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Epidemiological Analysis of Type II Diabetes Mellitus among Hail Residents, Saudi Arabia

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Abstract

Type II diabetes is a global health concern. This epidemic is elevating in increasing rates in Saudi Arabia. Thus, the study investigates a number of risk factors of Type II diabetes in Hail region, one of Saudi Arabia's highest regions in diabetes records among adults. Data are collected using diabetic subjects from the Diabetes Registry Records in King Khalid Hospital at the city of Hail, Saudi Arabia, where 200 subjects' records from 2014 to 2018 were included. A binary logistic regression was utilized to assess the association between age, gender, obesity, hypertension, family history, hypercholesterolemia, and hyperglyceridemia as risk factors and Type II diabetes. Some risk factors yielded statistical significant associations such as age (OR = 486.00 for 61 and older; OR = 468.00 for 51 - 60; and OR = 130.50 for 41 - 50; p-values ≤ 0.01), obesity (OR = 3.088; p-value ≤ 0.01), and hypertension (OR = 8.476; p-value ≤ 0.01), while gender, family history, hypercholesterolemia, and hyperglyceridemia were insignificant risk factors in our study. Proper intervention measures targeting diabetes risk factors may tackle or delay this public health issue.

Keywords

Type II Diabetes, Risk Factors, Saudi Arabia

1. Introduction

As demonstrated by the recent trends in diabetes prevalence, there is an increased worry about the rising tide of type II diabetes in Arabic-speaking regions. Saudi Arabia is among these that have probably the most elevated rates of diabetes increase [1]. The prevalence of Type II diabetes in grown-ups in Saudi Arabia is 24.3%, which is 17.1% of the population [2]. On the other hand, fewer

epidemiological examinations have been conducted among the quickly developing population in the Hail region of Saudi Arabia.

In Hail region, Type II diabetes is a major public health concern due to the expanding prevalence and enduring health issues in this region. Indeed, even with incredible improvements in clinical sciences and diabetes science, it is as yet a desperate long-lasting illness. In Hail City, Type II diabetes is quickly developing among various age groups for both males and females [3] [4]. In that regard, it draws in different physiological and economic challenges concerning the city and the surrounding region due to the prevalence of the disease [5]. Like in many other developed countries, Type II diabetes has become increasingly prevalent in Saudi Arabia, especially in the twenty-first century.

According to contemporary literature on diabetes, the prevalence of diabetes in Saudi males was discovered to be 35.2% and 28.7% in their female counterparts. These trends were almost consistent in Hail region where the prevalence of diabetes was reported to be 31.1% (32.6% for males and 29.6% for females) [4]. In fact, in the 2013 Health Information Survey administered by the Saudi Ministry of Health, Hail region was one of the top two regions in diabetes prevalence, hypertension, cholesterol level, and scored the highest region in obesity levels across the nation [2]. On the other hand, there is a high prevalence of child and grown-up weight and diabetes among the Saudi female population of the Hail region [6]. As illustrated by WHO, the Middle East will have the highest increase in the female diabetes population in the next two decades [7]. This information and the accompanying statistics focus research towards the rising weight issues and diabetes in Hail region and the rest of the Saudi population and its likely explanations. Currently, few epidemiological studies have been accounted for on the occurrence and prevalence of diabetes in Hail region, just as it is the case for the rest of Saudi Arabia. The major financial changes in this nation during the past few years are a possibility of this case. Similarly, the effect of the dietary patterns, lack of physical exercises, and general lifestyles of individuals living in Hail region [8], alongside the aging of the population, make it a significant issue that requires more in-depth scrutiny [9].

In Hail region, as in the remainder of Saudi Arabia, females had higher occurrence paces of Type II diabetes among children and youths than males, and more seasoned age gatherings of children and teenagers had higher rate paces of Type II diabetes than more youthful age groups. The occurrence pace of Type II diabetes was higher in the nation's focal region [9]. A more noteworthy prevalence of Type II diabetes was accounted for among those living in metropolitan than in the rural areas. This study prescribes that critical consideration should be paid to creating, backing, and implementing health interventions, rules, and strategies from one side of the country to the other. There can be major intervention measures to hinder the avoidance of issues that increase the chances of diabetes and to advance self-administration of diabetes [7]. For the future, all

around planned epidemiological investigations are needed to consider more exact and standard observation of the occurrence and prevalence paces of diabetes across Saudi Arabia.

There are low awareness and information levels to measure Type II diabetes-related data among northern parts of the Saudi Arabian population. This requires the enhancement of conditions for a complete awareness program. Females are more deprived of being focused on Type II diabetes counteraction and control programs [10]. In such cases, indiscriminate actions into this issue at the health strategy level are essential for a better understanding of this health problem, and in order to prompt an extreme reduction in the pressure of Type II diabetes in Saudi Arabia.

As explained by Kameel *et al.* [11], results such as eye examination, foot examination, nephropathy, annual triglyceride level, HDL cholesterol, LDL cholesterol, and blood pressure measurements are critical indicators of diabetes. These indicators are collected when people go for usual medical checkups as well as standard treatment procedures. In that regard, they are considered, among others, major indicators of the prevalence of diabetes in Hail region and the rest of the Saudi population. Elevated levels of blood pressure and obesity are also major risk factors of diabetes that are known to be associated with diabetes in Saudi Arabia and in the rest of the world [12].

Thus, this study aims to investigate a number of risk factors of Type II diabetes among Hail residents, Saudi Arabia. This will be explored through analyzing the association between diabetic patients in Hail and some well-established risk factors of the disease; namely, age, gender, weight, hypertension, family history of the disease, hypercholesterolemia and hyperglyceridemia.

2. Methodology

2.1. Data Collection Procedure

As the study is based on Hail residents in Saudi Arabia. A random sample of 200 diabetic patients aged 10 years and above was obtained from the Diabetes Registry Records in King Khaled Hospital in Hail, Saudi Arabia. The obtained records include information on admitted diabetic patients from 2014 to 2018, containing their residence, type of diabetes, age, gender, weight, hypertension, comorbidities and others. The Diabetes Registry Records registers and collects information on all patients who were admitted to the hospital seeking diabetes consultation and/or treatment for several years. However, in 2012, electronic records were introduced and files were created for each patient, after obtaining proper consents, containing their personal information, demographic and socioeconomic data, and medical history. It then assigns an identification number for each file for patient confidentiality purposes. The data for this study was obtained by limiting the data timeframe to the years between 2014 and 2018, and by the use of digital randomization selection, 200 subjects were included. The researchers have obtained legal data release forms from the registry and the

study is officially approved by the Research Ethics Committee (REC) at the University of Hail with letter number 42/5/38862.

2.2. Study Design and Risk Factors

A retrospective study design was adopted to review the data and determine the association between Type II diabetes and selected risk factors of diabetes, based on knowledge from literature and availability of data. These risk factors include age, gender, obesity, family history of the disease, hypertension, hypercholesterolemia and hyperglyceridemia. Age was categorized into six categories (20 and below, 21 - 30, 31 - 40, 41 - 50, 51 - 60, 61, and older), and (20 and below) was considered as the reference group for age. Male was considered as the reference group for the gender risk factor. Moreover, participants were asked and tested whether or not (Yes or No) they had family history of diabetes, obesity, and/or hypertension (obesity = 30 BMI or higher and hypertension = 140/90 mm Hg or higher). Likewise, hypercholesterolemia and hyperglyceridemia were tested and categorized as high or normal (high hypercholesterolemia = 240 mg/dL or more and high hyperglyceridemia = 500 mg/dL or more).

2.3. Statistical Analysis

Binary logistic regression was used to determine the risk factors for Type II diabetes mellitus among Hail residents, Saudi Arabia. The objective of the analysis was to determine the association between Type II diabetes and specific risk factors that were considered in this study, which included age, gender, family history of diabetes, obesity, hypertension, hypercholesterolemia, and hyperglyceridemia. First, descriptive statistics, using means and standard deviations, were generated to review data patterns and help understand the effect of the selected risk factors. Then, a binary logistic regression model was adopted that yielded odds ratio with a 95% confidence interval and p-value ≤ 0.01 to determine the significance level. The data was analyzed using SPSS 21.0 software.

3. Results

Data were collected from a total of 200 patients with diabetes. The mean age of patients was (52.78) years with a standard deviation (14.23) (see Table 1). The distribution of age is visualized in Figure 1. Young adults (20 and below) make up to 5% of this study. This category of age was also the least affected by the disease. There were only 2% of the diabetic patients between the age of 31 - 40 years old. Most of the patients belong to the 41 - 50 years age category (31%), and more than 50% of patients were 51 years old and above (54%) (see Figure 1).

There were less obese (57%) patients with diabetes Type II in the sample as compared to the obese (43%) (see Table 1). A similar pattern can be observed for hypertension, (54%) diabetic patients with no hypertension and (46%) patients with hypertension (see Table 1).

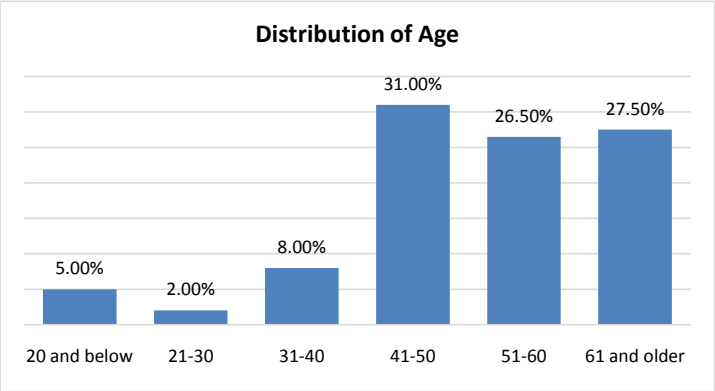


Figure 1. The age distribution.

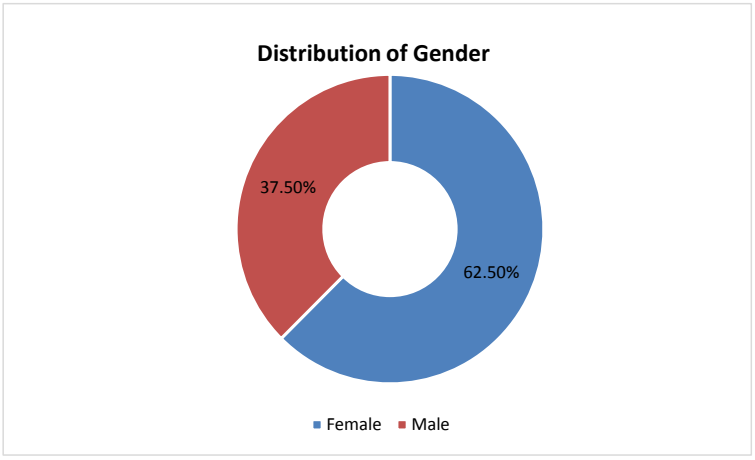
Table 1. Descriptive statistics of selected risk factors for Type II diabetes.

Risk Factors	Mean	Standard deviation
Age	52.78	14.23
	Yes	No
Obesity	43%	57%
Hypertension	46%	54%
	High	Normal
Hypercholesterolemia	26.52%	73.48%
Hyperglyceridemia	17.13%	82.87%

There were no patients with Type II diabetes in the random sample who had low hypercholesterolemia and low hyperglyceridemia. Most patients with Type II diabetes had normal hypercholesterolemia (73.48%), while only one-third of the sample patients had high hypercholesterolemia (26.52%) (see **Table 1**). There were more diabetic patients with normal hyperglyceridemia (82.87%) as compared to high hyperglyceridemia (17.13%) (see **Table 1**).

Similarly, for gender, there were more female (62.5%) with Type II diabetes as compared to male patients (37.5%). Furthermore, there were more patients in the sample with a family history of diabetes (80.5%) (see **Figure 2**).

In this study, age was the most substantial risk factor contributing to Type II diabetic patients (OR = 486.00 for 61 and older; OR = 468.00 for 51 - 60; and OR = 130.50 for 41 - 50; p-value ≤ 0.01). This implies that the older the person the more likely to have diabetes, while younger ages showed no significant association with the disease. Furthermore, hypertension was another significant risk factor that contributes to Type II diabetic patients (OR = 8.476; p-value ≤ 0.01). Likewise, obesity was found to be a significant risk factor in diabetic patients (OR = 3.088; p-value ≤ 0.01), making it another important contributor to the Type II diabetes in Hail region (see **Table 2**). Surprisingly, our data showed weak associations between gender and family history, on one hand, and having diabetes on the other. Similarly, hypercholesterolmia, and hyperglyceridemia had no significant effects on acquiring Type II diabetes.



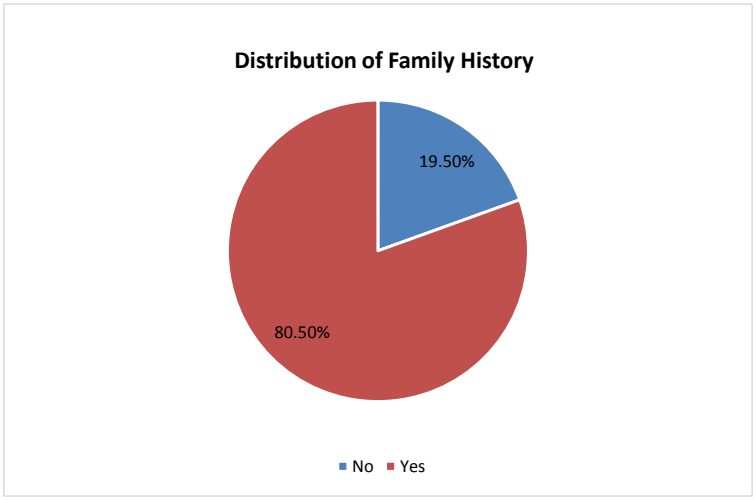


Figure 2. Distribution of gender and family history.

Table 2. Odds Ratio estimates for diabetes Type II.

	Odds ratio	*p*-value	95.0% C.I. for Odds ratio	
			Lower	Upper
20 and Below		<0.001		
21 - 30	3.00	0.482	0.140	64.262
31 - 40	7.00	0.096	0.709	69.121
41 - 50	130.50	<0.001	13.070	1303.013
51 - 60	468.00	<0.001	26.783	8177.740
61 and older	486.00	<0.001	27.826	8488.208
Hypertension	8.476	0.001	2.461	29.194
Obesity	3.088	0.010	1.312	7.271
Gender (Female)	0.811	0.631	0.344	1.910
Family History	0.686	0.511	0.223	2.112
Hypercholesterolemia	0.858	0.753	0.332	2.218
Hyperglyceridemia	1.604	0.467	0.449	5.733

4. Discussion

This study showed that age, hypertension, and obesity were statistically significant risk factors found in Type II diabetic patients living in Hail region, Saudi Arabia. Notably, the association between age and obesity, as risk factors, and Type II diabetes was consistent with the finding in previous literature. It has been noted that the older the patient, the more likely to be exposed to having Type II diabetes. For instance, the Centers for Disease Control and Prevention (CDC) listed age (over 45 years old) and overweight as likely risk factors for Type II diabetes [13]. Hypertension, on the other hand, was reported to be twice as a common condition in diabetic people compared to nondiabetic people [14].

Other risk factors, family history of diabetes, gender, hypercholesterolemia, and hyperglyceridemia were found to be statistically insignificant in the model, contrary to the findings of some previous studies. Gender, for instance, was found to be significant risk factors for Type II diabetes in multiple studies [15] [16] [17] [18]. Likewise, the American Diabetes Association and the CDC have listed family history as a strong indicator for developing prediabetes and Type II diabetes [13] [19].

To explain these inconsistencies, one must explore the sample at hand and consider the different factors that may have affected the results. As for gender, although there were more females than males with Type II diabetes in the sample, gender has not been always a strong risk factor. This is due to the fact that in some studies males were more susceptible to diabetes than females [15], while in others the case was vice versa [18]. Thus, there seems to be mixed results in this regard which may indicate that this risk factor might be affected by other elements. In fact, recent literature has started to challenge the proposition that there is a gender bias in acquiring diabetes. For example, Kautzky-Willer, Harreiter & Pacini stated that the susceptibility of Type II diabetes differs between gender due to biological, cultural, genetic, and lifestyle differences, and that it can affect one gender in one place or culture differently than it affects the same gender in another place or culture [20]. Moreover, some suggest that the gender risk factor appears more in older studies and that recent literature has refuted this proposition. Gale and Gillespie state that "type II diabetes showed a pronounced female excess in the first half of the last century but is now equally prevalent among men and women in most populations" ([21] p. 3). Therefore, despite the higher percentage of diabetic women in the sample compared to men, the factors contributing to it might be biasing the results, whether these factors were cultural, environmental, or any other factors unaccounted for in the study sample.

Family history, on the other hand, is an established risk factor by the general consensus in the scientific community. The fact that our results showed otherwise draws the attention to what was wrong in the sample. The most plausible explanation is that participant either had no knowledge of family history as a leading risk factor for diabetes or did not report it for unknown reasons. The

former could be supported by evidence from studies conducted on the knowledge and attitude towards diabetes and its risk factors in the same Hail community. A study by Ahmed *et al.* [10] reported that around 60% of the surveyed population in Hail had few or no knowledge about the risk factors, symptoms, and prevention of diabetes mellitus (DM). Perhaps more importantly was the finding of another study that explored participants knowledge of diabetes in Hail and stated that "participant's age was found to have a significant association with participant's knowledge of diabetes" ([22] p255), and that younger participants only, compared to the older ones, identified the linkage between family history and diabetes [22]. This may explain our results of having no association between family history and diabetes, especially knowing that participants in our study were more likely to be older than younger.

The lack of association between hypercholesterolemia and hyperglyceridemia, as risk factors, and Type II diabetes was not alarming since some studies have yielded similar finding. Besseling *et al.* [23] noted that Type II diabetes was substantially lower in patients with hypercholesterolemia compared to those who had no hypercholesterolemia. Similarly, it has been demonstrated that although hyperglyceridemia is usually linked with diabetes, this factor may not, by itself, be a risk for developing the disease [24].

Finally, this study has several limitations to point out. First, there might be a number of important risk factors that were neglected. For instance, the CDC listed out lack of physical activity and dietary habits as some of the essential causes of Type II diabetes. The lack of such data in the obtained medical records has prevented the inclusion of those risk factors in our study. Second, the study sample seems to suffer from some drawbacks. The sample size (200 subjects) might not be large enough to reflect more accurate results regarding the issue. Moreover, although the intention was to collect a random sample, the fact that all subjects were drawn from medical records located in one hospital may compromise that intention, and it could suffer from biases usually present in convenience sampling. However, given the lack of similar studies that targeted this issue in Hail region, and given the more complex study design used here in comparison to other existing studies, it may make our finding valuable for policymakers and future researchers alike. This contribution must not be overlooked, and preventive policies as well as knowledge accumulation can be enhanced through the utilization of the finding in this study in order to improve and tackle the diabetes epidemic in this region.

5. Conclusion

This study investigated a number of risk factors of Type II diabetes in Hail region, one of Saudi Arabia's highest regions in diabetes records among adults. The study showed significant associations between Type II diabetic patients and age, hypertension, and obesity. These results were consistent with a major body of literature investigating diabetes risk factors. However, unlike finding in some

previous studies, other risk factors such as gender, family history, hypercholesterolemia, and hyperglyceridemia showed no association with the disease. Future studies may expand on ours by the adoption of proper study designs that do not rely on historical data, such as prospective cohort study design, and ensure that a collection of comprehensive data takes place through surveys in order to include all possible risk factors of the disease. We, however, advise policymakers to take steps based on our finding by developing sufficient health promotion policies and interventions which target risk factors such as hypertension and obesity in order to mitigate the diabetes epidemic in Hail region.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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