Original Article

Occurrence and Distribution of Diabetes Mellitus in Mardan, Pakistan

Huma Fatima[1], Ayesha Bibi[2], Asma Ashraf [3,] Nargis Shaheen[4,] Laiba[1] and Fawad Ali[5*]

[1]Department of Zoology, Women University, Mardan, Pakistan
[2]Department of Human Nutrition and Dietetics, Women University, Mardan, Pakistan
[3]Department of Zoology, Division of Science and Technology, University of Education, Lahore, Pakistan
[4]Department of Zoology, Quaid-e-Azam University, Islamabad, Pakistan
[5]Institute of Biotechnology and Microbiology, Bacha Khan University, Charsadda, Pakistan

ARTICLE INFO

ABSTRACT

Diabetes Mellitus (DM) is a metabolic disorder which is described by chronic hyperglycemia due to faulty insulin secretion. Metabolism of lipids, carbohydrates and proteins are disturbed in DM **Objective:** To assess the occurrence and distribution of diabetes mellitus in Mardan, Pakistan **Methods:** It is a cross-sectional, survery-based study conducted at District Headquarter Hospital Mardan, Khyber Pakhtunkhwa. The detailed information about age and gender of the patients was collected. Blood glucose level was detected by Glucose oxidase test. **Results:** The overall prevalence of DM was found as 50.4%. DM was found dominant in females (52%) as compared to males (48%). Moreover, the age groups of 30-40 years were most affected. Fasting blood sugar (FBS) range was high in the age of 10-20 years and Random blood sugar (RBS) range was high in the age of 40 years and above. **Conclusions:** It is concluded that DM is most commonly found in females and the age group of 30-40 years is more affected. FBS range was high in the age group of 10-20 years and RBS range was high in the age of 40 years and above.

INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder in which the digestion of lipids, carbohydrates and proteins are affected due to insulin deficiency or dysregulation of its secretion [1,2]. Furthermore, polyuria in which a person urinates frequently, polydipsia in which thirst is increased and polyphagia in which hunger is increased are the conditions associated with DM. It is the main cause of disability and death in main population of the world as declared by the International Diabetes Federation (IDF) and World Health Organization (WHO) [3]. WHO indicated that in 2030, DM will be the 7th leading cause of death [2]. DM was first recognized by the Egyptians and is characterized by weight reduction and polyuria. Later on a Greek physician

Aertaeus gave it the term Diabetes mellitus. In Greek, diabetes means "to go through" and mellitus means honey referring to sweet taste [4]. In 1500 BC a Hindu scholar for the first time reported diabetes in his writing. They had defined that it is a dangerous disease that causes thirst, huge amount of urine and the urine of an effected person are more attracted by flies and ants [5]. The movement of glucose in the cells is maintained by Insulin hormone. In Type1 diabetes the body is not capable to make enough insulin which controls the blood sugar level. Earlier it was also called insulin-dependent diabetes or juvenile diabetes [6]. Type1 diabetes mellitus (T1DM), also identified as autoimmune diabetes, in which pancreatic β-cell are loss

113

due to insulin deficiency that leads to hyperglycemia in which the insulin level decreases in plasma and the patients do not receive insulin from outside which is known as ketoacidosis. In early stages of DM type 1, there is enough insulin in the body of patients and they have no need to take insulin which lower the danger of ketoacidosis [7]. Type 2 DM also known as non-insulin dependent DM is the most common form of DM considered by insulin resistance, hyperglycemia, and relative insulin deficiency [8]. It is a long lasting condition that affects the process of metabolism of glucose, which acts as main source of fuel in the body. Similarly, in DM type 2 case the body does not produce insulin or either show resistance to the effect of insulin which maintain normal glucose level in individual body. However, the pancreas has some ability to produce insulin but it does not fulfill the basic needs of the body in DM type 2 and also the body cell shows resistant in action to insulin. It mostly affects the elder peoples mainly at the age of 40 years. It should be treated on time if not so later on it may be leads to ketoacidosis [9]. Gestational diabetes mellitus (GDM) is defined as a glucose intolerance resulting in hyperglycemia which causes major problems during pregnancy [10]. About more than 2000,000 cases are reported annually and about 7% of them are the results of GDM. The prevalence of all pregnancies may range from 1 to 14%, that depends on population and diagnostic test studies [11]. It is found all over the world including rural parts of low- and middle-income countries. According to IDF about 1.1 million children and teenagers of 14-19 years are suffering with T1DM. If no proper measures have been taken to stop the increase in DM, there will be more chances about 629 million people living with the disease. About 4 million deaths occur annually due to high blood glucose, and the assessments of IDF predicted that the annual global health care spending was US$ 850 billion in 2017 diabetes among adults (WHO, 2019). In 2015 about 415 million of adults had diabetes and the rate of increase in people is increasing day by day which will be rise to 642 million in 2040 as estimated by IDF. Among these over 60% of people with diabetes live in Asia, ranging from 3% to 47.3% of prevalence across countries. More number of cases of diabetes is reported in Thailand. More than 200,000 deaths annually among the Thai population are due to chronic non-communicable diseases, and about 30,000 deaths are due to diabetes, a leading cause of death in Thailand [12]. In Pakistan the prevalence of number of diabetic peoples has increased. The prevalence of diabetes in Pakistan is more than 6.5 million according to World Health Organization. The number of affected people will grow to 11.5 million in 2025 until measure are taken for the control of disease [13]. The prevalence of diabetes mellitus in Pakistan is 11.77%. Males are affected more about

(11.20%) while (9.19%) are females. In urban areas the prevalence is high 14.81% as compared to rural areas i.e., 10.34% [14]. In 2017, Pakistan ranks 10 out of 221 countries having 7.5 million cases of diabetes (20–79 years). Since 1947 three national diabetes surveys have been conducted in Pakistan. The combined data of first national diabetes survey of Pakistan (NDSP-I) was published in 2007 and it was conducted in four phases (1995-98). The total number of subjects (n = 5433) in NDSP-I combined data was higher than the sum of subjects examined in four individual studies. So, the prevalence of DM predicted in NDSP-I was under- reported. In 2016-17 the second national diabetes survey of Pakistan (NDSP-II) was reported and similarly, in 2017 the third diabetes prevalence survey of Pakistan(DPS-PAK) was conducted. Although at the same time both the survey was conducted so the prevalence rate was (26.3 vs.16.98%). Also in Pakistan in the prevalence of DM varied between 0.95% and 32.9% according to the regional diabetes survey in the last two decades [15]. Almost nine million cases of diabetes are estimated in Pakistan with nearly 11.7% in the Khyber Pakhtunkhwa [16]. The number of diabetics in Pakistan is estimated to be almost nine million, National Diabetes Survey of Pakistan was completed from 1994-1998, which indicated the prevalence of diabetes as 8.7% which rose to 26.3% in 2017. KPK has the lowest prevalence with 13.2% [17].

METHODS

This study was conducted in different areas of district Mardan in Khyber Pakhtunkhwa province of Pakistan. The total area of district Mardan lies from 34° 05' to 34° 32' at north latitudes and 71" 48' to 72° 25' east longitudes. It is surrounded by Buner district and Malakand protected area from the north, on the east by Swabi and Buner districts, Nowshera district from the south and on the west by Charsadda district and Malakand protected area. The total area of the district is 1632 square kilometers. A Total of 250 blood samples were collected from Mardan District Head Quarter (DHQ) hospital and different medical centers. Glucose oxidase test was used as a diagnostic test for diabetes in pathology lab of District Headquarter Hospital (DHQ). Materials used in this study were Glucose reagent, Glucose standard, test tube, gloves, adjustable juster, distal water, 1ml sugar reagent, 10µl patient serum, Chemistry analyzer, Centrifuge, Micro pipette.In this procedure blood taken from the patients was first centrifuged at 3000 rpm for 4 minutes, at 25oC. The serum was separated from RBCs. About 10µl of serum was transferred to Eppendorf tube to which 1µl of glucose reagent, 10µl of Glucose standard and 10µl distilled water were added. All the contents were mixed well and kept for 10 minutes at room temperature. The blood glucose level was

analyzed through UV spectrophotometric technique [18]. The data was analyzed through software (SPSS Version 17), calculation were done for frequencies, percentage and ratio. For testing significances of frequencies between the groups T test was used. P value is < 0.05 was considered as statistically significant.

RESULTS

The total prevalence of DM in district Mardan was 50.4%. Total 250 samples were collected out of these 126 (50.4%) samples were positive and 124 (49.6%) were negative cases (Table 1). The number of males were 61 (48%) and the remaining 65 (52%) were females (Table 2). Table 3 reveals that mean-prevalence of diabetes among male and female; 0.4552 (male) and 0.5603 (female). This means that prevalence of diabetes is higher in female as compared to male. The table reveals that F-statistic of Levene's test is insignificant, so the variance of the two groups (male/female) is equal; hence results of t-test provided in the first row are valid. Respective t-statistic = –1.660 and its p-value = 0.098 suggest that the mean prevalence of diabetes statistically significantly differ among the male and female. The results revealed 7 (5%) were positive cases in the age of 1-10 years, 11 (9%) were positive cases in the age of 10-20 years, 30 (24%) were positive cases in the age of 20-30 years, 45 (36%) were positive cases in the age of 30-40 years, 33 (26%) were positive cases in the age of 40 years and above (Table-4). FBS and RBS level of positive 126 cases were monitored and categorized according to age groups. The FBS range in low age group i.e. 1-10 years was 115-120 mg/dl however RBS range was 140-155 mg/dl. Similarly, at the age of 10-20 years, FBS range was 118-128 mg/dl and RBS range was 160-177 mg/dl. At the age of 20-30 years, FBS range was 121-127 mg/dl and RBS range was 159-181 mg/dl, at the age of 30-40 years, FBS range was 114-121 mg/dl and RBS range was 162-182 mg/dl. FBS range was 113-127 mg/dl and RBS range was 163-189 mg/dl in the age of 40 years and above (Table 5).

Total samples	Positive cases (n)	Positive case (%)	Negative cases (n)	Negative case (%)
250	126	50.4	124	49.6

Table 1: Overall prevalence of diabetes in District Mardan

Gender	Total	Positive case (n)	Prevalence of diabetes (%)
Male	126	61	48
Female	126	65	52

Table 2: Gender wise prevalence of diabetes in District Mardan

		Levene's Test for Equality of Variances		t-test for Equality of Means							
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Differ-ence	Std. Error Differ-ence	95% Confidence Interval of the Difference	
									Lower	Upper
Diabetic	Equal variances assumed	.242	.623	-1.660	248	.098	-.10512	.06331	-.22982	.01958
	Equal variances not assumed			-1.661	243.082	.098	-.10512	.06330	-.22981	.01957

Table 3: Result of Independent Samples t-Test

Age wise (Years)	Total	Positive case (n)	Prevalence of diabetes (%)
1-10	126	7	5
10-20	126	11	9
20-30	126	30	24
30-40	126	45	36
40 and above	126	33	26

Table 4: Age Wise Prevalence of diabetes in district Mardan

Age wise (Years)	Total	Positive case (n)	FBS range (mg/Dl)	RBS range (mg/Dl)
1-10	126	7	115-120	115-120
10-20	126	11	118-128	118-128
20-30	126	30	121-127	121-127
30-40	126	45	114-121	114-121
40 and above	126	33	113-127	113-127

Table 5: Age wise FBS and RBS level in District Mardan

DISCUSSION

Diabetes is the major problem all over the world in every population and regions, with rural parts of low- and middle-income countries. National Diabetes Survey of Pakistan from 1994-1998 showed the prevalence of DM to be 8.7% which rose to 26.3% in 2017. This study showed prevalence of DM as 50.4% in district Mardan being more prevalent in female as compared to male. These results are against Basit [19]. whose findings show prevalence of DM to be more in male. The current examination shows DM was more prevalent in age group 30-40 (36%) as compared to younger and old age groups. These findings are in contrast to Jawad's [20]. who found high prevalence in the age of 25 years whereas Parveen and Ahmad [3] found DM to be more prevalent at the age of 31-45 years. Similarly, a study done in China by Yang and Weng [21] showed DM to be more prevalent in age group 60 years and above. FBS range was high in the age of 10-20 years. However, there was exception in case of Rehman [22] whose study showed FBS range to be high in the age of 31-40 years. The RBS range was high in the age of 40 years and above. The present study support another study conducted by Zekewos [23]. According to their study RBS range was high in the age of 40 years and above. This study is also supported by Ruhemebe study [24] that showed the prevalence was high

in females. Furthermore, the study conducted by Hayat is also in support of this study [25]. According to his study diabetes were more in females as compared to males. This examination is likewise upheld by another investigation Laakso and Pyorala [26], which demonstrated that prevalence of DM at above age 50 as 73%.

CONCLUSIONS

It is concluded from this study that the overall prevalence rate of diabetes was observed as 50.4%. It was observed that generally diabetes was found more commonly in female population as compared to male, it may be due to lack of physical activity or high stress level in females. The prevalence of diabetes at age 30-40 years' age group was high as compared to younger and older age groups. The prevalence of FBS range was high in the age of 10-20 years and RBS range was high in the age of 40 and above years as compared to other age groups.

REFERENCES

[1] Gao Y, Wang Y, Zhai X, He Y, Chen R, Zhou J, et al. Publication trends of research on diabetes mellitus and T cells (1997–2016): A 20-year bibliometric study. PloS one. 2017;12(9):e0184869. doi.org/10.1371/journal.pone.0184869

[2] Karamanou M, Protogerou A, Tsoucalas G, Androutsos G, Poulakou-Rebelakou E. Milestones in the history of diabetes mellitus: The main contributors. World journal of diabetes. 2016;7(1):1.doi.org/10.4239/wjd.v7.i1.1

[3] Parveen K. Studies on The Efficacy and Therapeutic Poential of Some Herbal Drugs In The Treatment of Diabetes Mellitus In The Rat.

[4] Kaul K, Tarr JM, Ahmad SI, Kohner EM, Chibber R. Introduction to diabetes mellitus. Diabetes: Springer.2013;1-11.doi.org/10.1007/978-1-4614-5441-0_1

[5] Das AK, Shah S. History of diabetes: from ants to analogs. J Assoc Physicians India. 2011;59 (Suppl)):6-7.

[6] Inzucchi SE, Sherwin RS. Type 2 diabetes mellitus. Cecil Medicine 24th ed Philadelphia, Pa: Saunders Elsevier 2011. doi.org/10.1016/B978-1-4377-1604-7.00562-5

[7] Katsarou A, Gudbjörnsdottir S, Rawshani A, Dabelea D, Bonifacio E, Anderson BJ, et al. Type 1 diabetes mellitus. Nature reviews Disease primers. 2017;3(1):1-17. doi.org/10.1038/nrdp.2017.16

[8] Olokoba AB, Obateru OA, Olokoba LB. Type 2 diabetes mellitus: a review of current trends. Oman medical journal. 2012;27(4):269. doi.org/10.5001/omj.2012.68

[9] Kharroubi AT, Darwish HM. Diabetes mellitus: The epidemic of the century. World J Diabetes. 2015 Jun 25;6(6):850-67. doi: 10.4239/wjd. v6. i6.850.

[10] Baz B, Riveline J-P, Gautier J-F. Gestational diabetes mellitus: definition, aetiological and clinical aspects. Eur J Endocrinol. 2016;174(2):R43-51.doi.org/10.1530/EJE-15-0378

[11] American Diabetes Association. Gestational diabetes mellitus. Diabetes Care. 2004 Jan;27 Suppl 1: S88-90. doi: 10.2337/diacare.27. 2007.s88.

[12] Aekplakorn W, Chariyalertsak S, Kessomboon P, Assanangkornchai S, Taneepanichskul S, Putwatana P. Prevalence of diabetes and relationship with socioeconomic status in the Thai population: National Health Examination Survey, 2004–2014. Journal of diabetes research 2018. doi.org/10.1155/2018/1654530

[13] Zuhaid M, Zahir KK, Diju IU. Knowledge and perceptions of diabetes in urban and semi urban population of Peshawar, Pakistan. Journal of Ayub Medical College Abbottabad. 2012;24(1):105-8.

[14] Uzma Hassan A, Khurshid WAN. Awareness of Diabetes Mellitus and Associated Factors in Diabetic Patients; Visiting Rawal General and Dental Hospital Islamabad. population Research. 2018;4:11.

[15] Adnan M, Aasim M. Prevalence of type 2 diabetes mellitus in adult population of pakistan: a meta-analysis of prospective cross-sectional surveys. Annals of Global Health. 2020;86(1).doi.org/10.5334/aogh.2679

[16] Ullah M, Mehmood S, Ali M, Bussmann RW, Aldosari A, Khan RA, et al. An ethnopharmacological study of plants used for treatment of diabetes in the Southern and Tribal regions of Khyber Pakhtunkhwa province, Pakistan. Ethnobotany Research and Applications. 2019;18:1-20.doi.org/10.32859/era.18.8.1-20

[17] Rafiullah AR, Khan K, Ali A, Khan A, Sajid A, Khan N. Prevalence of Theileria Parva in large ruminants through conventional and molecular techniques in district Lakki Marwat and Peshawar (Pakistan). Sarhad Journal of Agriculture. 2019;35(2):320-9.

[18] Mashal S. prevalence and different comorbidities linked to diabetic patients in dera ismail khan, khyber pakhtunkhwa, pakistan. 2019.

[19] Badruddin N, Basit A, Hydrie MZI, Hakeem R. Knowledge, attitude and practices of patients visiting a diabetes care unit. Pakistan Journal of Nutrition. 2002;1(2):99-102. doi.org/10.3923/pjn.2002.99.102

[20] Jawad F. Diabetes in Pakistan. Diabetes voice. 2003;48(2):12-4.

[21] Yang W, Lu J, Weng J, Jia W, Ji L, Xiao J, et al. Prevalence of diabetes among men and women in

China. New England journal of medicine. 2010;362(12):1090-101. doi.org/10.1056/NEJMoa0908292

[22] Rahman S, Ismail AA-S, Ismail SB, Naing NN, Rahman ARA. Effect of rosiglitazone/ramipril on preclinical vasculopathy in newly diagnosed, untreated diabetes and IGT patients: 1-year randomised, double-blind, placebo-controlled study. European journal of clinical pharmacology. 2007;63(8):733-41. doi.org/10.1007/s00228-007-0315-3

[23] Zekewos A, Loha E, Egeno T, Wubshet K, Merga Z. Prevalence of diabetes mellitus and associated factors in Southern Ethiopia: a community based study. Ethiopian Journal of Health Sciences. 2018;28(4).doi.org/10.4314/ejhs.v28i4.11

[24] Ruhembe CC, Mosha TC, Nyaruhucha CM. Prevalence and awareness of type 2 diabetes mellitus among adult population in Mwanza city, Tanzania. Tanzania journal of health research. 2014;16(2). doi.org/10.4314/thrb.v16i2.4

[25] Hayat U, Khan M, Kazmi NHS, Ali N, Mufti WA, Khan FI, et al. frequency of newly diagnosed diabetes mellitus in patients with acute myocardial infarction. Journal of Ayub Medical College Abbottabad. 2014;26(3):368-70.

[26] Laakso M, Pyörälä K. Age of onset and type of diabetes. Diabetes care. 1985;8(2):114-7. doi.org/10.2337/diacare.8.2.114