diabetes. Researchers concluded that diabetic patients had higher rate of CHD (37.5 per 1000 person-years) than nondiabetics (7.3per

1000 person-years). Among those with diabetes, women had a higher risk than men[113].

Another cohort study which followed up 7198 women and 5907 men for 20 years in Copenhagen. At the beginning of the study none of the participants had heart attack or stroke. At the end of the study they found that type 2 diabetic patients had much cardiovascular problems compared with nondiabetic patients. Researchers showed that for women the risk of heart attack is 1.5 to 4.5 times greater and for men 1.5 to 2 times greater. Moreover, for women with type 2 diabetes the risk of stroke is 2 to 6.5 times greater, and for men 1.5 to 2 times greater. For men and women physical activity decreases the risk of death[114].

A study published by the American Diabetes Association found that the CVD incidence and the levels of the CVD risk factors were higher in diabetic than nondiabetic patients for both men and women. No differences were found between men and women in the influence of diabetes on coronary heart disease, peripheral vascular disease or stroke, but cardiovascular mortality and cardiac failure were higher in women[115].

In previous studies, diabetic women were at higher risk of atherosclerotic vascular disease. A study conducted in Canada to explain why there is difference in the risk between diabetic and nondiabetic women more than diabetic and nondiabetic men. The cardiovascular risk factors (SBP, c-reactive protein, Apo B, LDL-cholesterol, non-HdL cholesterol and LDL particle county), body composition (WC, WHR, BMI) and serum hormone

were compared in 524 nondiabetic women, 258 diabetic women, 421 nondiabetic men and 220 diabetic men. The results indicated that diabetic women had elevated levels of atherogenic particles (ApoB, LDL particle count) which may be resulted from abdominal obesity[116].

In Pakistan, a cross-sectional study was conducted to investigate the frequency of diabetic complications in patients attending tertiary care. Mean BMI and TC were higher than risk indicator values for females only, but other risk factors were higher for both gender. The frequency of obesity, low HDL and HTN was significantly higher in females. Conversely, the frequencies of retinopathy, nephropathy, neuropathy, diabetic foot ulcer were significantly higher in males than females. In the other hand, diabetic patients with longer duration of diabetes (>10 years) have higher frequencies of retinopathy, nephropathy, diabetic foot ulcer, coronary artery disease, stroke and PVD (P=0.000 for each disease)[117].

In USA, all micro- and macrovascular complication prevalence were high in diabetic males than diabetic females. Prevalence of chronic kidney diseases was 30.4%, 25% in diabetic men and women, respectively. Moreover, diabetic eye disease was in 20.3% of diabetic men and 17.55% of diabetic women[118]. In another study in Spain, researchers found no gender differences in the prevalence of microvascular diseases. However, CHD was in men 22.6% vs 14.8% in women. Similarly, peripheral ischemia was in men 10.3% vs 2.2% in women[119].

In Lebanon, a study carried out to investigate the epidemiology of diabetes in relation to other cardiovascular risk factors. The results of this study indicated that abnormal (increased) BMI and WHR were higher in male and female participants with type 2 or IGT than normal participants. The degree of obesity (BMI) and mean of WHR were more observable in females with DM type 2 and IGT than males. TC, TG, LDL-C, SBP, DBP and family history of diabetes were significantly higher in both females and males with DM or IGT than normal females and males. Ex and current smoking are significantly higher in males than females. In males, current smoking percentages were nearly the same in normal males and those with DM or IGT. But ex smokers males with DM or IGT were higher than ex smoker normal males[120].

In Israel, a follow up study conducted to identify the association between TG over time (readings was took in five years apart) and the prediction of diabetes in young men. TG was an independent predictor of diabetes when studied with other risk factors. The hazard ratio (HR) of developing diabetes was highest (HR= 12.62) in men whose TG increased from the lowest readings to the highest reading of TG[121].

2.4 Place of residency

In India, a study conducted to compare the prevalence of diabetes, IGT, IFG and cardiovascular risk factors between a city, a town and periurban villages. The results showed that diabetes significantly associated with age, family history, waist circumference and physical inactivity was not. Moreover, individuals in the city had more prevalent overweight, elevated waist circumference, hypertension and dyslipidemia[122].

In United Arab Emirates, a study was conducted to investigate the CHD risk factors in type 2 DM, obesity and hypertension. The results indicated that urban population were associated with higher blood glucose levels (P=0.000) and with higher BMI 27% (P=0.02). The prevalence of hypertension was higher in urban population[123].

In Oman, a study was conducted to reveal the effect of urbanization on diabetes. The study revealed that Omani population has high prevalence of diabetes, obesity, hypertension and high cholesterol level, especially among urban population and older people. But the differences in obesity and cholesterol levels between urban and rural are less significant[65].

In Palestine, a study conducted in a rural and urban Palestinian West Bank community to compare the prevalence of metabolic syndrome components (HTN, abnormal glucose metabolism, dyslipidemia, central obesity and overall obesity). Urban population had more prevalent elevated

triglyceride, low HDL cholesterol and overall obesity as a result of a rapid urbanization[124].

A cross-sectional study was conducted about diabetes mellitus in an urban Palestinian population (old Rammalla city) in 2001. By including significant risk factors in the logistic regression analysis, the independent variables that significantly associated with diabetes were age, sex, BMI, WHR and family history. The odds ratios were: BMI (OR=2.04, CI 95% 1.06-3.90), WHR (OR=5.53 CI 95% 2.11-14.52) and for family history of diabetes (OR=2.42, CI 95% 1.30-4.51). Diabetic women were older than nondiabetics and their BMI, WHR, DBP, SBP and TC are significantly higher. Similarly, diabetic men had significantly higher BMI, WHR, DBP, SBP and TC levels compared to nondiabetic men[125].

2.5 Diabetes Route of Treatment

A report from the chronic disease center in Palestine indicated that during 2008; the percentages of diabetic patients with different route of treatments were: 0.9% in diet only, 65.3% in oral hypoglycemic agents (OHA), 27.2% in Insulin and 6.6% in combination of insulin and OHA[126].

2.6 Diabetes Duration

A cross-sectional study of 7875 of type 2 diabetic patients was conducted in Netherlands. In this study researchers assessed the role of diabetes duration on treatment. After the first year following diabetes diagnosis, treatment with diet only decreased and treatment with oral hypoglycemia increased. 10 years following diabetes diagnosis, treatment with OHA diminished and insulin treatment increased to reach two-third of diabetic patients after 20 years following diagnosis. This treatment sequence (diet, OHA, insulin treatment) reflected the progression of ß-cell failure in diabetic patients with increasing diabetes duration[127].

A study conducted in Boston to test the hypothesis that diabetes duration is important predictors for CHD incidents in diabetic patients. Of 588 diabetic patients, 86 patients had CHD events, including 36 deaths. The risk of CHD was 1.38 times higher for each 10-year increase in duration of diabetes and the risk of death of CHD was 1.86 times higher. So diabetes duration was an independent risk for CHD death of coexisting risk factors (age, sex and CHD risk factors)[128].

2.7 Patients' awareness and counseling

Physician counseling and educational programs are necessary to increase patients' awareness and induce lifestyle modification. Although CVD accounts for high percentage of deaths in diabetic patients, patients' awareness of diabetic complications and cardiovascular risk factors stills low.

Surveys illustrate that methods to reduce the risk of cardiovascular disease in diabetic patients are not emphasized by their physicians[129].

According to a survey published on Feb 2002 in Washington about the lack of awareness among diabetic patients of the associated cardiovascular risk factors, 68% of people with diabetes do not consider cardiovascular disease to be a serious complication of diabetes, 60% of them do not feel at risk for either high blood pressure or cholesterol problems[130].

Another study was conducted in the US population with and without diabetes to study physicians' advice to quit smoking and the changes in cigarette smoking from the mid 1970s to 1990. The results indicated that there was a decrease in the prevalence of smoking for both diabetic and nondiabetic patients to reach 25.8%, 25.6%, respectively. The physicians' advice to quit smoking was more in diabetic patients than nondiabetics 58.4%, 46.0%, respectively. This means that more efforts are needed from health care providers, as 40% of diabetic smokers reported that they never received advice to stop smoking[131].

In India, a study was conducted using a structured questionnaire to assess the awareness in an urban south Indian population about diabetes, its prevalence, prevention, risk factors and complications. Of the whole population only 19.0% were aware of diabetic complications and just 40 % of diabetic patients were aware of diabetic complications[132].

To increase the community awareness, the Australia's national diabetes program launched a key message during the national diabetes week: reduce your waist, reduce your risk. This message was to inform people about the seriousness of diabetes disease and that a large waist circumference is a risk factor for type 2 diabetes[133].

CHAPTER III

METHODOLOGY

3.1 Target population

This study targeted type2 diabetic patients (cases) and nondiabetic residents (controls) at any age attending MoH and UNRWA clinics in Nablus district between February 2008 and April 2008.

3.2 Study design and study sample

Study design

The study is an observational case-control study.

Sampling frame

Diabetic and nondiabetic control individuals registered in 7 primary health care centers in Nablus district. All diabetic clinics in Nablus district administered by MoH and UNRWA were included. Clinics included were in Nablus city (MoH), Hewara village (MoH), Beita village (MoH), North Aseara village (MoH), Askar refugee camp (UNRWA), Balata refugee camp (UNRWA) and No.1 refugee camp (UNRWA).

Sampling design

Participants were selected by random sampling in all seven clinics. The samples were allocated proportionally.

Eligibility criteria:

- **Inclusion criteria:**

Subjects:

- Males or females with type 2 diabetes mellitus.
- Residents of Nablus district (city, villages and refugees), receiving treatment in MoH or UNRWA primary health care clinics.

Controls:

- Subjects with FBG <100mg/dl.
- Subjects without diagnosed DM, residents of Nablus district (Nablus city, villages and refugees) and attending MoH or UNRWA primary care clinics.

- **Exclusion criteria:**

Subjects:

- Females who are pregnant.

Controls:

- Females who are pregnant.
- Participants with FBG ≥100 mg/dl

Sampling size

The sample size was chosen according to the following formula:

$$S = \frac{Z^2 P (I-P)}{e^2}$$

Z value is derived from our anticipated confidence level. Recommended value of Z-score is 1.96 to give confidence level of 95%.

e equal 0.05 as our precision (confidence interval =5%).

P is derived from the prevalence of diabetes in Palestine as 9%[41].

The minimum sample size according to this equation is 125 cases of diabetic patients. To account for non-response, a sample of 299 cases and 248 controls were chosen. Among the control group 89 were excluded because their blood sugar level was ≥100mg/dl. As individuals with FBG 100-125 mg/dl considered in a prediabetic stage and they have a high chance of developing T2DM. Moreover, this group may be at high probability of having undiagnosed Type 2 diabetes.

The 299 cases were divided according to the total number of subjects registered in each clinic (table 3.1). The distribution was as follow: Nablus city clinic (146), Hewara clinic (29), Beita clinic (16), North Asears clinic (16), Askar camp clinic (27), Balata camp clinic (38), No.1 camp clinic (27). The percent of the sample was 49%, 9.5%, 5%, 5%, 9%, 13%, 9%, respectively. This was calculated by dividing the total number of subjects in each clinic by the total number of subjects in Nablus district (MoH and UNRWA), and then multiplied by 299.

Table 3.1: numbers and percentages of diabetic and studied patients in Nablus district (MoH, UNRWA)

Clinic	No. of registered diabetic patients	Percentage	No. of studied patients
Nablus city	3825	49%	146
Hewara village	745	9.5%	29
Beita Village	404	5%	16
North Aseara village	439	5.5%	16
Askar refugee camp	697	9%	27
Balata refugee camp	1003	13%	38
Camp No.1	712	9%	27
Total	7825	100%	299
On Feb 2008, the total number of diabetic patients in Nablus district (MoH, UNRWA) was 7825 patients.			

The 248 controls were selected randomly in the selected 7 primary health care clinics on the same days of visiting MoH, UNRWA diabetic clinics and selecting diabetic subjects.

After excluding the controls with FBG≥100mg/dl, the final number of control individuals was 159.

3.3 Data collection

Data was collected over a period of three months between February 2008 and April 2008. The researcher took permission from the MoH and UNRWA officials before starting the collection of data.

Patients were interviewed using a structured questionnaire after their informed consent to take part in this study.

Instrument: A questionnaire (Annex A) was developed by the researcher, then tested and retested on a small group of patients (20 patients) with a week interval which showed high reliability, after that validated by health experts including diabetes specialist. By this questionnaire we were able to measure what we wanted to measure.

A questionnaire was filled by the researcher through using a clear Arabic language. Personal data was entered to the questionnaire using English language.

- Demographic information: age, gender, level of education and place of residence,

- Family history of cardiovascular diseases and diabetes in first degree relatives: father, mother, sister, brother.

- Smoking: consider current smokers and if they smoke cigarettes or waterpipe, the frequency and number of smoking each day.

- Physical activity: indication of 30 minutes of moderate-intensity physical activity (e.g., walking) a day at least five days a week to be considered physically active.

- Counseling by physicians and awareness of associated cardiovascular risk factors and cardiovascular diseases; identifying the percentage of people who received counseling from physicians and the percentage of

people who are aware of these associated cardiovascular diseases and risk factors.

Obtaining the following physical tests.

- Blood pressure {SBP (systolic blood pressure) and DBP (diastolic blood pressure)}; obtained twice with the subjects in the sitting position using sphygmomanometer.

- Body Mass Index (BMI): person's weight in kilograms divided by height in meters squared (BMI=kg/m2). Height was measured with shoes removed, using a stadiometer. Weight was measured with participants wearing light clothing without shoes. Subjects were considered to be of normal weight if their BMI was < 25 kg/m2, overweight if their BMI was 25-29.9 kg/m2 and obese if their BMI was 30 kg/m2 or over.

- Waist circumference (WC).

Circumference measurements were carried out using a D-loop tape measure.

Waist circumference was measured around the smallest circumference between the ribs and the iliac crest.

Normal in women < 88 cm Normal in men < 102 cm

- Waist-to-hip ratio (WHR)

Hip circumference was measured at the widest circumference around the buttocks; waist-to-hip ratio was calculated from these circumferences: Normal in women < 0.85 Normal in men < 0.90

- The following lab tests were conducted at Al-Najah central laboratory. Blood samples were taken for fasting participants (not to eat or drink, except water, for at least 8 hours).

Fasting blood glucose: normal <126 mg/dl.

Total cholesterol: normal <240mg/dl.

Triglyceride: normal<150mg/dl.

3.4 Data Analysis

All data collected from 548 participants were entered in the computer. Statistical Packages for Social Science (SPSS 17) was used to analyze these data obtained from the questionnaires. Continuous variables (SBP, DBP, FBG, TC, and TG) are expressed as mean ± SD and categorical variables (WHR, WC, BMI, physical inactivity, smoking, FHD and diabetic complications) are expressed as percentage.

The continuous variables were compared using the student *t*-test to assess whether the means of continuous risk factors were statistically different between diabetics and nondiabetics.

The categorical variables were compared using the $\chi 2$ test to evaluate the statistically significant differences between the diabetics and nondiabetics in the proportion of CVD risk factors and diabetic complications.

Binary logistic regression was used to identify predictors.

3.5 Ethical consideration

I have received an approval from the ethical committee at An-Najah University, as this research will bring benefits to the Palestinians' health. Confidentiality was highly taken into consideration in respect of data obtained either from patients' medical records or tests conducted to subjects. No participant in this research was included unless I had received informed consent from the participant to take part in this research.

CHAPTER IV

RESULTS

4.1 Frequencies of socio-demographic characteristics of the study population

The characteristics of the study sample are shown in table 4.1. Patients with diabetes who are included in the study were less educated than the nondiabetic controls (p=0.000). Moreover, the ratio of participants without work is higher among nondiabetic patients group compared to diabetic controls (p= 0.000). In addition, monthly income is higher among nondiabetic controls compared to diabetic patients group (p= 0.000). Although there was no significant difference in age, gender and place of residency between the diabetic patients and nondiabetic controls, but the ratio of females in diabetic patients group is higher than nondiabetic controls group.

Table 4.1: Frequencies of socio-demographic characteristics of the study population.

Variable	Diabetic Patients 299	Nondiabetic controls 159	P-value
Gender			
Male	118 (39.5%)	78(49.1%)	0.059
Female	181(60.5%)	81(50.9%)	
Age group			
< 40	15 (5.0%)	12(7.5%)	0.340
40 – 49	49(16.4%)	33(20.8%)	
50 - 59	91(30.4%)	50(31.4%)	
60 – 69	94(31.4%)	46(28.9%)	
> 70	50(16.7%)	18(11.3%)	
Residency			
City	98(32.8%)	57(35.8%)	0.331
Village	109(36.5%)	47(29.6%)	
Camp	92(30.8%)	55(34.6%)	
Education			
Diploma and above	29(9.7%)	42(26.4%)	0.000
Tawjihi	20(6.7%)	28(17.6%)	
Less than Tawjihi	193(64.5%)	74(46.5%)	
Illiterate	57(19.1%)	15(9.4%)	
Profession			
Free work	21(7.0%)	14(8.8%)	0.000
Employee	23(7.7%)	38(23.9%)	
Worker	26(8.7%)	17(10.7%)	
Retired	11(3.7%)	15(4.9%)	
Without work	218(72.9%)	75(47.2%)	
Monthly Income			
> 2500 NIS	22(7.4%)	23(14.5%)	0.000
1000 – 2500 NIS	52(17.4%)	53(33.3%)	
<1000 NIS	3 (1.0%)	7(4.4%)	
No income	222(74.2 %)	78(47.8%)	

4.2.1 Comparison of cardiovascular risk factors among diabetic and nondiabetic participants.

Continuous risk factors[1] and categorical risk factors[2] were compared between diabetic patients and nondiabetic controls using ***t*-test[1] and chi square test[2]** as shown in table 4.2. The results indicate that there are significant differences in all studied risk factors except for SBP, DBP and smoking. FBG is higher in diabetic patients than nondiabetic participants about (189±72 vs 90±24, P=0.000). Similarly, TC (195 ±50 vs 186 ±33, P=0.025) and TG (184 ±137 vs 143±78, P=0.000). Moreover, the frequency of obesity is significantly higher among diabetic patients than nondiabetic controls. Obesity includes WHR about (83% vs 66%, P= 0.000), WC about (74% vs 43%, P=0.000) and BMI >24.9 (kg/m2) about (88% vs 62%, P=0.000) for diabetic patients and nondiabetic controls, respectively. The frequency of first degree family history is significantly higher among diabetic patients vs nondiabetic controls about (75 % vs 47%, P=0.000). Moreover, diabetic patients are significantly physically inactive compared to nondiabetic controls about (47% vs 32%, p=0.001).

Table 4.2: Mean values ±SD and frequencies (%) of cardiovascular risk factors among diabetic patients and nondiabetic participants.

Risk factor	Diabetic patients 299	Nondiabetic controls 159	P-value
SBP[1]	126.78 (±19.35)	125.77(±14.80)	0.553
DBP[1]	80.18 (±10.92)	78.31(±9.55)	0.070
FBG[1]	188.87 (±72.03)	89.80(±24.00)	0.000
TC[1]	195.24 (±50.49)	186.35(±33.52)	0.025
TG[1]	184.42 (±137.22)	143.55(±78.52)	0.000
WHR[2]	247(82.6%)	105(66.0%)	0.000
WC[2]	222(74.2%)	68(42.8%)	0.000
BMI (kg/m2) [2]			0.000
overweight	88(29.4%)	42(26.4%)	
obesity	174(58.2%)	58(36.5%)	
Physical Inactivity[2]	140(46.8%)	50(31.4%)	0.001
Smoking[2]			0.582
Ex-smoker	68(22.7%)	30(18.9%)	
Current smoker	58(19.4%)	30(18.9%)	
FHD[2]	224(74.9%)	75(47.2%)	0.000

[1]values are expressed as means ±SD, P<0.05 is considered to be significant.
[2] values are expressed as frequencies (%), P<0.05 is considered to be significant

By including the studied risk factors in the **logistic regression analysis** (SBP, DBP, TC, TG, WHR, WC, BMI, physical inactivity, smoking and FHD), the results presented in table 4.3 show that TC is the strongest predictor of diabetes with about (OR= 4.3, CI95% 1.8- 7.2, P= 0.000), followed by FHD about (OR=3.1, CI95% 2.0-5.0, P=0.00), WC about (OR=2.1, CI95% 1.2-3.7, P=0.009) and the least significant predictor of diabetes is TG which represents about (OR=1.7, CI95% 1.1-2.7, P=0.019). Other risk factors; which include SBP, DBP, BMI, WHR, physical inactivity and smoking, are not statistically significant predictor of diabetes in the logistic regression analysis.

Table 4.3: Logistic regression analysis of cardiovascular risk factors, adjusted OR and CI 95%.

Risk Factor	P-value	OR	CI 95%
TC	0.001	4.340	1.796-10.487
FHD	0.000	3.100	1.970-4.877
WC	0.009	2.140	1.207-3.793
TG	0.019	1.717	1.091-2.703

4.2.2 Comparison of macrovascular and microvascular complications among diabetic and nondiabetic participants

In our study, about 61% of participants suffer from at least one of the following complications (Ischemic heart disease, stroke, peripheral arterial disease, retinopathy, nephropathy, neuropathy, amputation and diabetic foot). Of these complicated participants about 50%% are diabetic patients.

Table 4.4 shows that about 78% of diabetic patients have at least one complication compared to 31% nondiabetic controls.

Table 4.4: Frequencies and percentages of ≥ 1 complication among diabetic patients and nondiabetic controls.

Complication	Type 2 Diabetes Patients (%)	Nondiabetic controls (%)	Total	P-value
complication	233(77.9%)	49(30.8%)	282(61%)	0.000
No complication	66(22.1%)	110(71.1%)	176(38.4%)	
Total	299(100%)	159(100%)	458(100%)	

The macrovascular and microvascular complications were compared between diabetic patients and nondiabetic controls using **chi square** test. The results in table 4.5 show significant association between all complications and diabetes. The most prevalent macrovascular complication among diabetic patients is hypertension compared to nondiabetic participants with about (55% vs 25%, p= 0.000). The most prevalent microvascular complication among diabetic patients is neuropathy compared to nondiabetic controls (37% vs 0.5%, p= 0.000).

Table 4.5: Frequencies and percentages of microvascular and macrovascular complications among diabetic patients and nondiabetic controls.

complications	Diabetic Patients 299	Nondiabetic controls 159	P-value
Hypertension	165(55.2%)	43(27.0%)	0.000
Ischemic heart disease	39 (13.0%)	3(1.9%)	0.000
Stroke	16 (5.4%)	1(0.6%)	0.009
Peripheral arterial disease	6 (2.0%)	0 (0.0%)	0.097
Retinopathy	91 (30.4%)	2(1.3%)	0.000
Nephropathy	33 (11.0%)	2(1.3%)	0.000
Neuropathy	111 (37.1%)	1(0.6%)	0.000
Amputation	14 (4.7%)	0(0.0%)	0.003
Diabetic Foot	10 (3.3%)	0(0.0%)	0.017

4.3.1 Comparison of cardiovascular risk factors among female and male participants.

The study sample consists of 181 diabetic females, 118 diabetic males, 81 nondiabetic females and 78 nondiabetic males.

Using **t-test and chi square test,** the means and frequencies of cardiovascular risk factors were compared between the different groups as shown in table 4.6:

- Females.

Means of FBG, TC and TG are significantly higher among diabetic females than among healthy females (192±75 vs 87±12, p=0.000), (198±47 vs 187±35, p=0.049), (179±132 vs 141±79, p=0.004), respectively. Moreover, the frequencies of risk factors are significantly higher among diabetic females than nondiabetic females; except smoking, with about : WHR (79% vs 46%, P=0.000), WC (91% vs 52%, P=0.000), physical inactivity (59%vs 45%, P=0.045), BMI >24.9 kg/m2 (93% vs 67%, P=0.000) and first degree family history of diabetes (75% vs 48%, P=0.000) for diabetic and nondiabetic females, respectively.

- Males.

Means of FBG (184±67 vs 92± 12, p=0.000), TG (193±145 vs 147±78, p=0.004) and DBP (83±11 vs 78±10, p=0.001) were significantly higher among diabetic males than nondiabetic males, respectively. Moreover,

frequency of WC is significantly higher among diabetic males than nondiabetic males (49% vs 33%, P=0.039). Similarly, BMI >24.9 kg/m2 is higher among diabetics than nondiabetics (80% vs 58%, P=0.007). Furthermore, first degree family history is significantly higher among diabetic than nondiabetic males (75% vs 46%, P=0.000). Other risk factors including SBP, TC, WHR, physical inactivity and smoking are not significantly different between the two groups.

- Diabetic females and diabetic males.

Systolic blood pressure is higher among diabetic male than female patients with about (130.0 ± 18.7 vs 124.8 ±19.6, P= 0.029). In addition, DBP is significantly higher among diabetic male than female patients with about (82.6 ± 11.1 vs 75.6 ± 10.5, P= 0.002). Moreover, frequencies of high WHR is higher among diabetic males than female patients with about (88% vs 79%, P= 0.044). On the contrary, the frequency of abnormal WC is significantly higher among diabetic female than male patients with about (91% vs 49%, P=0.000). Body mass index is significantly higher among diabetic females than diabetic patients (93% vs 80%, P=0.000). Moreover, diabetic females are significantly less physically active than male patients (59% vs 28%, P=0.000). While diabetic males are more likely to be smokers than female patients (69% vs 24%, P=0.000). Other risk factors including FBG, TC, TG and FHD are not significantly different in those twogroup

Table 4.6: Mean values ±SD and frequencies (%) of cardiovascular risk factors among females and males with and without diabetes.

Risk factor	Female N=262			Male N=196			*P-value
	*Diabetes N=181	No diabetes N=81	P	*Diabetes N=118	No diabetes 78	P	
SBP[1]	124.82 (±19.5)	124.65(14.6)	0.947	129.80 (± 18.6)	126.94(15.1)	0.259	0.029
DBP[1]	78.58 (± 10.50)	78.51(9.6)	0.957	82.63 (± 11.1)	78.12(9.5)	0.004	0.002
FBG[1]	192.33(± 74.8)	87.59(12.2)	0.000	183.56 (± 67.4)	92.09(12.0)	0.000	0.304
TC[1]	197.63 (± 47.1)	187.33(34.6)	0.049	191.58 (± 55.3)	185.32(32.5)	0.320	0.312
TG[1]	178.68 (± 132.1)	140.56(79.0)	0.004	193.22(± 144.8)	146.67(78.4)	0.004	0.371
WHR[2]	143((79.0%)	37(45.7%)	0.000	104(88.1%)	68(87.2%)	0.828	0.044
WC[2]	164(90.6%)	42(51.9%)	0.000	58(49.2%)	26(33.3%)	0.039	0.000
Physical Inactivity[2]	107(59.1%)	37(45.7%)	0.045	33(28.0%)	13(16.7%)	0.085	0.000
Smoking[2]			0.322			0.367	0.000
Ex-smoker	26(14.4%)	8(9.9%)		42(35.6%)	22(28.2%)		
Current smoker	18(9.9%)	5(6.2%)		40(33.9%)	25(32.1%)		
BMI[2]			0.000			0.007	0.000
overweight	43(23.8%)	20(24.7%)		45(38.1%)	22(28.2%)		
obesity	125(69.1%)	34(42.0%)		49(41.5%)	24(30.8%)		
FHD[2]	135(74.6%)	39(48.1%)	0.000	89(75.4%)	36(46.2%)	0.000	0.892

[1] values are expressed as means±SD, P<0.05 is considered to be significant. [2] values are expressed as frequencies, P<0.05 is considered to be significant. *P-value for differences in risk factors between diabetic females and males.

To identify significant risk factors for diabetic females and males, **logistic regression analyses** for risk factors were conducted. The results in table 4.7 show that the best predictors of diabetes among diabetic female are WC about (OR=3.9, CI 95% 1.4-10.5, P= 0.007), FHD about (OR=3.0, CI 95% 1.6-5.0, P=0.001), TG about (OR= 2.9, CI 95% 1.2-4.4, P=0.014) and WHR (OR= 2.3, CI 95% 1.1-4.6, P=0.026). For male patients, one predictor is similar to female patients: FHD (OR=3.6, CI 95% 1.8-7.4, P=0.000). But the strongest predictors in males is TC (OR=11.13, CI 95% 2.2-56.7, P=0.004) followed by DBP (OR=4.2,CI95% 1.5-11.4, P=0.005).

Table 4.7: Logistic regression analysis of cardiovascular risk factors among diabetic females and males.

Risk Factor	P-value	OR	CI 95%
Female			
WC	0.007	3.904	1.447-10.534
FHD	0.001	3.058	1.592-5.873
TG	0.014	2.292	1.180-4.452
WHR	0.026	2.267	1.105-4.655
Male			
TC	0.004	11.128	2.188-56.587
DBP	0.005	4.199	1.552-11.363
FHD	0.000	3.636	1.788-7.394

4.3.2 Comparison of macrovascular and microvascular complications among female and male participants

Using **chi square test**, the frequencies of macrovascular and microvascular complications were compared among females and males patients, as shown in table 4.8.

The frequency of IHD is significantly higher among diabetic males than females with about (20% vs 9%, P= 0.009). Furthermore, nephropathy is significantly higher among diabetic males than female patients with about (19% vs 6%, P=0.001). While other complications are not significantly different between the two groups including: HTN, stroke, PAD, retinopathy, neuropathy, amputation and diabetic foot.

Table 4. 8: Frequencies of microvascular and macrovascular complications among diabetic females and males.

Complications	Diabetic females N= 181	Diabetic males N=118	*P-value
HTN	106(58.6%)	59(50.0%)	0.155
IHD	16 (8.8%)	23(19.5%)	0.009
Stroke	6 (3.3%)	10(8.5%)	0.066
PAD	3 (1.7%)	3(2.5%)	0.684
Retinopathy	49 (27.1%)	42(35.6%)	0.125
Nephropathy	11(6.1%)	22(18.6%)	0.001
Neuropathy	67(37.0%)	44(37.3%)	1.00
Amputation	5 (2.8%)	9(7.6%)	0.089
Diabetic foot	3 (1.7%)	7(5.9%)	0.054

P-value for chi square differences between diabetic female and diabetic male.

4.4.1 Comparison of cardiovascular risk factors among diabetic patients residing in the city, village and refugee camp

Since our study consists of diabetic patients residing in city (98), village (109) and refugee camp (92), we analyzed possible associations between the indicated factors associated with diabetes and place of residency.

Univariate analysis[1], **post hoc test**[1] and **chi square**[2] test were used to compare the risk factors among diabetic patients residing in the three locations as shown in table 4. 9. The mean of SBP was found to be significantly higher among patients residing in camps compared to city or village (P=0.000). However, patients residing in the city show significantly higher DBP and TG than patients in the village with about (83.0±10.0 vs 78.4±11.3, P=0.008), (215.1±182.3 vs 162.5±112.6, P= 0.016), respectively. In addition, patients in the city have significantly higher TC than patients in camps (208.6±53.4 vs 180.3±36.7, P= 0.000). Moreover, ex-smoking and current smoking are significantly more frequent among patients residing in the city (P=0.000).

Table 4.9: Mean values and frequencies of cardiovascular risk factors among diabetic patients living in the city, village and camp.

Risk factor	City	Village	Camp	P
SBP[1]	124.18±18.55	122.34±19.28	134.82±17.94	0.000
DBP[1]	82.96±10.09	78.44±11.25	79.27±10.90	0.007
FBS[1]	200.95±81.43	177.56±62.70	189.3±70.32	0.065
TC[1]	208.59±53.43	195.90±54.63	180.25±36.67	0.000
TG[1]	215.12±182.33	162.54±112.55	177.63±97.76	0.019
WHR[2]	86(87.8%)	92(84.4%)	69(75.0%)	0.056
WC[2]	75(76.5%)	83(76.1%)	64(69.6%)	0.466
BMI[2]				0.420
Overweight	28(28.6%)	34(31.2%)	26(28.3%)	
Obese	59(60.2%)	57(52.3%)	58(63.0%)	
Physical Inactivity[2]	51(52.0%)	50(45.9%)	39(42.4%)	0.399
Smoking[2]				0.000
Ex smoker	43(43.9%)	8(07.3%)	17(18.5%)	
Current smoker	23(23.5%)	18(16.5%)	17(18.5%)	
FHD	79(80.6%)	78(71.6%)	67(72.8%)	0.092

[1] values are expressed as means±SD, P<0.05 is considered to be significant.
[2] values are expressed as frequencies, P<0.05 is considered to be significant.

Logistic regression analysis was used to identify the predictors of diabetes among patients in the city, village and camp. According to the data shown in table 4.10, clearly FHD was the same predictor in the three locations. However, DBP was a predictor of diabetes only among patients residing in the city. None of the obesity measures was a predictor of diabetes in the city. On the contrary, WC was a predictor in the village and BMI in the camps. Moreover, TC was a predictor in diabetics in the village and TG in the diabetics in the refugee camps, but both TC and TG were predictors of diabetes in the city.

Table 4.10: Logistic regression analysis of cardiovascular risk factors among diabetic patients living in the city, village and refugee camps.

Risk Factor	P	OR	CI 95%
City			
TC	0.010	8.466	1.672-42.866
DBP	0.003	5.724	1.779-18.422
FHD	0.001	4.849	1.929-12.191
TG	0.027	2.623	1.115-6.169
Village			
WC	0.000	7.614	2.601-22.290
FHD	0.010	2.970	1.300-6.788
Refugee camp			
BMI	0.024	4.161	1.209-14.319
TG	0.004	3.438	1.485-7.959
FHD	0.005	3.214	1.427-7.236

4.4.2 Comparison of macrovascular and microvascular complications among diabetic patients residing in the city, village and refugee camp.

The frequency of HTN seems significantly higher among diabetic patients living in camps in comparison to those living in the city or village (P=0.006) as shown in table 4.11. However, diabetic patients living in the city have significantly higher frequencies of IHD, retinopathy, nephropathy and neuropathy than patients living in the village or camp (P=0.000). Other complications including stroke, PAD, amputation and diabetic foot appear not significantly different among patients residing in the three locations. Clearly the number of patients with part of these complications is relatively small and therefore more cases should be looked for before reading a conclusive result concerning this part.

Table 4.11: Frequencies of macrovascular and microvascular complications among diabetic patients residing in the city, villages and refugee camps.

Complications	City 98	Village 109	Camp 92	P-value
HTN	56(57.1%)	48(44.0%)	61(66.3%)	0.006
IHD	72(27.6%)	8(7.3%)	4(4.3%)	0.000
Stroke	9(9.2%)	3(2.8%)	4(4.3%)	0.107
PAD	1(1.0%)	3(2.8%)	2(2.2%)	0.668
Retinopathy	46(46.9%)	37(33.9%)	8(8.7%)	0.000
Nephropathy	23(23.5%)	9(8.3%)	1(1.1%)	0.000
Neuropathy	65(66.3%)	37(33.9%)	9(9.8%)	0.000
Amputation	6(6.1%)	7(6.4%)	1(1.1%)	0.145
Diabetic foot	6(6.1%)	2(1.8%)	2(2.2%)	0.174

4.5 Cardiovascular risk factors and diabetes complications related to first degree family history of diabetes

The cardiovascular risk factors between diabetics and nondiabetics with and without first degree family history of diabetes are summarized in table 4.12. The results show that there are significant differences in most cardiovascular risk factors between diabetics and nondiabetics either with or without family history of diabetes which are higher in diabetics. On the contrary, there are no differences in the risk factors between patients with and without family history of diabetes except for SBP ($p=0.038$).

Table 4.12: Mean values and frequencies of cardiovascular risk factors among diabetics and nondiabetics with and without family history of diabetes.

Risk Factor	Family History			No Family History			*p-values
	*Diabetes	Nondiabetes	p-value	*Diabetes	Nondiabetes	p-value	
SBP[1]	125.4±18.97	126.27±15.7	0.695	130.92±19.99	125.33±14.1	0.046	0.038
DBP[1]	79.86±11.00	78.57±11.0	0.383	81.13±10.68	78.08±8.0	0.042	0.382
FBG[1]	191.15±68.7	90.32±11.8	0.000	182.04±81.07	89.33±12.6	0.000	0.344
TC[1]	196.49±49.0	187.35±32.7	0.075	191.25±54.29	185.29±34.4	0.385	0.461
TG[1]	184.30±141.8	136.76±76.4	0.000	184.76±123.21	149.62±80.0	0.037	0.980
WHR[2]	185(82.6%)	50(66.7%)	0.005	62(82.7%)	55(65.5%)	0.091	1.000
WC[2]	168(75%)	32(42.7%)	0.000	54(72.0%)	36(42.9%)	0.000	0.648
BMI[2]			0.000			0.000	0.111
Overweight	72(32%)	14(18.7%)		16(21.3%)	28(33.3%)		
obesity	128(57.1%)	35(46.7%)		46(61.3%)	23(27.4%)		

[1] values are expressed as means±SD, P<0.05 is considered to be significant.

[2] values are expressed as frequencies, P<0.05 is considered to be significant.

*P-value for differences in risk factors between diabetics with and without family history of diabetes.

Complications were compared among patients with and without first degree family history of diabetes as shown in table 4.13. The results show that only the frequency of HTN appears significantly higher among patients without a family history than those with a family history of diabetes (p= 0.005).

Table 4.13: Frequencies of diabetic complications among patients with and without first degree family history of diabetes.

Complications	Diabetic Patients		p-value
	Family History 224	No Family History 75	
HTN	113(50.4%)	52(69.3%)	0.005
IHD	29(12.9%)	10(13.3%)	0.535
Stroke	10(4.5%)	6(8%)	0.186
PAD	4(1.8%)	2(2.7%)	0.469
Retinopathy	74(33%)	17(22.7%)	0.059
Nephropathy	24(10.7%)	9(12.0%)	0.455
Neuropathy	89(39.7%)	22(29.3%)	0.069
Amputation	11(4.9%)	3(4.0%)	0.517
Diabetic foot	9(4.0%)	1(1.3%)	0.537

4.6 Association of cardiovascular risk factors with respect to routes of diabetes treatment

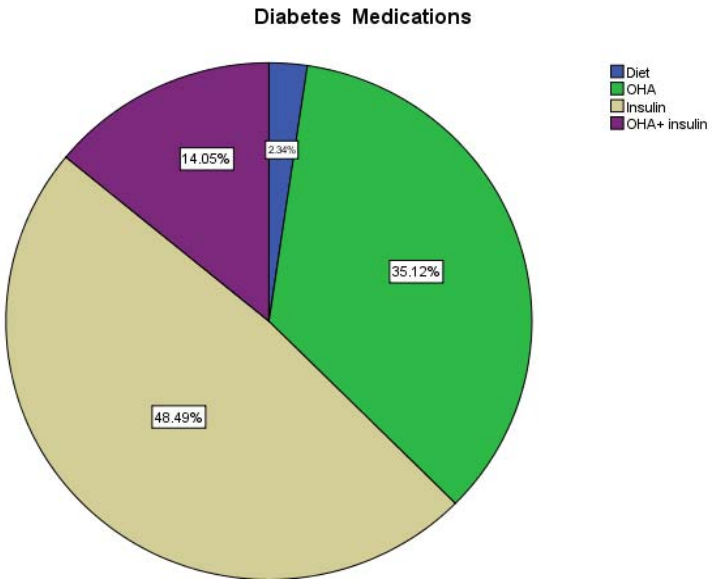

Figure 4.1: Percentages of diabetes route of treatment.
Diet 2.34%, OHA 35.12%, Insulin 48.49%,
OHA + Insulin 14.05%

Figure 4.1 shows that only small percentage of patients (2.34%) is able to control their illness with diet. About 62%% of patients are dependent on insulin either alone or in combination with OHA.

Based on **univariate analysis**, the results presented in table 4.14 show a significant difference in SBP between patients with OHA and insulin, FBG level between patients with diet therapy and the combination of insulin and OHA, and TC level between patients with oral medication and

insulin therapy . There are no significant differences in the other risk factors among patients with different route of therapies.

Table 4.14: Mean values and standard deviation of cardiovascular risk factors among diabetic patients with different route of diabetic treatment.

Risk factor	Diet only 7	Oral medication 105	Insulin only 145	Combination insulin+ oral 42	P-value
SBP	132.0 ± 24.6	***129.9± 19.2***	***123.9±19.0***	127.8± 19.2	***0.015***
DBP	82.0 ± 6.9	80.4±11.5	80.0 ±10.9	97.7 ±10.3	0.951
FBS	***140.0 ± 20.6***	185.3±63.4	190.3±76.3	***200.9 ± 80.0***	***0.039***
TC	201.8± 51.3	***184.3±39.3***	***203.4 ± 56.7***	192.9 ± 47.5	***0.003***
TG	182.0 ±139.5	201.0 ±138.8	171.3± 143.5	188.6± 106.9	0.408

Values are expressed as means's± SD, P<0.05 is considered to be significant

4.7 Diabetes duration

- **The association between diabetes duration and diabetes route of treatment**

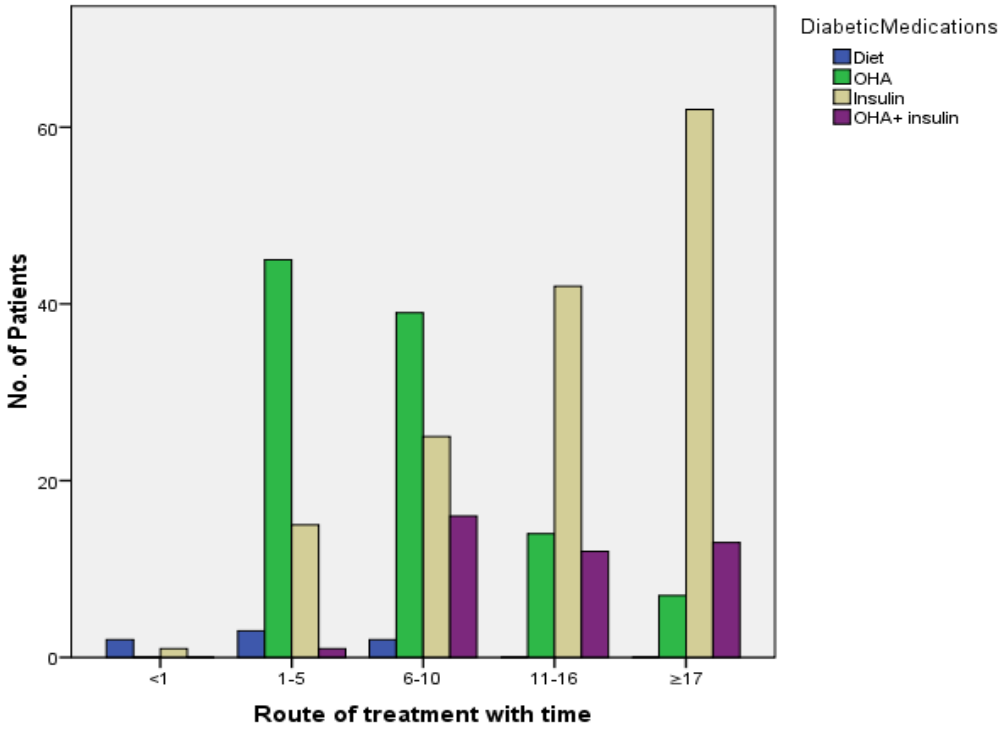

Figure 4.2: Relationship between diabetes duration and diabetes route of treatment.

After the first years following diagnosis, the proportions of patients treated with diet only lessens from 42.9% at 1-5 years to 0.0% > 10 years of disease duration. Treatment with oral hypoglycemic agent (OHA) diminishes after 10 years following diagnosis with: 42.9%, 37.1%, 13.3% and 6.7% of patients at 1-5, 6-10, 11-16 years, and ≥17 years, respectively. Treatment with insulin either alone or combination (insulin

and OHA) significantly higher after 10 years of diabetes diagnosis (P= 0.000).

- **The association of diabetes duration and diabetes complications**

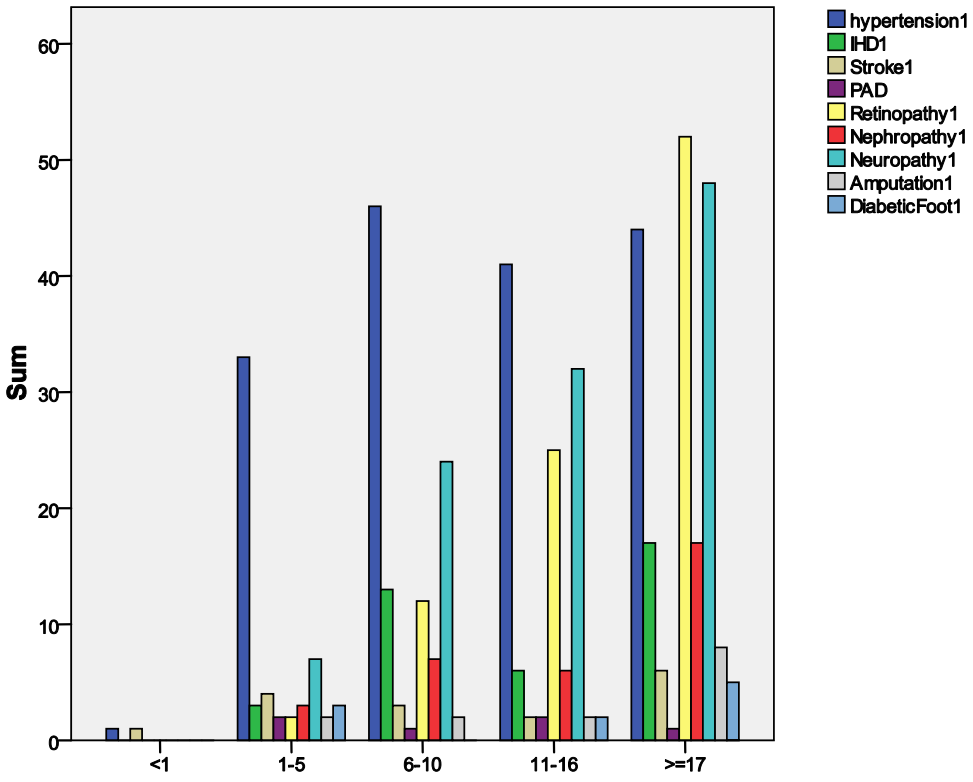

Figure 4.3: Relationship between diabetes duration and the frequencies of diabetes complications.

The results in figure 4.3 show that increasing the diabetes duration, increases the frequencies of diabetes complications especially microvascular complications (retinopathy, nephropathy, neuropathy), amputation and diabetic foot.

4.8 Association between hypertension, diabetes and other complications.

Our investigation revealed that hypertension is significantly more prevalent among patients than controls (55.2 vs 27 %, P= 0.000). When diabetic complications were compared between patients with diabetes and hypertension, patients with diabetes, patients with hypertension and subjects without diabetes and hypertension. The data clearly indicates that IHD and nephropathy are significantly higher among patients with diabetes and hypertension. In addition, retinopathy, neuropathy and amputation are significantly higher in patients with diabetes and among patients with both diabetes and hypertension.

Table 4.15: Frequencies and percentages of diabetes complications among participants without DM and HTN, with HTN, with DM and with both HTN and DM.

Complication	None	HTN	Diabetes	HTN+ Diabetes	P-value
IHD	2(1.7%)	1(2.3%)	14(10.4%)	25(15.2%)	0.001
Stroke	0(0.0%)	1(2.3%)	6(4.5%)	10(6.1%)	0.058
PAD	0(0.0%)	0(0.0%)	2(1.5%)	4(2.4%)	0.292
Retinopathy	2(1.7%)	0(0.0%)	41(30.6%)	50(30.3%)	0.000
Nephropathy	2(1.7%)	1(1.8%)	10(7.5%)	23(13.9%)	0.000
Neuropathy	1(0.9%)	0(0.0%)	52(38.8%)	59(35.8%)	0.000
Amputation	0(0.0%0	0(0.0%)	7(5.2%)	7(4.2%)	0.048
Diabetic foot	0(0.0%)	0(0.0%)	4(3.0%)	6(3.6%)	0.134

By comparing the means of the SBP and DBP between the four groups, we found significant differences among the different groups as presented in table 4.16, except for SBP: between patients with DM and healthy individuals p= 0.684, and in DPB between diabetic and healthy individuals p=0.120, and between hypertensive patients and patients with DM and HTN p=0.323.

Table 4.16: Mean values and standard deviation of SBP, DBP among participants without DM and HTN, with HTN, with DM and with both HTN and DM

Risk factor	None	HTN	Diabetes	HTN+ Diabetes	P-value
SBP	***121.38± 12.58***	***137.7± 13.9***	120.49± 16.5	131.90± 21.0	***0.000***
SBP	***121.38± 12.58***	137.7± 13.9	120.49± 16.5	***131.90± 21.0***	***0.000***
SBP	121.38± 12.58	***137.7± 13.9***	***120.49± 16.5***	131.90± 21.0	***0.000***
SBP	121.38± 12.58	137.7± 13.9	***120.49± 16.5***	***131.90± 21.0***	***0.000***
SBP	121.38± 12.58	***137.7± 13.9***	120.49± 16.5	***131.90± 21.0***	***0.045***
DBP	***76.47± 8.80***	***83.28± 9.70***	78.50± 10.37	81.54± 11.1	***0.000***
DBP	***76.47± 8.80***	83.28± 9.70	78.50± 10.37	***81.54± 11.1***	***0.000***
DBP	76.47± 8.80	***83.28± 9.70***	***78.50± 10.37***	81.54± 11.1	***0.008***
DBP	76.47± 8.80	83.28± 9.70	***78.50± 10.37***	***81.54± 11.1***	***0.011***

When other risk factors were included in the logistic regression analysis; including systolic BP, diastolic BP, FBG, TC, TG, WC, WHR, BMI, physical activity, smoking, family history of diabetes and diabetes duration, only of these factors, including systolic BP, FBG and TC, show significant associations with hypertension.

Table 4.17: Logistic regression analysis of cardiovascular risk factors in hypertension.

Risk factor	P -value	OR	CI 95%
Systolic BP	0.000	4.756	2.830-7.993
FBG	0.000	2.369	1.500-3.742
TC	0.032	1.908	1.056-3.450

4.9 Patients' awareness of macrovascular diabetes complications.

The results indicate that the awareness of macrovascular complications among diabetic patients and nondiabetic controls were almost the same (56.9% vs 57.2%, P=1.000).

Table 4.18: Frequencies and percentages of participants' awareness of diabetes complications.

Awareness	Diabetic Patients 299	Nondiabetic controls 159	P
Have idea	170(56.9%)	91(57.2%)	1.000
No idea	129(43.1%)	68(42.8%)	

4.10 Summary of the results

This chapter presented the findings of the statistical analysis. The results found that all studied CVD risk factors, except SBP, DBP and smoking, were significantly higher among diabetic patients than nondiabetic controls. The best predictors of diabetes using logistic regression analysis were TC, FHD, WC and TG. About 78 % of diabetic patients had at least one diabetes complications; HTN was in diabetic patients as twice as nondiabetics (55% vs 27%). Diabetic females were more obese (BMI, WC) and less physically active. But diabetic males were more ex- and current smokers than diabetic females. Frequencies of diabetes complications were more among diabetic male than diabetic females. Diabetic patients living in the city showed higher prevalence of almost all CVD risk factors except SBP which was higher among diabetics living in the refugee camps. Similarly, the diabetic complications were higher among diabetics living in the city. Awareness of cardiovascular complications of diabetes was low among both diabetic patients and nondiabetic controls (56.9% vs 57.2%, p=1.000) for diabetics and nondiabetics, respectively.

CHAPTER V

DISCUSSION AND RECOMMENDATIONDS

5.1 Discussion

Description of participants' characteristics

The number and percentage of diabetic females (60.5%) was higher than diabetic males (39.5%). This may inpart due to the fact that the time of collecting data conflicts with men schedule of work. While for women the response was higher as most of them are housekeepers and unemployed. Patients with diabetes who are included in the study are less educated than the nondiabetic controls. May be higher educated participants are much aware of CVD risk factors and adopt more efficient preventive actions.

The highest percentage of participants are without work, this because the highest percentage of the study population (45%) is older than 60 years old and females represents the high percentage of cases and most of them are housekeepers and without work.

The highest percentage of participants is without income for both diabetic and nondiabetic controls with 74.2%, 47.8%, respectively. These findings indicate that the Palestinian people are among worse economic situation due to the political situation. A continuous closure after Al-Aqsa Intifada led to have many persons without jobs, then getting bad economic situation among many shops, trading, and etc.

Hypotheses

We hypothesized that there is no association between diabetes and cardiovascular risk factors. Also, we hypothesized that there is no significant differences in the association of diabetes and cardiovascular disease risk factors between different gender types, place of residencies and positive family history of diabetes.

- First hypothesis

Similar to previous studies[75] [77] [78] [79], our data indicates a striking high prevalence of CVD risk factors which are significantly higher among diabetic patients in comparison to nondiabetics.

Although there is no data about systolic and diastolic BP control among the Palestinian diabetic patients, but in our study the ratio of diabetics who have systolic hypertension is 31.1% and the ratio of diabetic patients who have diastolic hypertension is 30.1%. However, the means of the DBP and SBP are acceptable for our study sample of diabetic patients as the goal for control of systolic pressure is 140 mmHg and for diastolic pressure is 90 mmHg. The difference between the prevalence of hypertension and the acceptable measurement of BP could be because of adequate pharmacological control in the studied sample. Another reason may due to the high prevalence of CVD and microvascular complications in our diabetic patients, so hypertension is measured and treated aggressively in diabetic patients for this reason[134]. In table 4.16, the means of SBP and

DBP are less in hypertensive patients with diabetes than hypertensive patients without diabetes.

Although many experimental studies did not show a causal relationship between the glycemic level and CVD[135], but it has been established that adequate control of glycemia among diabetic patients leads to tremendous reduction in the micro and macro- vascular complications of diabetes[136]. The level of control should be assessed using HbA1c rather than blood glucose level in blood which was not attainable in our study. There are no cut off points for accepted glucose levels that can be related to development of CVD, but our data shows a highly uncontrolled glycemia among diabetic patients in the study sample as measured by FBG 188.87±72.03 a value which is almost double the value for nondiabetic patients 89.80±24.0 (p=0.000). This conclusion can be interpreted as very inadequacy in the glycemic control among diabetic patients either by education or pharmacological intervention. Moreover, this is partly due to the fact that more than 50% of diabetic patients in this study are with diabetes duration of more than ten years, and diabetes duration influences glucose level directly and HbA1c indirectly [137].

Another risk factor that has been found to be high among diabetic Palestinians is total cholesterol level. The American Association for Diabetics goal for control of Cholesterol among diabetic patients (over 40 years old) is less than 135 mg/dl[62] and above this to be treated, whereas our sample of diabetic patient has a total cholesterol level of 195.24(±50.49)

which is significantly higher than the nondiabetic- cholesterol level 186.35±33.52, p = 0.025. Also, ADA recommends that level of TG to be under 150 mg\dl [138]. where as in our study the average of TG in the diabetic is 184.42 ±137.22 which was found to be significantly higher than that of nondiabetics 143.55±78.52,p=0.000. We measured only TC and TG, whereas HDL-C and LDL-C were not measured although they are meaningful in our study (financial reason). For any type of dyslipidemia (TC, TG), the prevalence was 50.7% in the whole participants and 58.2% in diabetic patients. This result is consistent with the results of other studies in Nablus[75], Saudi Arabia[90], Tunis[78], Tahran[89] and USA[79]. This suggests an important influence of diabetes on lipid profile in the diabetics in our study, lack of appropriate advice on diet and exercise and the shortage availability of regular drugs prescribed for dyslipidemia. In MoH, there is only one item of antilipidemia in the Palestinian Essential Drug List and it is rarely available in its clinics. In UNRWA, antilipidemia is not in the list of the drug that UNRWA makes available. So management of dyslipidemia in our diabetics must receive more attention, as these patients are already at higher risk of CVD. It has been suggested that using lipid-lowering agents is very important and to be more effective and cost-effective than treating hyperglycemia [139]. In our study diabetic patients are associated with obesity especially central obesity, and it is known that central obesity is associated with dyslipidemia[140]. So people with dyslipidemia especially central obesity people must be screened regularly for diabetes at any age.

Moreover, we found that diabetics have significantly higher BMI, WC and WHR than nondiabetic controls (P=0.000). However, about 80% of participants (diabetics and nondiabetics) showed overweight and obesity. For BMI (87.6% vs 62.9%, p=0.000), WC (74.2% vs 42.8%, p=0.000) and for WHR (82.6% vs 66.0%, p=0.000) for diabetics and nondiabetics, respectively. This reflects the increase of obesity in the Palestinian population as a result of urbanization, lifestyle shifting toward physical inactivity and increased food consumption. Similar to a study conducted in USA[87], BMI was the strongest predictors of diabetes in patients living in camp.

Although the relation between BMI and other risk factors was not studied in this research, but other studies[85] [86] showed the importance of having normal BMI, as control of other cardiovascular risk factors decreases with having higher BMI. Moreover, after including all cardiovascular risk factors in the logistic regression analysis, we found in this study that WC predicts the likelihood of diabetes (table 4.3) and WC, WHR (table 4.7) among diabetic females. These results are similar to the results of a study in Australia[88] and Canada[84].

It is important to mention that even though WHR, WC are convenient measures in epidemiological studies to provide estimation of the proportion of abdominal or upper body fat, but they do not differentiate between accumulations of deep abdominal fat and subcutaneous abdominal fat [141].

In addition to striking prevalence of obesity among the diabetic patients in our study, our study shows a significantly higher physical inactivity among the diabetics in comparison to nondiabetic controls (p=0.001). Prevalence of physical inactivity in the Palestinian with diabetes is less than the reported in a study conducted in US[79], although the definition of physical activity is more restrict in our study. The consideration of physical inactivity in our study defined as less than 30 minutes of moderate to intensity physical activity a day for at least 5 days a week but in that study the physical inactivity was defined as having no leisure time physical activity or who had physical activity less than 20 minutes 3 times or more times per week. This may be explained that the study in US was conducted before ten years and people now are more aware of the benefits of physical activity. Contrary to our study, physical inactivity was a predictor of diabetes in females in a study conducted in USA[87]. This may due to that the sample size in our study was not enough compared to that conducted in the USA.

The rate of smoking in all participants was 19.2%, which is close to the prevalence of smoking in the Palestinian population in 2006[32]. However, our data shows similar rate of smoking among the two study groups which could be interpreted as lack of education to stop smoking. Because of the similarity rate of smoking in diabetics and nondiabetics, smoking was not a predictor of diabetes disease. Although our results are similar to the health

survey conducted in South Wales[82], but they are different from many studies in which smoking is a predictor of type 2 diabetes[93].

As DNA analysis for susceptible genes for diabetes is not necessary till now, family history can better reflect both gene susceptibility and the other factors[20 91]. 74.9% of diabetic patients in this study had first degree family history of diabetes. The contribution of a positive family history is in agreement with the previous studies in Nablus 81%[75] and also in Ramallah district in which FHD was a predictor of diabetes[81 125]. These high percentages of family history of diabetes revealed an obvious familial propagation of diabetes in the Palestinian population. Individuals with a family history are about 2.00-4.9 times more likely to develop diabetes than those without a family history (table 4.3). On the contrary to a study conducted in Italy[92], in our study patients with positive family history of diabetes did not show significant differences in the risk factors and complications compared to those with negative family history. This may be explained that positive family history of diabetes has its effect on individuals through the development of diabetes.

In all studies conducted in Palestine, FHD was a predictor of diabetes. Similarly, it has been found in our study to contribute independently to diabetes for all participants (diabetic females and males) and diabetes in patients living in the city, village and camp. However, it is rarely used to assess such risk in Palestine, it is only included in the patient's medical file after the patient has already been diagnosed with diabetes. On the contrary,

the American Diabetes Association, the American Heart Association and the National Cholesterol Education Program included family history in their guidelines and considered family history as a factor to be assessed and made decision about treatment[21]. WHO estimated that half of diabetes individuals are undiagnosed[36]. So the use of family history screening could capture many of these undiagnosed individuals who may take advantage from early intervention.

In conclusion, diabetic patients in Nablus district in Palestine were found to have high prevalence of CVD risk factors which included SBP, DBP, hyperglycemia, high WC and WHR values, and high levels of TC and TG. Also, the diabetic patients in Palestine tend to be more obese, physically inactive, and equally smoker as non-diabetic controls.

The logistic regression model was run to predict the most significant CVD risk factors that are independently associated with DM. Our analysis indicates that TC, FHD, WC and TG are significantly associated with DM in the Palestinian group in Nablus table 4.3. Three of these four risk factors are modifiable. In a Palestinian semi-rural area, the risk factors associated with diabetes were age, FHD, TG and WHR[81]. In Jordan, the risk factors were sex, age, FHD, HTN, TC and TG[80]. These results were comparable to the results in our study.

Other factors which were not found to be significant in our model could have indirect association with DM. For example, physical inactivity could have an influence through TC, TG and WC.

Given the high prevalence of CVD risk factors among diabetics, the prevalence of macrovascular and microvascular complications was found to be strikingly high; about 78% of diabetic patients in our study were found to have at least one microvascular or macrovascular defect. This is alarming finding implies the necessity of implementing better strategies for the control of CVD risk factors among diabetics in Palestine. Further studies are needed to locate the shortcomings in the diabetes care in the primary healthcare units. Preventive intervention programs at both primary and secondary health care levels are warranted as treating microvascular and macrovascular complications could be very expensive.

The prevalence of complications range from twofold to many folds higher in diabetic patients than nondiabetic controls. On the contrary to the results of a study conducted by Al Quds university, in which diabetes was not consider a significant risk factor for stroke[97], diabetes in many studies was considered a risk factor for CHD[94], heart attack[95] and stroke[96]. A previous study in Finland indicated that the simultaneous presence of high FBG and dyslipidemia increase the risk of CHD to threefold[98]. Our results of diabetes complications are very similar to those results published in Saudi Arabia[102]. Although the complications in this study are less than the complications in the United Arab Emirate, the adverse risk factors are higher in our study

than those in the UAE. This may due partly to that methods used in diagnosing diabetic complications in the UAE are more sensitive as in nephropathy[103]. The rates of complications in this study were less than those in a study conducted in Iran[99] due to the differences in settings. Our study was conducted in the primary health care clinics and that study in hospitals with more complicated conditions. Diabetes complications in many studies developed even after controlling blood sugar[100] [101], in our study the mean of plasma blood glucose was high, so it is expected to have this high prevalence of complications in our study.

- Second Hypothesis

Gender differences

Several studies [112] [113] [114] [115] [116] indicated that the risk of CVD in diabetic female is higher than the risk in diabetic male. In this study, statistical significant greater adverse differences in the cardiovascular risk factors in diabetic versus nondiabetic were observed in women than in men, but in the other side the complications were more in diabetic males than diabetic females. This can be interpreted that important risk factors for micro- and macrovascular complications were more prominent in diabetic men than diabetic women as SBP, DBP, WHR and smoking. In other studies, SBP was the best predictor of CVD in men at any age and DBP in men< 60years old[142]. Furthermore, SBP was the most useful predictor of chronic kidney disease in men[143]. In Asia, the attributable risk from smoking for

developing CHD was about 30% in men and 3% in women[144]. Similarly, smoking showed an independent association with nephropathy[145]. Another possible explanation may include non-compliance in diabetic male with medications.

The frequencies of BMI and WC were significantly higher in diabetic female than diabetic males; this can be explained by the lower levels of physical inactivity in women than men, weight gains in pregnancy and not returning to optimal weight.

The results of our study are similar to results of a study conducted in Pakistan and Lebanon in which the frequencies of obesity, low HDL and HTN were significantly higher in diabetic females[117 120] but the frequencies of diabetic complications were higher in diabetic males [117 118 119].

In women, measures of central obesity (WHR, WC) are from the best predictors of diabetes. Our result is similar to results of a study conducted in Australia, in which WHR is the strongest predictor of diabetes especially in women[88]. Moreover, TG was a predictor of diabetes in females while TC was the strongest predictor in males. Our findings differ from an Israeli study in TG was an independent predictor of diabetes in young male. It is known that TG synthesis and utilization are influenced by insulin sensitivity and lifestyle factors. So TG readings could be a good biomarker of lifestyle[120].

Place of residency

Diabetic patients living in the refugee camps showed higher SBP and BMI than other diabetic patients and this is consistent with the result of previous study in Nablus[75]. Moreover, HTN is most prevalent in diabetic patients living in the refugee camps. This is can be interpreted that the prevalence of HTN in the Palestinian refugees was higher than the national percentage, 3.6%, 3.3%, respectively (Palestinian family health survey, 2006)[30]. Diabetic patients living in the city showed the highest means and frequencies of all cardiovascular risk factors except SBP and BMI (higher among patients living in camp). Moreover, the prevalence of diabetic complications was the highest among diabetic patients living in the city except HTN. This matches the findings that cardiovascular diseases are more prevalent in the urban areas due to higher prevalence of cardiovascular risk factors in the city than those in the village[65 122 123 124]. Diabetic patients living in camps showed almost the least frequencies of diabetic complications although they have nearly the same lifestyle and urbanization as individuals in the city. This may be interpreted that UNRWA diabetes clinics are more efficient in the treatment and follow up of diabetic patients.

Diabetes route of treatment

By comparing the percentages of route of treatment in Nablus district and the whole Palestinian population[126], the results showed a higher use of

insulin therapy either alone or in combination with OHA in Nablus district. This may be interpreted that patients in Nablus have uncontrolled glycemia compared to other Palestinians, partly may due to the social culture and the availability of several sweets in Nablus.

Diabetes duration

The results of studies confirm the need of treatment intensification as diabetes duration increases[127]. In this study, diabetes treatment intensified in order to reach adequate metabolic control, but the results indicated that even in intensified treatment the measures of cardiovascular risk factors were still high as in insulin treatments. This may due to decrease insulin sensitivity and ß cell failure as diabetes duration increases[127]. Moreover, the frequencies of diabetic complications were significantly higher among those with longer duration of diabetes. These results are comparable to other studies [117] [128].

Hypertension

Hypertension is a highly co-morbid condition in diabetic patients. In this study the prevalence of hypertension in diabetic patients was twice as frequent as nondiabetic controls (55.2 vs 27.0%, P= 0.000). This percentage is comparable to other studies[105]. Moreover, combination of diabetes and hypertension has increased the likelihood of the development of complications[106] [107].

SBP, FBG and TC were predictor of hypertension in this study. Lipids and BP have been associated in several studies[108] [109] [110]. So recognition of dyslipidemia and starting treatment and lifestyle changes can reduce the burden of hypertension and other CVD. Similarly for SBP which was also a strong predictor for hypertension in Utah studies[111].

Patient's awareness of macrovascular complications

There is no data about the level of awareness about diabetes complications in the Palestinian population. A study conducted in India indicated that diabetic patients are more aware of diabetic complications than the whole population[132]. On the contrary, the level of awareness of diabetic complications was comparable in diabetic patients and nondiabetics controls (56.9% vs 57.2%, P=0.000). These results are similar to the results of other studies like the one About 43% of diabetic patients are not aware of CVD complication of diabetes; they are more likely to be aware and fearful of complications of disabilities such as blindness and amputation (not reported), although CVD is the leading cause of diabetes-related death. So intensive diabetes education about diabetes complications can improve the patients' outcomes and glycemic control. With the knowledge of severity of complications, the public would not take the symptoms lightly and would search for medical consideration. This may cut the burden of diabetes and its complications.

The results of our study emphasize the need of multi-interventions for the multiple risk factors in diabetic patients, as the risk of CVD in diabetic patients can be lessened by a targeted, long term, intensified intervention for multiple risk factors[146].

5.2 Recommendations

Recommendations from the study

- Sustainable availability of expensive dyslipidemia medications are rarely achieved in MoH and never in UNRWA. So we recommend more attention from the decision makers about the problem of dyslipidemia in diabetic patients and the availability of medications.

- In the MoH and UNRWA diabetes clinics, only BMI was used to indicate obesity. Other important measures as WC, WHR must be added to routine follow up procedure of diabetic patient's status and inform patients about the target value of these measures.

- Only 56.5% of diabetic patients in this study showed both SBP less than 140 mmHg and DBP less than 90 , but most BP guidelines now recommend a lower target for diabetic patients than nondiabetics, as in ADA 130/80 mmHg. So adding this target to our protocol for diabetes treatment is highly recommended.

- In UNRWA clinics, screening for diabetes is done for all people > 40 years old age. Just step in the MoH clinics will be helpful as many diabetes complications start before the diagnosis of diabetes. Moreover, it is recommended to consider screening in adults of any age who have risk factors for diabetes as central obesity, dyslipidemia and first degree family

history of diabetes. Moreover, diabetic patients should be screened frequently for early complications and treated appropriately.

- There is a need to improve the diabetic patients' and general populations' awareness of diabetic complications, cardiovascular risk factors and the importance of lifestyle modifications. This could be achieved by improving patients' counseling by primary care physicians, or through campaigns and media to aware general populations, with messages like in Australia, reduce your waist, reduce your risk.

- The results of this study indicated that type 2 diabetes mellitus is becoming a major public health problems. Major efforts by health policy-makers are needed to improve public education and health programmes that aim at early detection and enhanced control of T2DM (especially for diabetic patients living in the city and diabetic males). Moreover, clustering of cardiovascular risk factors with DM need more attention.

Recommendations for further researches

- High percentage of studied diabetic patients (about 81.2%) was with uncontrolled FBG. Further studies are needed to identify the causes of hyperglycemia that may be attributed to inefficient current treatment or patient's incompliance to treatment and recommended diet.

- A considerably high percentage of cardiovascular risk factors and diabetic complications were revealed in our diabetic patients. Although the results

are apparently disappointing, they may not reflect our diabetic populations as a whole since the subjects selected were outpatients in the MoH and UNRWA diabetes clinics, further researches in this subject are recommended with including inpatient diabetics and diabetics in the private sector.

Finally, as life expectancy in Palestine is increasing, more risk factors and complications of diabetes are expected in the next years. So effective interventions must be developed and implemented in the national level.

5.3 Limitation of the study

- The study included only outpatients diabetics registered in MOH and UNRWA diabetes clinics, diabetic patients treated in private sector or in the hospitals are not included, so the results may not be generalizable to the overall diabetic patients.

- Although it is a case control study but it is not able to show causality, as exposure and effect were measured simultaneously.

- Part of the questionnaire was based on self-report, so there was the potential of recall bias, particularly about the counseling of cardiovascular risk factors by physician.

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Questionnaire

About cardiovascular risk factors and diseases in Diabetic and nondiabetic people in Nablus district

No:

Demographic Data	
Name	
Gender	**a- Male b - Female**
Age	
Level of education	**a-Illiterate b- Less than Tawjihi c-Tawjihi c- Bachelor and above**
Place of Residence	**a- City b-Village c- Camp**
Address, Tel	
Marital status	**a- Single b- Married c-Widow/er**
Profession	
Average income per month	**a- <1000 NIS/month. b- 1000-2500 NIS/month. c- >2500 NIS/month. d- No income**

Diabetic and Nondiabetic Patients	
Do you have diabetes?	**a - Yes b - No**
When your diabetes was first diagnosed?	
How your diabetes was first diagnosed?	**a- Routine investigation b- By chance c- Symptoms d-Gestational Diabetes**

Physical Activity	
Do you walk (or do other moderate activity) for at least 30 minutes on most days, or at least 150 min per week?	**a - Yes. b - No.**

Smoking Tobacco	
Do you smoke tobacco?	**a- Current smoker. b- Ex-smoker. c- Never smoker.**
What kind of tobacco do /did you use?	**a- Cigarette. b- Waterpipe. c- Both.**

Current smokers:	
For cigarette smokers	**a- < 10 cigarettes /day.** **b- 10-19 cigarettes /day.** **C- 20-29 cigarettes /day.** **d- 30-39 cigarettes/day.** **e - > 40 cigarettes/day.**
For waterpipe users **How many times do you use waterpipe?**	**a- 1 time/day.** **b- 2 times/day.** **c- 3 times/day.** **d- > 4 times/day.**
For ex-smoker: **I have quitted smoking for**	**a-Less than 1 year.** **b-More than 1 year and less than ten years.** **c- More than ten years.**

Family History	
Do other members of the family have cardiovascular diseases (mother, father, sister, brother)?	**a - Yes.** **b - No.**
Do other members of the family have diabetes (mother, father, sister, brother)?	**a- Yes.** **b- No.**

***Patient awareness*:**
1. Which of the following conditions could diabetes cause? • **Myocardial Infarction.** • **Stroke.** • **Peripheral arterial disease.**

Counseling:
Do you receive counseling from your physician about the following topics? • **Weight loss.** • **Smoking cessation.** • **Increasing physical activity.** • **Eating less fat.**

***Cardiovascular diseases*: Do you have any of the following diseases?**		
Hypertension	**a - Yes**	**b - No**
Ischemic heart disease	**a - Yes**	**b - No**
Stroke	**a - Yes**	**b - No**
Peripheral arterial disease	**a - Yes**	**b - No**
Retinopathy	**a - Yes**	**b - No**
Nephropathy	**a - Yes**	**b - No**
Neuropathy	**a - Yes**	**b - No**
Amputation	**a - Yes**	**b - No**
Diabetic Foot	**a - Yes**	**b - No**
Hyperlipidemia	**a - Yes**	**b - No**

Other diseases	

Current medications:	

Blood pressure	
Average blood pressure of the two reading	**mmHg**

Blood sugar	
Blood sugar level	**mg/dl**

Lipid profile	
Total cholesterol	**mg/dl**
Triglycerides	**mg/dl**

Anthropometric indices		
Body mass index (BMI)	**Weight =**	**Kg**
	Height =	**m**
	BMI =	**kg/m2**
Waist circumference (WC)	**WC =**	**cm**
Waist-to-hip ratio (WHR)	**Hip =**	**cm**
	(WHR) =	**%**

Patient name and signature:

Date:

جامعة النجاح الوطنية
كلية الدراسات العليا

أمراض القلب الوعائية و عوامل الخطر القلبية الوعائية بين مرضى السكري, منطقة نابلس, الضفة الغربية, فلسطين: دراسة الحالة المراقبة

إعداد

هدى نمر محمد اللحام

إشراف
د. هشام درويش
د. سامر حمايدة

قدمت هذه الأطروحة استكمالاً لمتطلبات درجة الماجستير في الصحة العامة بكلية الدراسات العليا في جامعة النجاح الوطنية في نابلس، فلسطين.

2009

أمراض القلب الوعائية و عوامل الخطر القلبيية الوعائية بين مرضى السكري، منطقة نابلس، الضفة الغربية، فلسطين: دراسة الحالة المراقبة

إعداد
هدى نمر محمد اللحام
إشراف
د.هشام درويش
د. سامر حمايدة

الملخص

هدف الدراسة:

الهدف الرئيسي للدراسة هو مقارنة معدل انتشار عوامل الخطر القلبية الوعائية و مضاعفات مرض السكري القلبية الوعائية عند المرضى المصابين بالسكري و غير المصابين بالسكري في منطقة نابلس.

طرق البحث:

تم إجراء هذه الدراسة في 7 عيادات سكري تابعة لوزارة الصحة الفلسطينية و وكالة الغوث الدولية ل 299 مريض سكري و 159 مشارك غير مصاب بالسكري. تم إجراء مقابلة وجها لوجه لتعبئة الإستبانة الخاصة بالدراسة، تم قياس مؤشر كتلة الجسم، محيط الخصر، معدل الخصر إلى الفخذ، و ضغط الدم، ثم تم أخذ عينة دم بعد صيام 8-10 ساعات لقياس نسبة السكر الصائم، مجموع الكولسترول الكلي و الدهنيات الثلاثية.

النتائج :

الدراسة بينت أن جميع عوامل الإختطار القلبية الوعائية ما عدا ضغط الدم الانقباضي والانبساطي و التدخين هي أعلى عند مرضى السكري من غير المصابين بالسكري. و بتطبيق تحليل الانحدار

اللوجستي تبين أن مجموع الكولسترول الكلي، التاريخ العائلي للإصابة بالسكري، قياس الخصر و الدهنيات الثلاثية كانت عوامل مستقلة مصاحبة للسكري يعتد بها إحصائيا.

حوالي 78% من مرضى السكري يشكون على الأقل من مضاعف واحد من مضاعفات السكري، حيث نسبة ارتفاع ضغط الدم عند مرضى السكري 55.2%هي ضعف نسبته عند غير المصابين بالسكري 27%.

أظهرت الدراسة أن الإناث المصابات بالسكري هن أكثر سمنة و أقل نشاط بدني من الذكور المصابين بالسكري. في حين نسبة المدخنين السابقين و الحاليين هي أعلى عند الذكور. كما أن معدل مضاعفات مرض السكري هي أعلى عند الذكور المصابين بالسكري من الإناث المصابات بالسكري.

معدل انتشار معظم عوامل الخطر القلبية الوعائية أعلى عند مرضى السكري المقيمين في المدينة من المرضى المقيمين في القرى و المخيمات ما عدا ضغط الدم الانقباضي و دليل كتلة الجسم حيث أنه أعلى عند المرضى المقيمين في المخيمات. بالنسبة لمضاعفات مرض السكري نسبتها أعلى عند المقيمين في المدينة.

نسبة الوعي بمضاعفات مرض السكري كانت قليلة بالنسبة لمرضى السكري و غير السكريين.

و أخيرا ، بما أن نسبة التمدن و السمنة في فلسطين عالية و نسبة الوعي قليلة، فإنه من المتوقع حصول زيادة في عوامل الخطر و مضاعفات مرض السكري في السنوات القادمة، لذا يجب تطبيق و تطوير التدخلات الفعالة على المستوى الوطني.

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Maternal mortality ratio (per 100 000 live bi

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