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Epidemiology of Type-II Diabetes and its Risk Factors in Punjab, Pakistan: A Retrospective Study

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ABSTRACT

Type-II diabetes is the most common type of diabetes, which has affected more than 465 million people globally and has become the ninth leading cause of mortality. The current study aims to determine risk factors associated with type-II diabetes such as BMI, cholesterol levels, physical activity, and smoking along with co-morbidities associated with this disease. The data was collected from the province of Punjab, Pakistan. For this purpose, a survey was performed for investigating the prevalence of type II diabetes and associated risk factors combined with it. A sample size of 265 patients was collected and interviewed through a questionnaire who were observed having type-II diabetes. A questionnaire was designed to record these patients' responses. The questionnaire contained sub-categorizes, such as participants characteristics, lifestyle, and comorbidities associated with the disease. The findings indicated that the mean BMI was 25.62 in the studied cohort. However, 78% of the patients had a family history of diabetes. Moreover, 76% of the participants were reported to be non-smokers and 75.67% of the participants reported atypical features associated with this disease. It was also observed that 13 % of the patients with low BMI (less than 18.5) had gastrointestinal diseases and 14.72% of the patients with a BMI greater than 18.5 but less than 25 had hypertension, and 8.30 % of the patients with more than 30 BMI also had hypertension. High BMI was found to be a major risk factor associated with type-II diabetes in this study population. The patients observed with high BMI were also more prone towards comorbidities associated with this disease. However, data suggested that most of the patients had familial type-II diabetes.

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Keywords: BMI, diet, diabetes, lifestyle, risk factor

1. INTRODUCTION

Non-communicable diseases (NCDs) are non-infectious and non-transmissible among people. These are chronic diseases arising due to genetic, environmental, and physiological factors. Globally, in 2010 34.5 million deaths were caused by these NCDs [1]. It has been found that more than 60% of the global deaths occurred due to NCD in Korea, Japan, and China by following the static lifestyle, increased fat and protein intake in the diet are the major cause of increased mortality rate [2]. The mortality rate in Korea due to NCDs increased from 39.4% in 1983-56.0% in 2011 [3]. In 2009, heart diseases, cerebrovascular disease, and neoplasm were identified with the prevailing causes of death resulting in more than 50% of the total amount of death [4]. For minimizing NCDs there must be a comprehensive understanding of the complete disease spectrum starting from health promotion and risk factor promotion to the rehabilitation. Among all, risk factor monitoring has been proven to be an efficient strategy in reducing NCDs [5]. The major cause of NCD includes the consumption of tobacco and alcohol, unhealthy dietary intake, and a sedentary lifestyle. In China, Japan, and Korea the transition in the diet pattern is the major cause of the rapid growth of NCD. They transformed their diet from the traditional vegetable pattern to an unhealthy diet, such as fast food and oily food. The protection and treatment of risk factors is proven to be more efficient in reducing mortality due to NCDs. Several public health centers target risk factor for preventing NCDs. Among China, Japan, and Korea some valuable achievements in risk factors have been noticed in the past few years. They have improved their dietary lifestyle [6].

In the Western countries the major cause of cardiovascular disease is high BMI (body mass index) according to previous epidemiological research [7], while in Asian countries low BMI is a major cause of cardiovascular death [8]. Prior studies have also indicated that people can prevent themselves from diabetes type II by having a healthy lifestyle routine. Different lifestyle factors have contributed to type II diabetes [9]. The risk factors for diabetes include obesity, weight gain, and physical inactivity, which can independently act as a risk factor [10].

According to the International Diabetes Federation (IDF), it was estimated that approximately 463 million of the adults worldwide (20-79

years of age) were suffering from type-II diabetes mellitus and by 2045 this number is expected to rise by 700 million. Furthermore, it was identified that 79% of the diabetic adults were living in low income countries. Moreover, 1 in every 2 individuals are undiagnosed diabetes patients. Globally, diabetes mellitus has caused over 4.2 million deaths and 374 million individuals have been found to have an increased risk of developing mellitus type-II diabetes.

Pakistan falls under the top 10 countries for absolute increasing rate due to diabetes prevalence, which reached 17.1% in 2019. A comparison with previously reported figures was drawn in this study, which suggested a 148% increased percentage of this disease. Additionally, over 19 million adults in Pakistan were estimated with having diabetes, while 8.5 million out of these were undiagnosed [11]. This study focused on the prevalence of diabetes with associated risk factors and some atypical features (the features which are unusual and not the part of diagnostic procedures), which may or may not be linked to diabetes mellitus in Punjab, Pakistan.

2. METHODOLOGY

The current study deployed a cross-sectional survey to investigate the prevalence of NCDs and associated risk factors combined with the lifestyle and dietary controls of diabetic patients. The survey was conducted in Punjab province of Pakistan having a population of 220,892,340 as of 2020 [12]. The sample size was calculated using the formula as described earlier [13].

A questionnaire consisting of 27 questions was designed for the survey, which was divided into three parts, namely comprising sub-sections as participants characteristics, lifestyle-related questions, and questions-related to comorbidities. Participants' characteristics consisted of several questions related to the general information about the participants, such as their gender, age, weight, height, and family history. Participant's weight was converted into pounds similarly participant's height was recorded in feet was converted into inches to calculate the BMI of every participant [14].

A population of 265 participants were chosen having all type-II diabetes. The participants were made aware regarding the questions included in the survey, with each question being verbally explained to them by the conducting team. Furthermore, a written consent form was first filled

out by all the participants. Most of the lifestyle-related questions had 'yes' or 'no' answers. The analysis was compiled on Microsoft Excel with the descriptive analysis function and co-relations were analysed by using the AND function in MS Excel.

3. RESULTS

3.1. Participants Characteristics

Among the selected participants 39.8% of the participants were males. Most of the participants belonged to the age group 50-59(25%), while the age group 20-29 contained the least of the participants (1.14%). Table 1 summarizes the characteristics of the participants. The mean height in inches of the participants was 62.37 ± S.D (standard deviation) of 9.7 inches. Similarly, the mean weight in pounds was 145.12 ± S.D of 2.54 lbs and mean BMI was found to be 25.62 ± S.D of 8. It was also observed that 78% of the participants had a family history of diabetes disease.

Table 1. Participants' Characteristics of the Study (*n*= 265)

Indices	Number	Percentage
Gender		
Males	105	39.8%
Females	159	60.2%
Age		
<=19	51	19.32%
20-29	3	1.14%
30-39	16	6.06%
40-49	50	18.94%
50-59	66	25.00%
60-69	45	17.05%
70=>	33	12.50%
BMI		
<18.5	64	24.81%
18.5-24.9	65	25.19%
25-30	57	22.09%
>30	72	27.91%
Family History		
Yes	207	78%

Indices	Number	Percentage
No	58	22%
(Mean BMI = 25.62 ± 8)		
(Mean Weight in Pounds = 145.12 ± 2.54 = 2.54)		
(Mean height in inches = 62.37 ± 9.7)		

3.2. Lifestyle Behaviour

The questionnaire targeted the participants who spent their holidays, while evaluating their diet and physical activity, which was significantly related to their disease. The exercise was among the foremost asked question in which 43.3% of the participants answered positively that they were actively engaged in exercise, while 28.35% answered "a few days a week", whereas the same percentage answered "No". When asked to choose between the work type, sedentary, mobile, and moderately active", 43.68% of the participants chose sedentary, while only 17.24% chose mobile. (Table 2)

Another question of self-evaluation was considered to ask the participants whether they have checked their daily sugar intake or not. The results indicated that 75.67% of the participants chose Yes, which was a positive response. Participants were also asked about their dinner and sleep timings to calculate the interval between these activities. It was indicated that18% of the participants went to sleep in 2 hours, while 42% of the participants went to sleep right after 2 hours of having dinner, whereas 32% the participants were those who took 2-5 hours of sleep. Additionally, there were 3% of the participants who took more than 5 hours of sleep. However, 2% of the participants had insomnia.

When asked about smoking habits, 14% of the participants were smokers, while 76% were non-smokers. Additionally, 2% of the participants claimed that they quit and 7% said that they smoked On and off, while 1% of the participants answered Sometimes.

Table 2. Lifestyle Behaviour of the Type-II Diabetic Patients (*n*= 265)

Indices	Number	Percentage
Exercise		
Daily	113	43.30%
A few Days in a week	74	28.35%
No	74	28.35%

Indices	Number	Percentage
Work Type		
Sedentary	114	43.68%
Moderately Active	102	39.08%
Mobile	45	17.24%
Check on Daily sugar intake		
Yes	199	75.67%
No	64	24.33%
Time interval between dinner and sleep		
<2 hours	47	18%
Insomnia	5	2%
2 hours	111	42%
2 to 5 hours	86	32%
More than 5 Hours	7	3%
Smoking		
Yes	37	14%
No	202	76%
Sometimes	2	1%
Quit	5	2%
On and off	18	7%
Check on Daily Sugar Level		
Yes	150	57%
No	113	43%

3.3. Atypical Features

Participants were asked about atypical symptoms, which they might have that may or may not be linked to their diabetic health profile. These are given in Table III. However, these patients were asked about dizziness or weakness, around 199 (75.67%) participants agreed that they had these symptoms. Whereas 143(54.37%) of the participants reported the feeling pain or a burning sensation in their body. Additionally, 189(71.86%) reported numb feet and 53(20.15%) participants reported foot sores, while body ulcers were also reported by 58 (22.05%) of the participants.

Table 3. Atypical Features Associated with Type-II Diabetic Patients (*n*=265)

Indices	*n* (Percentages)	*n* (Percentages)
Atypical Features	Yes	No
dizziness/weakness	199(75.67%)	64(24.33%)
Feel of pain or Burning	143(54.37%)	120(45.63%)
Numb feet	189(71.86%)	74(28.14%)
foot Sores	53(20.15%)	210(79.85%)
Body ulcers	58 (22.05%)	205(77.95%)
Amputation	29 (11.03%)	233(88.59%)

3.4. Co-analysis

Table 4 highlights the relationship between different categories of questions. A percentage of 6.79% of the participants were mentioned having all the symptoms as given in Table 3, while 80% of the participants had at least one of these symptoms (Table 3). When a link between lifestyle and work type of the participants was made, it was found that 16.98% of the participants had a sedentary lifestyle and did not exercise at all. The participants, which had a mobile lifestyle and exercised daily were observed to be 18(6.79%), while 19(7.17%) participants had a moderately active lifestyle and exercised a few days in a week. It was observed that patients with low BMI (less than 18.5) were indulged in stomach, liver, and intestine diseases with a percentage of 13%. Participants with BMI greater than 18.5 but less than 25 had Hypertension (14.72%) and patients with more than 30 BMI had hypertension as well (8.30%).

Table 4. Co-analysis of Different Risk Factors in Type-II Diabetic Patients (n=265)

Serial No.	Indices	Participants (Percentage)
1.	Participants that have at least one of the mentioned symptoms	212(80.00%)
2.	Participants that have a sedentary lifestyle and do not exercise	45(16.98%)
3.	Participants that have a moderately active lifestyle and exercise a few days in a week	19(7.17%)

Serial No.	Indices	Participants (Percentage)
4.	Participants that have a mobile lifestyle and exercise daily	18(6.79%)
5.	Participants that have all the mentioned symptoms	18(6.79%)
6.	Participants with <18.5 BMI and have stomach, liver or intestine diseases	35(13%)
7.	People with <25 BMI and have Hypertension	39(14.72%)
8.	People with >30 BMI and have hypertension	22(8.30%)

Table 5 gives the prevalence of co-morbidities with diabetes. Hypertension was the most common disease with 81.89% of the participants suffering from it. Blood cholesterol was the second highest with 81.51% of the participants. Additionally, 58.49% of the participants reported heart disease. However, other (40.75%) reported diseases related to Stomach, intestine, and liver, while in a separate category of GI diseases, 40.75% of the participants were identified with these diseases. Among all only 2.26% of the participants reported having paralysis issue.

Table 5. Prevalence of Co-morbidities with Type –II Diabetes

HT	217 (81.89%)
Cholesterol	216(81.51%)
Heart Diseases	155(58.49%)
Stomach Liver Intestine	80(30.19%)
GI	108(40.75%)
Paralysis	6(2.26%)

4. DISCUSSION

Non communicable diseases (NCDs) have been linked with effective lifestyle behaviours. It has been reported that a successful change in lifestyle caused a 58% reduction in the diabetic incidence rate [15]. However, in developing countries, more than 80% of the deaths have been reported as a result of cardiovascular diseases and diabetes [16]. Behavioural risk factors and physiological risk factors have been reported to be the primary causes for NCDs [17]. Physical activity has been inversely related to different

diseases, such as diabetes [18]. Nevertheless, even today, there are quite less solutions that deal with physical inactivity. Reportedly, data collected from Brazil reported that 61% of the adults did not reach satisfactory levels of physical activity [19].

Hayes, L., et al studied the prevalence of diabetes in Pakistan before and after the physical activity of Pakistani population and its risk factors, which are associated with diabetes. He indicated that Pakistanis are less physically active than European people [20]. This corroborates with the current study in which 7.17% participants were found to have a moderately active lifestyle and people who were indulged in exercising were more active. A good percentage of participants approximately 43.68% had a sedentary work type and 16.98% out of these did not considered physical exercising as a part of active lifestyle behaviour.

Diabetes is also linked with sleep disturbances [21], which was actively found in this study, 2% of the participants reported insomnia, while 3% of the participants took more than 5 hours to sleep after taking dinner. It is worth mentioning that a considerable amount, approximately 32% took 2-5 hours of sleep, which could either be a lifestyle choice or can also be the cause of sleep disturbances [22]. 5% of the participants had sleep disorders, which can also be linked to diabetes.

Reportedly, this study identified that patients having diabetes were diagnosed with body ulcers and foot sores, which were 22.05% and 20.15%, respectively. According to some previous studies, there are serious complications among patients suffering from diabetes contributing to morbidity and mortality [23]. Noticeably, patients who were often prescribed inappropriate antibiotics worsened the situation leading to adverse effects, unlikely to heal. Diabetics with active ulcers have healing rates up to 75%. The amputation rate in this study's findings is 11.03%, while 15-20% of the amputations are of prior studies [24].

An extensive number of the participants, approximately 71.86% reported numbness of feet, which can be an indication of diabetic neuropathy [25]. Furthermore, it was observed in this study that diabetic patients who are overweight (25-30 BMI) and obese (>30 BMI) suffered from hypertension. This association corresponds with the results of previous findings. Moreover, higher levels of BMI was linked to the increasing blood pressure of patients and the gradient observed strongly suggested that there

could be a direct effect of BMI on blood pressure disregarding other clinical factors [26]. The results of these findings indicated a mean BMI of 25.62 ± 8. with males having a mean BMI of 25.69 and females having a BMI of 29.58 as compared to the body mass index 24.1 and 24.7, respectively of diabetic patients in Japan [27].

Several studies conducted in Asia identified Stroke and coronary heart diseases are also associated with comorbid conditions of diabetes. Moreover, these studies indicated diabetes as a leading cause of death in patients and with reported stroke rate of 42%, respectively [28]. However, no valuable association was found between BMI and stroke in the epidemiologic report of Japan [29]. Smoking has been reported as a significant associated risk factor for developing diabetes with 44% of the increased risk rate [30]. Cigarette smoking induces insulin resistance and inadequate compensatory insulin secretion responses.

4.1. Conclusion

The study was conducted on a population sample of 265 participants, which were suffering from the diabetes. Noticeably, high BMI was found to be a major risk factor associated with type-II diabetes in this study population. Moreover, patients having a high BMI were also more prone towards comorbidities associated with this disease. Markedly, proper diet and exercise can reduce the risk of type-II diabetes among patients.

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