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Research Article

Assessment of Prevalence and Possible Risk Factors of Type II Diabetes in Hazara Region Khyber Pakhtunkhwa, Pakistan

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SJ was the chief investigator who collected data and wrote the manuscript. MFK helped in data analysis. IU critically reviewed and facilitated in tabulation and submission. ST supervised and designed the research project.

Keywords
Diabetes, Hazara, Insulin, Prevalence, Pakistan

Abstract | Pakistan ranks fourth among countries with a high burden of type II diabetes, with approximately 8 million (6.72%) people suffering from it. The present study was carried out to assess the prevalence and the possible risk factors of type II diabetes in Hazara region Khyber Pakhtunkhwa, Pakistan. The total area was divided into six clusters, and the data was collected randomly from different hospitals, clinics, and different localities of Hazara region. The report included 2,400 participants, amongst which, 1,000 subjects were suffering from type II diabetes, including 432 males (43.2%) and 568 females (56.8%). Whereas 814 (81.4%) of them were over 40 years of age. Battagram district had the highest prevalence (24.2%) because of the lack of awareness about the disease, while Torghar exhibited the lowest prevalence (12.4%). The sociodemographic factors were analyzed one by one to assess their association with the disease. Smoking having OR=1.47, 95%CI=1.07-2.02 and P=0.0173 as well as a high level of stress having OR=1.27, 95%Cl=2.16-4.22 and P<0.0001were found more allied with the disease as these factors increase insulin resistance of the body cells and act as risk factors for developing the disease. Family history of diabetes having OR=3.35, 95% Cl=2.98-4.20, and P<0.0001 was also found having a strong association with the condition due to the heritability of the disease. The results concluded that the incidence was high among people with a positive family history of diabetes in first-degree relatives, housewives, and retirees of District Battagram. Sedentary, as well as a stressful lifestyle, could attribute to the disease. So regional campaigns should be initiated for awareness.

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Introduction

In type II *diabetes*, the body exhibits resistance to insulin formed by the pancreas, usually occurring in later or middle age (Nussey and Whitehead, 2013). Based on current prevalence data, type II diabetes is a mounting health problem for both urban and rural population in low and middle-income countries (Hwang *et al.*, 2012). Also, approximately 75% of people with type II diabetes reside in low or middle-income countries. The global burden of type II diabetes is enormous in terms of financials, with roughly $673 billion expenditures in 2015, accounting for 12% of global medical spending in 2015 (Tripathy *et al.*, 2017). About 230 million people worldwide have type II diabetes, accounting for about 6 percent of the world's adult population (American Diabetes Association, 2007). One person dies after every 10 seconds due to diabetes-related consequences, and 6 million people get type II diabetes every year (Akhtar *et al.*, 2011; Hall *et al.*, 2006).

Up to 2025, the number of people with diabetes worldwide will reach around 300 million (King *et al.*, 1998). The world's significant diabetic population is living in India,

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and it is expected to reach up to 35 million in the coming few years (Hall *et al.*, 2006; Akhtar *et al.*, 2011). The frequency of the disease is expected to increase by 50 percent until 2030. The rapid growth of this situation means that diabetes is expected to be the seventh leading cause of death in the world until 2030 (Whiting *et al.*, 2011). Globally, 80% of cases of type II diabetes live in underdeveloped regions and countries (Shaw *et al.*, 2010). Due to rapid economic development, nutritional changes, and urbanization in a relatively short period, Asia has become the center of diabetes in the world (Chan *et al.*, 2009). Till 2030, 5 of the ten countries with the most significant number of diabetic patients are estimated to be in Asia, India, Bangladesh, Pakistan, Indonesia and China (Shaw *et al.*, 2010). Pakistan is the fourth country in the world having the most prevalent type II diabetes affected people with 8 million diabetic patients (Zhao *et al.*, 2011). However, according to the World Health Organization, this number will become twice until 2025. In Pakistan, the present incidence of type II diabetes is 11.77%, 9.19% among women and 11.20% in men. The average incidence rate for women is 11.70% and 16.2% for men in Sindh. The average percentage of type II diabetes among women is 9.83% and 12.14% for men in Panjab. The average incidence of diabetes among women is 8.9% and men 13.3% in Baluchistan while in Khyber Pakhtunkhwa (KP), it is 11.60% among women and 9.2% in men (Meo *et al.*, 2016). The prevalence is more common in cities (14.81%) than in the rural zones (10.34%) in Pakistan. The frequency of affected males is higher than females (Meo *et al.*, 2016). According to WHO, there were 12.9 million diabetic patients in Pakistan in 2011, accounting for 10 percent of the total population of Pakistan (Gundogan *et al.*, 2016). The present study investigated the prevalence and possible risk factors for type II *Diabetes* in the Hazara region of Khyber Pakhtunkhwa, Pakistan.

Materials and Methods

Study area

The study was conducted in the Hazara region of Khyber Pakhtunkhwa, Pakistan. Hazara is an area in the north-east of the Khyber Pakhtunkhwa, Pakistan. Six districts; Abbottabad, Haripur, Battagram, Mansehra, Torghar, and Kohistan, comprised Hazara region, occupying the area of 18,013 square Kilometres. The Hazara region has a multilingual and multi-ethnic population.

Data collection

The area was divided into six clusters; Abbottabad, Haripur, Battagram, Mansehra, Torghar, and Kohistan. A total of 2,400 people was randomly investigated. Out of which, 1000 were positive, and 1400 were negative. The data was collected through a pre-tested structured questionnaire from the general population in various hospitals and clinics of the Hazara region after obtaining informed consent from the study subjects. The collected data included information about age, gender, ethnicity, weight, family history of the disease, blood group and various other demographic and host factors that may have a role in the progression of the disease. The studied population was segregated into two groups to evaluate the risk factors; the disease group (affected from type II diabetes) and the control group. Doctors in hospitals and clinics conducted various physical examinations of their current disease status and various questions were personally asked by the researchers of the study from the patients about multiple symptoms and risk factors for TIIDM, including polyphagia, polyuria, dry mouth, and unexplained weight loss, fatigue, family history of diabetes, blurred vision, exercise, cholesterol levels, blood pressure. The control group was also interrogated for the same parameters. The collected data were then segregated into two different groups concerning different variables, independent variables, including blood type, height, age, gender, marital status, occupation, caste and family history and sleeping time. Also includes some clinical signs and symptoms, namely, polyphagia (increased appetite), polydipsia (excess thirst), polyuria (excessive urination) and excessive sweating as well as dependent variables, including, heart disease, smoking and some other diseases including high blood pressure, high cholesterol levels, and high stress. The Ethics Committee of the Department of Zoology, Hazara University Mansehra approved the experimental procedure of the present research work.

Statistical analysis

The collected data was then analysed by using numerous statistical parameters, including odd-ratio (OR) and logistic regression with 95% confidence intervals to measure the association and strength of various risk factors with TIIDM. Also, two-tailed probability or Fisher's exact test was used to verify the results. R and R studio software (version 2.1.1) were used to evaluate the association of risk factors with TIIDM.

Results and Discussion

Prevalence of type 1I diabetes

In the present study, data were collected randomly from the subjects belonging to six different clusters of Hazara Division (n=2400), among them, 1000 (41.7%), of the total subjects, were found positive for having TIIDM, while, 1400 (58.3%) subjects were negative for *TIIDM* in having no signs and symptoms of the disease. Also, amongst all the six districts of Hazara region, the highest frequency of TIIDM was documented in District Battagram (24.2%), while, a low incidence of the disease was recorded in District Kohistan (11.6%). Moreover, females (56.8%) suffering from the disease were more in number as compared to males (43.2%). An overview of the total prevalence of the disease in the Hazara region is given below in Figure 1.

Table 1: The socio-demographic attributes of the case-control sample population and their relationship with type II diabetes.

Demographic variables	Cases No=1000 (%)	Controls No=1400 (%)	OR(95%CI)	Z-value	P-value
Age categories					
Up to 30	62 (6.2)	468 (33.4)	0.38(0.27-0.53)	-5.570	<0.0001
31-40	124 (12.4)	362 (25.9)	Ref	--	--
41-50	268 (26.8)	310 (22.0)	2.52(1.94-3.28)	6.942	<0.0001
51-60	322 (32.2)	220 (15.8)	4.27(3.28-5.59)	10.684	<0.0001
Above 60	224 (22.4)	40 (2.9)	6.34(4.14-7.50)	13.920	<0.0001
Gender					
Male	432 (43.2)	596 (42.6)			
Female	568 (56.8)	804 7(5.4)			
Marital Status					
Single	36 (3.6)	324 (23.1)	0.12(0.08- 0.17)	-11.397	<0.0001
Married	940 (94.0)	1072 (76.6)	Ref	--	--
Widowed	24 (2.4)	4 (0.3)	6.84(2.63- 23.34)	3.549	0.000387

Ref (Reference, taken by software); Cl (Confidence interval); OR (Odds ratio); 95% CI (95% confidence interval); P-value (Calculated probability); Z-value indicates how many standard deviations (SD) an element is from the mean.

Type 1I diabetes association with sociodemographic characteristics and unifactorial analysis

Social demographic features, in addition to lifestyle and clinical features, were analyzed to evaluate the probable association of risk factors with type II diabetes in the population of Hazara region.

The age categories, "Above 60" (OR=6.34(4.14-7.50), P-value<0.0001), "41 to 50" (OR=2.52(1.94-3.28), P<0.0001) and "51 to 60" (OR=4.27(3.28-5.59), P<0.0001) exhibited a significant association with type II diabetes. Most of the respondents of the study having TIIDM were adults with 51-60 years of age (32.2%). According to Suastika *et al.* (2012), the occurrence of TIIDM increases with increasing age, and the findings of the present study are also in agreement with his previous study. In the United States, the frequency of TIIDM from 2005 to 2008 was 3.7% among people aged from 20 to 44, while, in the population aged 45 to 64, the rate of occurrence was 13.7% and the highest percentage was observed among the people of age ≥65 years. In the current study, the proportion of the disease in the people of 41 to 50 years of age was 26.8%, while, in 51-60 years of age it was 32.2% and, in the people, having over 60 years of age it was 22.4%. The results are also supported by Hirani and Ali (2008). The highest proportion of type II diabetes may be found in people aged 65 to 74 (Hirani and Ali, 2008). Most of the patients of type II diabetes were females (56.8%). Although males (43.2%), (OR=1.02(0.87-1.20), P=0.759) were also not safe from the disease. Also, the present study shows a high association of marital status with TIIDM as 94% of all the diabetic patients of the study were married. Also, the marital status of the "widowed" category (OR = 6.84 (2.63-23.34), P = 0.000387) showed significant association with the disease (Table 1).

Type 1I diabetes' association with clinical features and unifactorial analysis

More sweating (OR = 4.52 (3.10-6.62), P < 0.0001) was found to be associated with the disease, as most diabetic patients in the study sweated more (65.6%). Also, low-stress levels (OR=1.27(1.17-2.40), P<0.0001), and high level of stress (OR=3.19(2.16-4.22), P<0.0001), both were significantly associated with the disease. One in every five patients of type II diabetes mellitus had depression or high level of stress (Ali *et al.*, 2006). In this study also, 66.8% of all the diabetic patients participated in the study were those bearing a high level of stress. Similarly, 19.1% of people from the UK with TIIDM usually exhibited high anxiety or depression, almost twice as many as healthy people (10.7%) (Roy and Lloyd, 2012). In this study also, people with high levels of stress were more likely to develop the disease.

Most of the diabetic respondents of the study were feeling increased thirst (78.8%). Therefore, it was also found that "increased thirst" (OR = 10.67 (6.32-18.68), P < 0.0001) was associated with the disease. In addition, blood group types, A+ (OR = 1.89 (1.25-2.90), P = 0.0027), B+ (OR=2.02(1.35-3.07), P=0.0027) and O+ (OR=3.09(1.97-4.90), P<0.0001) were also significantly associated with type II diabetes mellitus. Most of the respondents of the study having TIIDM were those having B+ blood group (39%) followed by those having A+ and O+ blood groups. Also, according to Kamil *et al.*, (2010), blood group O, A and B are positively correlated with TIIDM.

In the present study, most of the diabetic respondents of the survey were those having 6 to 10 times urination per day (52.4%). The urination categories, "6 to 10" (OR = 1.87 (1.23-3.31), P <0.0001), "11 to 15" (OR = 2.70 (2.18-3.45),

Table 2: Clinical features of case-control sample population and their relationship with type II diabetes.

Characteristics	Cases No=1000 (%)	Controls No=1400 (%)	OR (95%CI)	Z-value	P-value
Sweating					
More	656 (65.6)	190 (13.6)	4.52(3.10- 6.62)	7.827	<0.0001
Normal	286 (28.6)	1134 (81.0)	0.33(0.22 0.47)	-5.937	<0.0001
Less	58 (5.8)	76 (5.4)	Ref	--	--
Stress level					
Low	38 (3.8)	84 (6.0)	1.27(1.17- 2.40)	6.356	<0.0001
High	668 (66.8)	400 (28.6)	3.19(2.16- 4.22)	7.899	<0.0001
Normal	294 (29.4)	916 (65.4)	Ref	--	--
Thirst level					
Increased	788 (78.8)	192 (13.7)	10.67(6.32-18.68)	8.604	<0.0001
Decreased	20 (2.0)	52 (3.7)	Ref	--	--
Normal	192 (19.2)	1156 (82.6)	0.43(0.25- 0.75)	-3.060	0.002213
Blood group					
A -	36 (3.6)	92 (6.6)	Ref	--	--
A +	258 (25.8)	348 (24.9)	1.89(1.25- 2.90)	2.999	0.0027
AB-	10 (1.0)	26 (1.9)	0.98(0.41-2.19)	-0.041	0.9673
AB +	100 (10.0)	192 (13.7)	1.33(0.84- 2.11)	1.232	0.2178
B -	20 (2.0)	64 (4.6)	0.79(0.41- 1.49)	-0.696	0.4861
B +	390 (39.0)	492 (35.1)	2.02(1.35-3.07)	3.395	0.0006
O -	36 (3.6)	62 (4.4)	1.48(0.84- 2.61)	1.374	0.1695
O +	150 (15.0)	124 (8.9)	3.09(1.97-4.90)	4.885	<0.0001
Urination categories					
1 to 5	118 (11.8)	1038 (74.1)	Ref	--	--
6 to 10	524 (52.4)	358 (25.6)	1.87(1.23-3.31)	10.490	<0.0001
11 to 15	294 (29.4)	2 (0.1)	2.70(2.18-3.45)	7.006	<0.0001
Above 15	64 (6.4)	2 (0.1)	4.49(3.67-5.97)	21.784	<0.0001
Appetite					
Increased	720 (72.0)	168 (12.0)	6.03(3.97-9.24)	8.366	<0.0001
Decreased	44 (4.4)	62 (4.4)	Ref	--	--
Normal	236 (23.6)	1170 (83.6)	0.28(0.18- 0.43)	-6.001	<0.0001
Cholesterol level					
High	408 (40.8)	112 (8.0)	Ref	--	--
Low	20 (2.0)	20 (1.4)	0.27(0.14- 0.53)	-3.874	0.000107
Normal	572 (57.2)	1268 (90.6)	0.12(0.09- 0.15)	-17.707	<0.0001
Blood pressure					
High[1]	520 (52.0)	196 (14.0)	Ref	--	--
Low	68 (6.8)	76 (5.4)	0.33(0.23- 0.48)	-5.819	<0.0001
Normal	412 (41.2)	1128 (80.6)	0.13(0.11- 0.16)	-19.501	<0.0001
Family history					
Yes[2]	339 (33.9)	625 (44.6)			
No	661 (66.1)	775 (55.4)			

[1]Systolic blood pressure ≥ 140 and diastolic blood pressure ≥ 90; [2]Having first degree relatives with diabetes.

P <0.0001) and "above 15" (OR = 4.49 (3.67-5.97), P < 0.0001) showed a significant association with disease. Also, the increased appetite (OR = 6.03 (3.97-9.24), P < 0.0001) was closely related to TIIDM, as most of the diabetic patients (72%) in the study were patients with increased appetite. In this study, cholesterol levels were not

Table 3: Lifestyle factors of case-control sample population and their relationship with type II diabetes.

Factors	Cases No=1000 (%)	Controls No=1400 (%)	OR (95%CI)	Z-value	P-value
BMI categories[1]					
Underweight	38 (3.8)	110 (7.9)	0.69(0.46-1.01)	-1.841	0.0656
Normal	436 (43.6)	878 (62.7)	Ref	--	--
Over weight	396 (39.6)	382 (27.3)	2.08(1.74- 2.50)	7.948	<0.0001
Obese	130 (13.0)	30 (2.1)	8.72(5.85-13.41)	10.274	<0.0001
Weight changes					
Yes	760 (76.0)	346 (24.7)			
No	240 (24.0)	1054 (75.3)			
Smoking					
Yes[2]	82 (8.2)	80 (5.7)	1.47(1.07-2.02)	2.381	0.0173
No	918 (91.8)	1320 (94.3)	Ref	--	--
Smoking categories					
1 to 5	24 (2.4)	12 (0.9)	Ref	--	--
6 to 10	20 (2.0)	22 (1.6)	1.45(1.17- 2.12)	1.679	0.0031
Above 10	38 (3.8)	44 (3.1)	3.43(2.18-4.96)	2.013	0.0044
No smoking	918 (91.8)	1322 (94.4)	0.34(0.16- 0.68)	-2.970	0.0029
Sleeping time in hours					
1 to 5	106 (10.6)	50 (3.6)	Ref	--	--
6 to 10	812 (81.2)	1286 (91.9)	0.29(0.20- 0.41)	-6.831	<0.0001
Above 10	82 (8.2)	64 (4.6)	0.60(0.37- 0.96)	-2.105	0.0353
Regular exercise					
Yes[3]	216 (21.6)	96 (6.9)			
No	784 (78.4)	1304 (93.1)			

significantly associated with the disease because most of the diabetic patients (57.2%) in the study were those with normal cholesterol levels. Whereas, high blood pressure was found to be associated with TIIDM in the present study as most of the diabetic patients (52.0%) of the study were those with high blood pressure.

In the present study, a positive family history of diabetes (OR=3.54 (2.98-4.20), P<0.0001) was also found to be significantly associated with the disease. In India, the frequency of TIIDM was higher in people with a positive family history of diabetes, as, 25.1% of people in India had type II diabetes, in which, 15.3% had fathers with TIIDM, and 12.1% had both parents with TIIDM, while, 47.4% have diabetic siblings, whereas, 40% of TIIDM patients in India were those having other relatives suffering from diabetes (Geetha *et al.*, 2017). Also, 33.9% of all the diabetic patients in the present study were those who had confirmed family history of diabetes in first-degree relatives (Table 2).

Type 1I diabetes association with Lifestyle factors and unifactorial analysis

Results revealed that continuous body weight changes (OR = 9.64 (7.99-11.67), P <0.0001) are closely related to the disease. As most of the type II diabetic respondents of the study were those who are having continuous body weight changes (76%). However, BMI in the category of "obesity" (OR = 8.72 (5.85-13.41), P < 0.0001) and overweight (R = 2.08 (1.74-2.50), P<0.0001) also exhibited greater association with disease.

According to Abdullah *et al.* (2010), also the obesity and type II diabetes are closely related to each other, and the risk of developing type II diabetes in obese and overweight people increased by 7-fold and 3-fold, respectively. The current study also determined that 81.2% of all obese participants and 50.9% of all overweight participants in this study had type II diabetes. Besides this, most of the diabetic participants (78.4%) of the study were not performing the routine exercise and were taking sleep of 6 to 10 hours every 24 hours (81.2%). In the present study, smoking (OR=1.47(1.07-2.02), P=0.0173) also presented a higher association with TIIDM. The Smoking categories, "6 to 10" (OR=1.45(1.17-2.12), P=0.0031) and "Above 10" (OR=3.43(2.18-4.96), P=0.0044) exhibited a significant association with the disease. According to Chang, 2012, the smoking was significantly increasing the risk of TIIDM, and about 12% of all TIIDM cases in the United States were due to tobacco whereas about 360,000

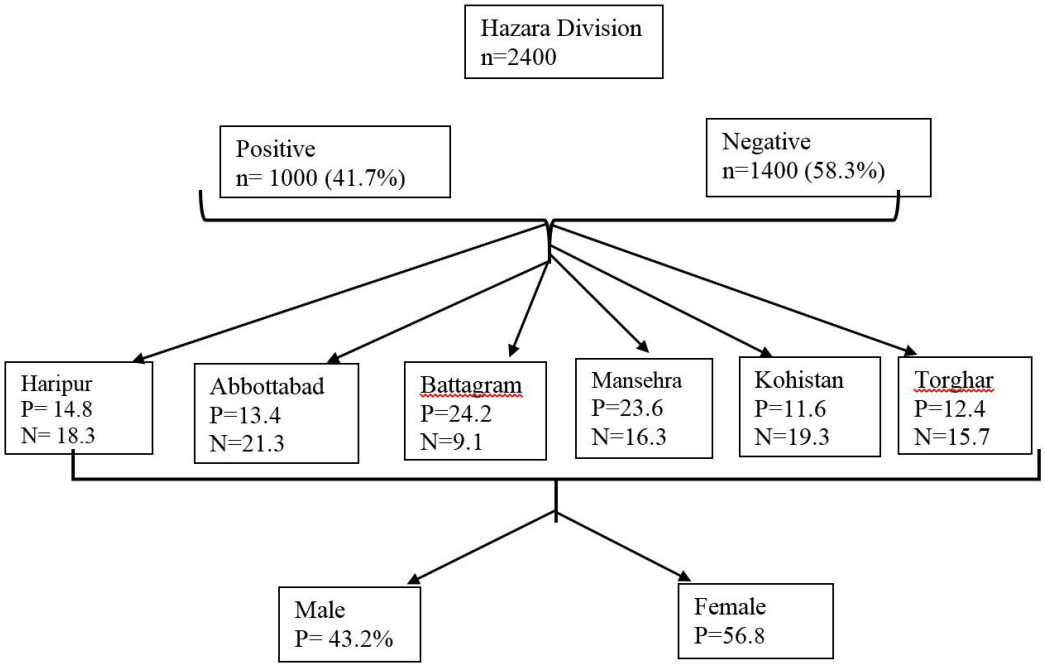

Figure 1: Prevalence spectrum of Diabetes Type II in different districts of Hazara region.

cases of T2DM in the UK were due to smoking. The current research's results revealed that 51.2% of smokers were suffering from TIIDM, while, the majority of the remaining 48.8% of smokers have an increased risk of developing the disease because they were living with some revealed significant symptoms of the disease. According to Cho *et al.* (2009), in South Korea, as compared with non-smokers (7.9%), chain smokers had a high incidence of TIIDM, 11.1%. While, according to the current research, the relationship between smoking and the disease varies depending on the number of cigarettes smoked per day. The risk of TIIDM due to smoking intensifies with an added number of cigarettes consumed per day. Men and women who smoke more than 40 cigarettes a day have 45% and 74% increased risk of TIIDM respectively (Cho *et al.* 2009). The current study also revealed that smoking more than ten cigarettes a day is more allied with the disease (Table 3).

Risk factors for TIIDM

Increasing age (above 40), blood group (A+, B+, O+), body weight (overweight and obesity), smoking, increased thirst and appetite, increased urination, more sweating and high level of anxiety were the risk factors which were significantly associated with TIIDM in a multivariate logistic regression model (Table 3).

Conclusion

It is concluded from the current study that the incidence of TIIDM was highest among people of Swati caste and the District Battagram has the highest frequency of diseases compared to other parts of the Hazara region. The rate was also high in the people having a family history of first-degree relatives with the disease and the rate of the disease among family wives and retirees were high as well. Men and women were almost equally affected by the disease, and as in other parts of the world, a high proportion of type II diabetes was present in people over the age of 40. In short, the ratio of this disease is particularly dangerous among older people. However, like the people over the age of 50, people under the age of 40 years were also not safe from the disease.

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