

**Association of Risk Factors of Type-II Diabetes Mellitus, A Case Study of Azad State of Jammu and Kashmir, Pakistan**

**Dr. Maryam Sadiq<sup>1\*</sup>, Sidra Younas<sup>2</sup>, Ramla Shah<sup>3</sup>**

1 Department of Statistics, University of Azad Jammu & Kashmir.

(\*Corresponding Author) Email: [hussainulahmad@gmail.com](mailto:hussainulahmad@gmail.com)

2 Department of Statistics, University of Azad Jammu & Kashmir. Email: [sidra.younas@ajku.edu.pk](mailto:sidra.younas@ajku.edu.pk)

3 Department of Statistics, University of Azad Jammu & Kashmir. Email: [ramlashah193@gmail.com](mailto:ramlashah193@gmail.com)

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**Abstract**

**Objective:** Diabetes Mellitus is the most common disease overall the world, particularly in developing countries. In this study, an attempt has been made to investigate the significant risk factors of Type II Diabetes Mellitus (T2DM). **Method:** A random sample of 2700 respondents was selected from Azad state of Jammu and Kashmir, out of these 900 T2DM case subjects and 1800 non-diabetic/control case subjects. To examine the associated risk factors, the most popular statistical technique, Chi-squared test statistics, is used. Risk factors were age at the time of diagnosis, gender, obesity, family history, physical activity and diet. Additionally, odd ratios (ORs) along with 95% confidence intervals (CIs) were derived from binary logistic regression to measure the association. **Results:** The results showed strong association of T2DM with age at the time of diagnosis, female gender (OR: 1.97, 95% CI: 1.66-2.35), positive family history (OR: 1.297, 95% CI: 1.105-1.523), physical inactivity (OR: 2.00, 95% CI: 1.5-2.6) and unbalance diet (OR: 3.0, 95% CI: 2.4-3.6). The prevalence risk of diabetes was highest among those aged 41-50 years (OR: 4.1, 95% CI: 2.7-6.4) and 51-60 years (OR: 4.1, 95% CI: 2.6-6.2). Obesity was found to be a non-significant risk factor of T2DM. **Conclusion:** Noteworthy association of T2DM with age at the time of diagnosis, gender, family history, physical inactivity and unbalanced diet was observed while obesity was not found associated with T2DM.

**Keywords:** Risk factor, odd ratio, logistic regression, Chi-squared, P-value.

**1. Introduction**

T2DM is a chronic epidemic defined as progressive metabolic disorder which results in improper functioning of body [1]. Diabetes prevalence rate is increasing continually for overall the globe as well as in Pakistan as it stands at seventh position with 7.1 million diabetic adults age 20-79 years in 2010 and estimated to have fourth position in 2030 with 13.8 million people of this age group. An alarming situation for developing countries is maximum diagnosis of diabetes in younger ones (45-64 years), however the picture is different for developed countries as highest prevalence rate is projected for older age group ( $\geq 65$  years) [2, 3]. A number of studies have been conducted to investigate the risk factors of T2DM. Ejaz et al. [4] examined the risk factors of diabetes epidemic in Pakistan and evidenced that family history (p-value=0.001) was the most significant risk factor of diabetes. Obesity/overweight (p-value=0.002) and physical inactivity (p-value=0.025) were also the common causes of this epidemic. Karkar et al. [5] assessed the risk factors of T2DM in adult population of South Asia and showed that main cause of diabetes was obesity for most South

Asian countries. Further risk factors were increasing age, gender, positive family history and physical inactivity. Ahmad et al. [6] also established nearly same results. King et al. [7] projected universal burden of diabetes by studying prevalence rate and numerical facts. A strong association between age and diabetes risk is reported but prevalence age differs according to financial status and gender. Women have greater chances of diabetes as compared to men for developed countries whereas equal gender ratio was found for developing countries. Wild et al. [8] and WHO [9] reported similar findings. Due to extensive complications, this epidemic is considered as a huge burden on humanity [10].

Therefore, study of risk factors of diabetes is vital and might result in novel information about this disease. The main objective of the present study is to find the significant risk factors for T2DM. This paper unfolds as follows: Section 2 describes the methodology involved and results are presented in Section 3. Finally, Section 4 consists of important findings of the present study.

## 2. About the data

The data consists of 2700 respondents which were selected from 900 T2DM case subjects and 1800 non-diabetic control subjects. T2DM cases were selected from three Combined Military Hospitals (CMH) of AJK using Cluster sampling technique. Equal sample sizes were taken from three hospitals ( $n_1=n_2=n_3=900$ ). There are 900 cases having T2DM whereas 1800 cases without T2DM.

A structured questionnaire was used to collect information about risk factors of T2DM. After getting the permission from hospital authorities and consent of participants, the information was recorded on the following characteristics: age at the time of diagnosis, gender, obesity, family history, physical activity and balanced diet. Age (years) at the time of diagnosis is categorized into 3 groups (<30, 30-50, >50). Gender is categorized into male and female. Family history is dichotomized as positive and negative considering up to one generation only. All other factors are classified as presence or absence. Obesity is measured in terms of body mass index (BMI) which is categorized according to international standards. Physical activity was classified on the basis of time duration of regular exercise. Diet plan included weekly intake of fruits, vegetables, meat and milk.

### 2.1 Coding Scheme

In this study reference category is indicated by 0 and rest of the factors are categorized as under.

**Table1:** Categorization of different factors of T2DM.

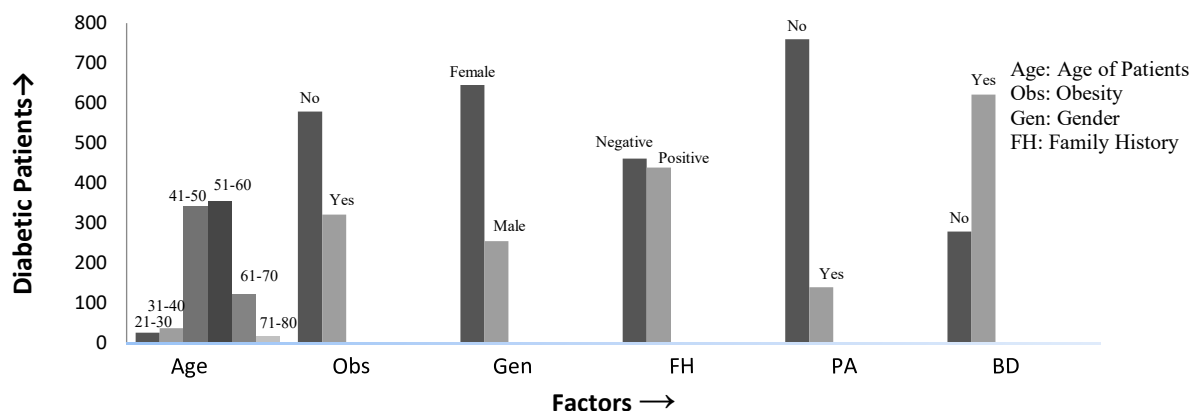
Factors	Categories	Coding Scheme
Age (years) at the time of diagnosis	<30	0
	30-50	1
	>50	2
Gender (Gen)	Male	0
	Female	1
Obesity (Obs)	Absent	0
	Present	1
Family history (FH)	Negative	0
	Positive	1
Physical activity (PA)	Present	0
	Absent	1
Balanced Diet (BD)	Present	0
	Absent	1

### 3. Statistical Analysis

Descriptive statistics were carried out to observe the main characteristics of the study population, and the results are shown in Table 1. With regard to age at the time of diagnosis, maximum diabetic patients (39%) and non-diabetic controls (33%) belonged to the age-group 51-60 years. Nearly similar percentage was observed for age group 41-50 years. The gender distribution presented that 72% cases and 56% control subjects were females. Obesity was recorded for only 19.2% case subjects and 22.3% control group subjects. About 48.8% diabetic cases and 42.3% non-diabetic controls reported positive family history of T2DM. Characteristics of nourishment of participants showed that 69% case subjects and 87% controls were taken balanced diet. Regarding physical activity, only 15.6% cases and 27% controls were regularly participating in physical activity. Moreover, Figure 1 depicts the distribution of diabetic cases regarding different risk factors. Risk factors are taken along the x-axis while the number of diabetic patients is presented along y-axis.

**Table 2:** Observed frequency table of Risk factors of T2Dm

Variable	Group	Cases		Control		Total	
		N	%	N	%	N	%
Age at the time of diagnosis	21-30	26	2.9	159	8.8	185	6.9
	31-40	37	4.1	142	7.9	179	6.63
	41-50	342	38	507	28.1	849	31.4
	51-60	355	39	536	29.7	891	33
	61-70	123	13.7	337	18.7	460	17.04
	71-80	17	1.9	119	6.6	136	5.03
Gender	Female	645	72	1011	56	1656	61.3
	Male	255	28	789	44	1044	38.67
Obesity	Present	173	19.2	401	22.3	802	29.7
	Absent	727	80.0	1399	77.7	1898	70.3
Family History	Positive	439	48.8	762	42.3	1201	44.48
	Negative	461	51.2	1038	57.7	1499	55.52
Balance diet	Present	621	69	1563	87	2184	80.90
	Absent	279	31	237	13	516	19.10
Physical activity	Present	140	15.6	489	27	629	23.30
	Absent	760	84.4	1311	73	2071	76.70



**Figure 1:** Distribution of diabetic cases according to risk factors.

### 3.1 . Binary Analysis

Chi-squared test was used to check the association of different risk factors with prevalence of T2DM and results are presented in Table 2 for comparison purpose. The results indicated strong association of this epidemic with age at the time of diagnosis, gender, family history, balance diet and physical activity showing p-value=0.001 for these factors. The findings illustrated that T2DM is independent of obesity (p-value=0.67).

**Table 3:** Testing the independence of risk factors of T2DM.

Factors	p-value
Age at the time of diagnosis	0.001
Gender	0.001
Obesity	0.67
Family history	0.001
Balanced Diet	0.001
Physical activity	0.001



Fig 2: Chi-square Test Results for Risk Factors of T2DM

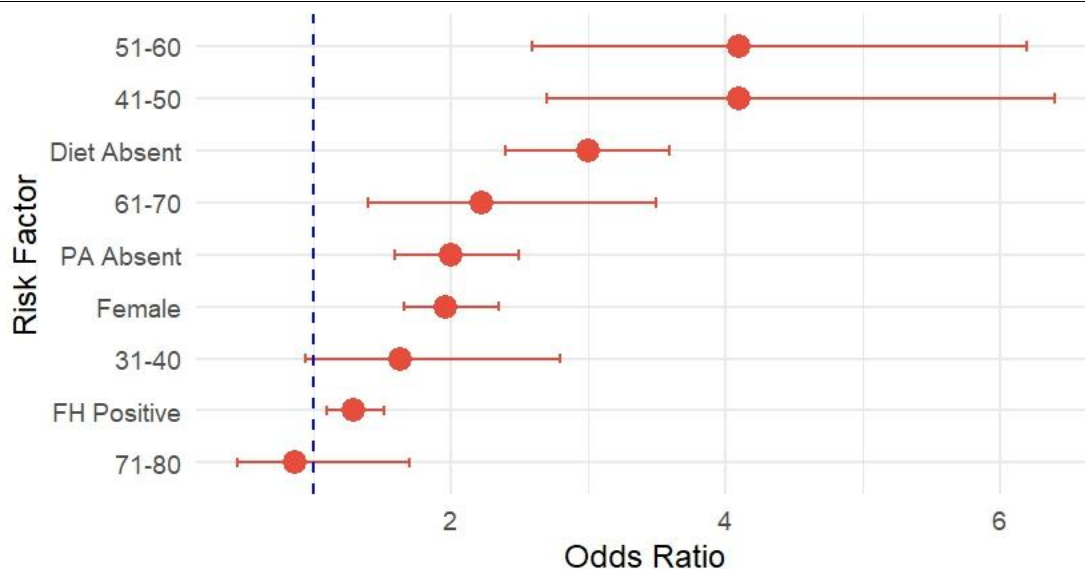
### 3.2 Parsimonious Model for T2DM

For the selection of Parsimonious model, logistic regression was applied to estimate the odd ratios and 95 percent confidence interval, and the results were presented in Table 3. The prevalence risk of diabetes is 4.1 times higher for aged 41-50 years (OR: 4.1, 95% CI: 2.7-6.4) and 51-60 years (OR: 4.1, 95% CI: 2.6-6.2) as compared to all other ages. Age group 61-70 years (OR: 2.23, 95% CI: 1.4-3.5) and 31-40 years (OR: 1.64, 95% CI: 0.95-2.8) also showed 2.23 and 1.64 times more possibility respectively of being diabetic than the reference group. But the findings showed 13% reduction (OR: 0.87, 95% CI: 0.45-1.7) in the prevalence risk for the age group 71-80 years. The chances of T2DM increased up to 1.97 times for females (OR: 1.97, 95% CI: 1.66-2.35) as compared to males. Subjects with positive family history of T2DM have 1.3 times (OR: 1.3, 95% CI: 1.105-1.523) more chance of developing this disease than reference group. Unbalanced diet (OR: 3.0, 95% CI: 2.4-3.6) increased the risk of T2DM up to 3 times

in contrast to balanced diet. Significant association between obesity and T2DM was not found. Physically inactive subjects have 2 times (OR: 2.00, 95% CI: 1.5-2.6) more risk of diabetes as compared to individuals involved in regular physical activity.

**Table 4:** Odd ratios and Confidence intervals using logistic regression model.

Variable	Group	O.R	95% CI
Age at the time of diagnosis	31-40	1.64	0.95-2.8
	41-50	4.1	2.7-6.4
	51-60	4.1	2.6-6.2
	61-70	2.23	1.4-3.5
	71-80	0.87	0.45-1.7
Gender	Female	1.97	1.66-2.35
Family History	Positive	1.3	1.105-1.523
Balanced Diet	Absent	3.0	2.4-3.6
Physical activity	Absent	2.00	1.6-2.5



**Fig 3:** Odd ratios and Confidence intervals using logistic regression model.

#### 4. Discussion

This case-control study demonstrated that age, gender, family history, physical activity and balanced diet were highly associated risk factors of T2DM while considerable significance of obesity was not observed. We observe that the age group 40-60 years have highest rate of prevalence of T2DM. Further, prevalence rate of T2DM was much higher in women than men. An increase in development of T2DM due to positive family history was observed but inverse relationships of physical activity and balanced diet were found. Our results are in agreement with previous studies [4, 5]. Moreover, obesity was a non-significant risk factor of T2DM. Contradictory findings were presented in other studies as obesity was established as a strongly associated risk factor of T2DM [4, 5]. The main reason of contradictory results regarding obesity for this region is infrequent use of fast food and preference to walk.

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