AVICENNA JOURNAL OF MEDICAL SCIENCES

OPEN ACCESS

ORIGINAL ARTICLE

Epidemiology of Diabetes Mellitus in Urban and Rural Areas of District Swat Khyber Pakhtunkhwa Pakistan; A Cross-Sectional Study

Muhammad Subhan **Nazar**[1], Adnan **Khan**[2], Shah **Khalid**[2], Karim **Ullah**[2], Abbas **Ahmad**[3], **Memoona**[4], Shahbaz Ahmad **Zakki**[1,*]

[1]*Department of Public Health and Nutrition, The University of Haripur, Khyber Pakhtunkhwa, Pakistan*
[2]*Governament Post Graduate Jahanzeb College Saidu, Affiliation with University of Swat, Khyber Pakhtunkhwa, Pakistan*
[3]*Department of Microbiology, The University of Haripur, Khyber Pakhtunkhwa, Pakistan*
[4]*Institute of Physiotherapy & Rehabilitation Sciences, Peoples University of Medical & Health Sciences for Women, Nawab-shah (SBA), Pakistan*

Abstract:

Objectives: From the beginning of December 2018 to the end of May 2019, the current study was undertaken to estimate the prevalence of Diabetes Miletus in urban and rural areas of Tehsil Kabal (rural) and Babozai (urban) district Swat.

Methods: In this study, samples were randomly collected from various Tehsil Kabal and Babozai locations. Each patient's gender, age, and demographic data were gathered using an appropriate questionnaire. Data were also gathered by laboratory tests such as blood sugar random, blood sugar fasting, and urine analysis. There were 300 total subjects chosen at random from each tehsil.

Results: There were 300 total subjects chosen at random from each tehsil. In this study, metropolitan areas had a 56% total incidence of diabetes compared to 37% in rural areas. In total, 54% of men and 58% of women in urban areas were found to have diabetes, compared to 20.66% of men and 53.33% of women in rural areas. According to our study, district swat's urban area (Babozai) has a higher prevalence of diabetes mellitus. In this investigation, older age groups were found to have a higher incidence of diabetes. In both urban and rural areas, the age categories of 51–60, 61–70, and 71–80 had the highest prevalence

Conclusion: Advanced age, being overweight or obese, having incorrect eating habits, and having a positive family history of diabetes were the main risk factors associated with diabetes.

Keywords: Epidemiology, Diabetes mellitus, Risk factor, Lifestyle.

How to cite: *Nazar MS, Khan A, Khalid S, Karimullah, Ahmad A, Memoona, Zakki SA. Epidemiology of Diabetes Mellitus in Urban and Rural Areas of District Swat Khyber Pakhtunkhwa Pakistan; A Cross-Sectional Study. Avicenna J Med Sci 2023; 3 (2): 18-25*

Introduction

Diabetes Mellitus (DM) is defined by high blood sugar levels that are sufficient to significantly encourage the development of a specific and unique smaller-scale angiopathy (retinopathy, nephropathy, and neuropathy), which is a group of metabolic illnesses [1,2] Diabetes is a chronic metabolic disorder. Imperfect insulin release or insulin activity deficiencies are used to characterize it [3].

In 1798, British Surgeon-General John Rollo used the term mellitus to differentiate this kind of diabetes from diabetes (insipidus), in which the urine had no taste [4]. In 1936, the distinction between type 1 and type 2 DM was clearly defined [5].

The WHO issued the initial categorization in 1980 [6]. The two major types of diabetes, insulin-dependent diabetes mellitus (Type I) and non-insulin-dependent diabetes mellitus (NIDDM), were described (Type II). There were also other classes included, like gestational diabetes. The redesigned type from 1985 was extensively embraced

Corresponding author: Shahbaz Ahmad Zakki,
Affiliations: Department of Public Health and Nutrition, The University of Haripur, Haripur, Khyber Pakhtunkhwa, Pakistan.
Email: sazakki@uoh.edu.pk

Received: July 19, 2023
Revised: August 08, 2023
Accepted: August 31, 2023
DOI: https://doi.org/10.59119/ajms.2023(3).2.4

eISSN 2958-2741 | pISSN 2958-2733

[7] and is still in use today. The classes Type I and Type II were provided to further explain the case since they are the earlier and more consistent types of diabetes and are caused by faults in insulin release [8].

Only around 5% to 10% of all diabetes cases are type I DM, but its prevalence is rising internationally and it has substantial short- and long-term consequences. When insulin is used to halt the progression of ketoacidosis, a trance-like state, and fatalities, class I shows how beta-cell destruction in the pancreases might eventually lead to diabetes mellitus [1]. Diabetes has been linked to fasting blood sugar levels of greater than 7 mmol/L (126 mg/dL), any blood sugar level of 11 mmol/L (200 mg/dL) or higher with symptoms of hyperglycemia, or an abnormal 2-hour oral glucose tolerance test. In 2009, the American Diabetic Association revised its diabetes guidelines. Millet's decision to add glycated hemoglobin (HbA1C; a test that evaluates an average blood sugar level over 90 days) levels of 6-6% or above [9]. For proper care and to minimize complications, a precise diagnosis of this condition is essential. Effectively detecting diabetic ketoacidosis at the time of type 1 diabetes diagnosis also indicates a crucial window for survival [10]. After the diagnosis of type 1 diabetes, there is no proven medication to stop the autoimmune destruction of cells. Interest in class 1 illness inversion has grown over the past six year[11]. Enhancing immune system tolerance against the cells and preventing immune system destruction are critical goals in order to preserve C-peptide production. The majority of techniques include administering either an immunosuppressant or a self-antigen (such as vaccination with specific islet-cell proteins like insulin or GAD). Unfortunately, stage 3 trials with anti-CD3 antibody (otelixizumab and teplizumab) and Diamide immunization (GAD-alum immune treatment), which showed promise in patients with later-onset class 1 diabetes and perceptible internal insulin production, failed to reach the primary endpoint [12,13].

The most well-known type of diabetes is type II. There are many people diagnosed with type II diabetes around the world, and many more cases go undiagnosed. If diabetes is not diagnosed or is not well managed, people with diabetes are at a significant risk of developing cardiovascular diseases like heart attack and stroke. Aside from kidney failure requiring dialysis or replacement, they also face a significant chance of losing their sight, losing limbs due to damage to the nerves and veins, and losing their feet [14]. In class II diabetes, the cells either fail to recognize the insulin or the body is unable to produce enough of it. For the body to be able to use sugar as fuel, insulin is necessary. Following a meal, the body converted all sugar into glucose, which serves as the cells' primary fuel source. Insulin transports sugar from blood arteries into the cell. When blood glucose levels rise despite reaching the cells, it might cause complications with diabetes [14,15].

First pregnancy-related diabetes diagnosis from a female patient. Obese women, women who may have had gestational diabetes in the past, and women with a strong family history of diabetes are more likely to develop gestational diabetes. Untreated gestational diabetes may cause problems for the unborn kid. Class II diabetes for others is more likely to occur in the mother and child together [16], while pregnant develop gestational diabetes. The mother's blood glucose level rises during pregnancy as a result of hormone release, and she is therefore unable to produce enough insulin to deal with the increasing blood glucose levels. Although gestational diabetes returns to normal after birth, the mother is more likely to acquire type 2 diabetes in the future. Similar to type 2 diabetes, it affects African Americans, American Indians, Hispanic Americans, and those with a family history of the disease more frequently [1].

The number of people with diabetes is rising due to factors such as population growth, ageing, suburbanization, an increase in overweight people, and a lack of physical activity. To enable wise resource allocation and planning, it is crucial to measure the prevalence of diabetes and the number of people affected by it at present and in the future [17]. In both developed and underdeveloped countries, the prevalence of diabetes mellitus has reached epidemic proportions, affecting more than 366 million people who suffer from its negative effects, and that number may increase to 5 billion and 52 million by 2030 [3]. By 2035, there may be 5 billion and 92 million people worldwide who have diabetes, up from 3 billion and 82 million in 2013. By 2035, the overall number of diabetics is likely to increase by 55% due to population growth, population maturation, suburbanization, and associated way of life changes. China has surpassed all other countries in the world in terms of the number of people who have diabetes [18].

When all factors are considered, diabetes mellitus (DM) ranks as the twelfth leading cause of death worldwide [19]. Diabetes Mellitus contributes 1% of Disability Adjusted Life Years (DALY) [20]. Diabetes Mellitus is a disorder with multiple risk factors; the primary ones include Body Mass Index (BMI), inactivity, poor diet, and infection, as well as age and a family history of the condition [21]. Inactive people are more at risk of developing this disorder, as are those who are overweight, obese, have blood vessel hypertension, fasting plasma glucose levels below 100 mg/dl, follow unethical dietary habits, are older, and have a family history of diabetes, which is regarded as a non-modifiable risk factor [22].

The risk factors for class II diabetes include being overweight, poor nutrition and inactivity, ageing, insulin resistance, family histories of the disease, hereditary factors, race and ethnic background. Regarding hereditary factors, research has shown that a certain gene is responsible for the chance of acquiring diabetes. These genes may influence how insulin affects body tissues, lower insulin production, and increase the risk of obesity. In various ethnic groups, including those of African Americans, Mexican Americans, American Indians, native Hawaiians, and some Americans of Asian descent, the prevalence of diabetes is higher for reasons related to race and ethnicity. The group mentioned above has a greater risk of developing diabetes and heart disease. The greatest rates of diabetes, obesity, and hypertension in that population render this insufficient. African Americans are more likely to have type II diabetes than people from other ethnic groups [23].

Around, 600 employees of the B.J. Medical College in Ahmedabad, Gujarat, participated in a cross-sectional study that examined the prevalence of diabetes and its relationship to risk factors. study was 10% for women and 9% for males [24]. 55 years or older for 28.07% of men and 24.61% of women who explained the diabetic background. In comparison to those with normal abdomen perimeter, those with a midsection perimeter >90 cm in males and >80 cm in women were at an increased risk of developing diabetes. The purpose of this study is to compare the incidence rates of diabetes in Tehsil Kabal and Babozai's urban and rural areas. Additionally, learn how diabetes Miletus affects people of various ages and sexes. The aims and objective of the study to find the prevalence of Diabetes mellitus in in urban and rural areas of Tehsil Kabal(rural) and Babozai (urban) district Swat.

Methodology

Study design, settings and participants:

An explanation from the beginning of December 2018 to the end of May 2019, a cross-sectional survey was conducted among the general people in District Swat, rural and urban areas of Tehsil Kabal and Babozai, Khyber Pakhtunkhwa, Pakistan. We choose this style due to a number of advantages. It doesn't cost much money to do it, and it takes little time. One-time data is needed in this. Different Tehsil Kabal and Babozai locations are chosen at random for sample collection, and a thorough epidemiological investigation is conducted using a questionnaire that includes questions about age and sex.

Study Variables:

Laboratory tests like Blood sugar fasting, Blood sugar random, and urine analysis are examples of dependent variables. Independent variables include gender, age and demography.

Statistical analysis:

Data entered into Microsoft Excel and summarized using descriptive statistics (frequency, percentages, means, median, and standard deviation).

Results

Out of 150 samples, the gender-based study reveals that men have 31 positive instances and 119 negative cases, for a rate of 20.66%. Females had 170 samples altogether, 175 positive cases, and 80 negative instances, for a percentage of 53.33%. 300 samples are gathered throughout the process, of which 111 are positive and 189 are negative. The combined rate of positive among men and women is 37%. in the Table 1.

Age wise incidence

A study on the incidence of diabetes in tehsil Kabal at the age of 11 to 20 found 8 negative instances but no positive cases in the samples that were taken. Ages 21 to 30 have a ratio of 4 positive instances to 22 negative cases, or a percentage of 15.3%. From the gathered samples, the population between the ages of 31 and 40 displays a percentage of 30.37%, with 24 cases being positive and 55 cases being negative. The percentage for those between the ages of 41 and 50 is 48.05, with 37 positive instances and 40 negative cases. Between the ages of 51 and 60, it is evident that there are 30 positive cases and 30 negative cases, with a proportion of 50%. The rate among those aged 61 to 70 is 35.71%, with 10 positive instances and 18 negative cases. According to table 2, there are 6 positive instances and 16 negative cases in the age group of 71 to 80. Their percentage is 27.27%.

Table 2: Age wise incidence of diabetes in Kabal.

Age	Positive	Negative	Percentage (%)
11-20	0	1	00.00
21-30	24	49	32.87
31-40	17	33	34.00
41-50	39	40	49.36
51-60	46	7	86.79
61-70	32	2	94.11
71-80	10	0	100

Area wise incidence:

According to area-wise incidence, there are positive and negative cases of diabetes in various places, such as Kozabandai, where there are 16 positive cases and 44 negative cases, with a positive case percentage of 26.6%. Kabal, on the other hand, has 31 negative cases and 29 positive cases, for a percentage of 48.3%. The rate in Ningolai is 36.3% with 22 positive cases and 38 negative ones. Kanjo has 31 positive instances and 29 negative cases, giving it the highest percentage of any of them at 51.6%. Totanobandai, on the other hand, has 13 positive instances and 47 negative cases, for a proportion of 21.6%, the lowest of all the groups in Table 3.

Table 3: Area wise incidence of diabetes in Kabal.

Area	Positive	Negative	Percentage (%)
Koza Bandai	16	44	26.6
Kabal	29	31	48.3
Ningolai	22	38	36.6
Kanjo	31	29	51.6
Totano Bandai	13	47	21.6

Babozai data:

Gender wise incidence

Out of 150 samples, a gender-based investigation reveals that males have 81 positive instances and 69 negative cases, for a rate of 54%. Female samples out of a total of 150 have 87 positives and 63 negatives, making up 58% of the total. 300 samples are taken throughout the process, of which 168 are positive and 132 are negative. According to table:4 and fig.1, the overall positive rate for both men and women is 56%.

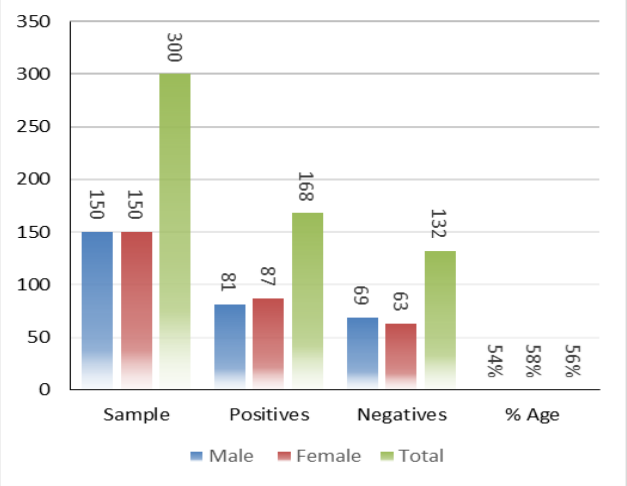

Figure 1. Gender wise incidence of diabetes in Babozai

Table 4: Gender wise incidence of diabetes in Babozai.

Gender	Sample	Positives	Negatives	Percentage (%)
Male	150	81	69	54
Female	150	87	63	58
Total	300	168	132	56

Age wise incidence:

The age-based table shows that there are no positive cases in the samples that were taken from people between the ages of 11 and 20. Between the ages of 21 and 30, 24 people are positive, 49 people are negative, and the ratio rises to 32.87%. From the 50 obtained samples, the population aged 31 to 40 indicates a proportion of 34% with 39 positive cases and 40 positive cases. The positivity rate for people in their 40s is 46, while the negativity rate is 7, and the percentage is 49.36%. The ratio of 46 positive cases to 7 negative cases in people aged 51 to 60 is 86.79%. The age group from 61 to 70 indicates 2 incidents of negativity and 32 cases of positivity, with the second-highest positivity percentage of 94.11%. Figure 2 illustrates the high rate of positivity in the age range of 71 to 80, where 100% of the 10 samples that were obtained out of the 10 were positive.

Area wise incidence

The table below displays the positive and negative instances of diabetes in various regions. For example, Qamber has 22 positive cases and 38 negative cases, with a positive case percentage of 36.6%. Saidu, on the other hand, has a percentage of 73.3% with 44 positive cases and 16 negative cases. The proportion for shagai is 48.3% with 29 positive cases and 31 negative instances. Odigram has a rate of 63.3% with 38 positive instances and 22 negative cases. Mingora, on the other hand, has the highest percentage of them all—73.3%—with 44 positive cases and 16 negative cases.

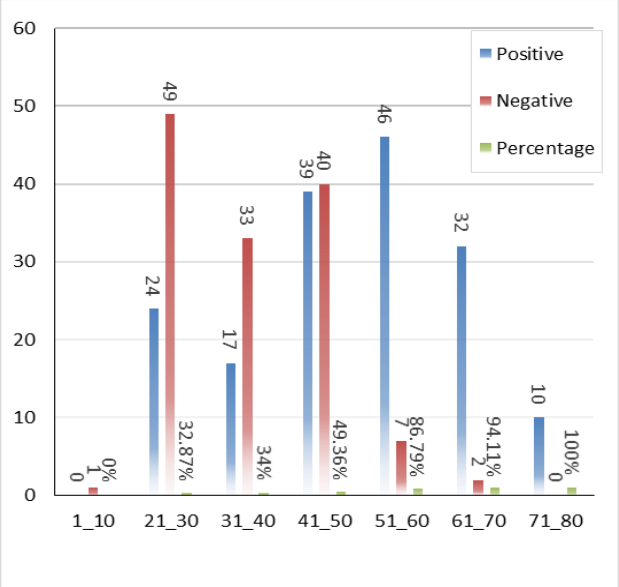

Figure 2. Age wise incidence of diabetes in Babozai.

Discussion

Numerous studies conducted in Pakistan and other countries have shown that the prevalence of diabetes is rising globally. In Pakistan and other Asian countries, the prevalence of diabetes is rapidly increasing. The prevalence of this chronic metabolic condition is rising everywhere in the world. Over 10% of Pakistan's adult population, which has a population of 1 billion and 54 million, suffers from diabetes[25]. Additionally, astounding is their sheer quantity, both in rural and urban areas. 2.15 million, 2.44 million, and 4.22 million people in rural areas would have diabetes, compared to 2.18 million, 2.84 million, and 10.24 million in urban areas[26]. The goal of the current study is to estimate the prevalence of diabetes and compare its incidence across urban and rural areas in the district of Swat.

Diabetes was found to be prevalent in 56% of urban regions and 37% of rural areas in district Swat, according to our study. This is lower than previous studies done in 1998 in urban (Quetta) and rural (Killimengal) regions of Baluchistan by A.S. Shera et al., which reported that 76% of urban areas and 81% of rural areas were afflicted[27]. The greater score might be attributed to a higher fat consumption and a less physically active lifestyle.

The overall incidence of diabetes in urban regions was found to be 56% in our study, which is higher than the 15.3% reported in a comparable study by Raghavendra A. H. et al. in an urbanised hamlet in east Delhi. The lowest results are attributable to people moving from rural to urban areas[28]. A survey conducted in 2003 in Chennai by Mohan et al found an increase in the incidence of diabetes attributable to changes in lifestyle variables brought about by urbanization[29].

According to our poll, 54% of men and 58% of women have diabetes, which is more common in metropolitan areas. When Jamal Zafar and colleagues performed a poll in Punjab in 2008, the results were 15.41% for women and 12.31% for men[30]. However, our results are comparable to those of Dhara Prajapati et al 2015's study in Ahmad Abad, India, where the prevalence of diabetes was 10% in women and 9% in males[24]. In addition, in a research conducted by Purty et al. in Puducherry, India, the incidence of diabetes was 5.3% in males and 6.2% in women[31]. Diabetes is more common in women due to a higher incidence of physical inactivity and obesity among women.

In contrast to a 2007 study by P.R. Kokiwar et al. in several rural districts of central India, which found that the incidence of diabetes was 3.67%, our study found that the incidence of diabetes is 37% in rural areas [32] and also, higher than from Sayyed et al where they found a prevalence of 4.3% in rural Bangladesh however, they used the 1997 America diabetic association Diagnostic criteria's[33]. Due to a changing way of life and the effects of environmental conditions, the value is at its lowest. According to our survey, rural areas have a higher incidence of diabetes in women than in men (20.33% in men and 53.66% in women), which is close to a 2009 study led by Shugang Li et al. that reported 7.4% in men and 8.6% in women[34]. Females have a higher frequency due to a variety of factors such as diet, quality of life, and attitudes toward cure and prevention.

Our study looked at people aged 10 to 80, and we found that the prevalence of diabetes rises with advancing years. In our study, older age groups were shown to have a greater incidence of diabetes. In both urban and rural areas, the age ranges of 51 to 60, 61 to 70, and 71 to 80 have the highest frequency, and our findings are comparable to those of a survey carried out in Punjab in 2008 by Jamal Zafar et al[30]. Arora et al, Ravikumar P et al also observed a considerable and statistically significant relationship between increasing age and diabetes[35,36]. Older persons have an increased chance of acquiring diabetes due to the mutual relationship between increasing insulin resistance and reduced pancreatic islet function with advancing age.

Individuals with central obesity, severe obesity, poor eating habits, advanced age, and a family history of diabetes are at a higher risk of getting this illness. All of the researchers described above present a similar finding, however when it comes to the incidence of diabetes, the percentage is presented with a distinct connection of risk factor. Urbanization, population growth, and lifestyle changes are all significant risk factors.

Conclusion

The prevalence of diabetes has considerably increased over the past several years in both district swat's urban and rural areas. Comparing our data to earlier research conducted in Pakistan, it reveals a higher prevalence of diabetes. According to our study, the urban region of district Swat (tehsil Babozai) has a higher prevalence of diabetes mellitus. More cases of diabetes indicate that ecological variables could have a significant impact on urban residents' risk of developing the disease. We found that the risk factors for diabetes in the current study to be advanced age, body mass index, obesity, high blood pressure, and persons with a family history of the disease.

Ethical approval and consent

The study was approved by the institutional board of studies and informed consent was obtained from each participants included in the study.

Acknowledgment

We thank the study subjects for participating in this study.

Disclosure

The authors affirm that they do not have any conflicting interests.

Author's contributions

MSNwas involved in the execution of the project. AK and SK executed the study and wrote the manuscript. K and AA helped in organization of data and did the statistical analysis. M and SAZ helped in the editing.All named authors have read and approved the final version of the manuscript.

Data availability

Available from the corresponding author on reasonable request.

Funding

There is no funding for this research.

References:

1. 1. World Health Organization. Definition, diagnosis and classification of diabetes mellitus and its complications: report of a WHO consultation. Part 1, Diagnosis and classification of diabetes mellitus. World health organization; 1999.
2. 2. World Health Organization. Obesity: preventing and managing the global epidemic.
3. 3. Danaei G, Finucane MM, Lu Y, Singh GM, Cowan MJ, Paciorek CJ, Lin JK, Farzadfar F, Khang YH, Stevens GA, Rao M. National, regional, and global trends in fasting plasma glucose and diabetes prevalence since 1980: systematic analysis of health examination surveys and epidemiological studies with 370 country-years and 2· 7 million participants. The lancet. 2011 Jul 2;378(9785):31-40.
4. 4. Ahmed AM. History of diabetes mellitus. Saudi medical journal. 2002 Apr 1;23(4):373-8.
5. 5. Patlak M. New weapons to combat an ancient disease: treating diabetes. The FASEB Journal. 2002 Dec;16(14):1853e-..
6. 6. Keen H, Fui SN. 1 The definition and classification of diabetes mellitus. Clinics in endocrinology and metabolism. 1982 Jul 1;11(2):279-305.
7. 7. Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Report of the expert committee on the diagnosis and classification of diabetes mellitus. Diabetes care. 2003 Jan 1;26 (suppl_1):s5-20.
8. 8. Goodpaster BH, DeLany JP, Otto AD, Kuller L, Vockley J, South-Paul JE, Thomas SB, Brown J, McTigue K, Hames KC, Lang W. Effects of diet and physical activity interventions on weight loss and cardiometabolic risk factors in severely obese adults: a randomized trial. Jama. 2010 Oct 27;304 (16):1795-802.
9. 9. Nakanga WP, Crampin A, Nyirenda M. Personal View: Should haemoglobin A1C be used for diagnosis of diabetes mellitus in Malawi?. Malawi Medical Journal. 2016 Apr 6;28(1):28-30.
10. 10. Usher-Smith JA, Thompson MJ, Sharp SJ, Walter FM. Factors associated with the presence of diabetic ketoacidosis at diagnosis of diabetes in children and young adults: a systematic review. Bmj. 2011 Jul 7;343.
11. 11. Greenbaum C, Atkinson MA. Persistence is the twin sister of excellence: an important lesson for attempts to prevent and reverse type 1 diabetes. Diabetes. 2011 Mar 1;60(3):693-4.
12. 12. Walter M, Philotheou A, Bonnici F, Ziegler AG, Jimenez R, NBI-6024 Study Group. No effect of the altered peptide ligand NBI-6024 on β-cell residual function and insulin needs in new-onset type 1 diabetes. Diabetes care. 2009 Nov 1;32(11):2036-40.
13. 13. Wherrett DK, Bundy B, Becker DJ, DiMeglio LA, Gitelman SE, Goland R, Gottlieb PA, Greenbaum CJ, Herold KC, Marks JB, Monzavi R. Antigen-based therapy with glutamic acid decarboxylase (GAD) vaccine in patients with recent-onset type 1 diabetes: a randomised double-blind trial. The Lancet. 2011 Jul 23;378(9788):319-27.
14. 14. Pasinetti GM, Wang J, Porter S, Ho L. Caloric intake, dietary lifestyles, macronutrient composition, and Alzheimer'disease dementia. International journal of Alzheimer's disease. 2011 Jan 1;2011.
15. 15. Haus JM, Solomon TP, Marchetti CM, Edmison JM, Gonzalez F, Kirwan JP. Free fatty acid-induced hepatic insulin resistance is attenuated following lifestyle intervention in obese individuals with impaired glucose tolerance. The Journal of Clinical Endocrinology & Metabolism. 2010 Jan 1;95(1):323-7.
16. 16. Harris MI. Epidemiological correlates of NIDDM in Hispanics, whites, and blacks in the US population. Diabetes care. 1991 Jul 1;14(7):639-48.
17. 17. King H, Rewers M, WHO Ad Hoc Diabetes Reporting Group. Global estimates for prevalence of diabetes mellitus and impaired glucose tolerance in adults. Diabetes care. 1993 Jan 1;16(1):157-77.
18. 18. Guariguata L, Whiting DR, Hambleton I, Beagley J, Linnenkamp U, Shaw JE. Global estimates of diabetes prevalence for 2013 and projections for 2035. Diabetes research and clinical practice. 2014 Feb 1;103(2):137-49.
19. 19. Khan MA, Hashim MJ, King JK, Govender RD, Mustafa H, Al Kaabi J. Epidemiology of type 2 diabetes–global burden of disease and forecasted trends. Journal of epidemiology and global health.

2020 Mar;10(1):107.
20. 20. Tunstall-Pedoe H. Preventing Chronic Diseases. A Vital Investment: WHO Global Report. Geneva: World Health Organization, 2005. pp 200. CHF 30.00. ISBN 92 4 1563001. Also published on http:// www. who. int/chp/chronic_disease_report/en.
21. 21. Park JE. Text book preventive and social medicine.
22. 22. Pires CG, Mussi FC, Cerqueira BB, Pitanga FJ, Silva DO. Prática de atividade física entre estudantes de graduação em enfermagem. Acta Paulista de Enfermagem. 2013;26:436-43.
23. 23. Boulton AJ, Vinik AI, Arezzo JC, Bril V, Feldman EL, Freeman R, Malik RA, Maser RE, Sosenko JM, Ziegler D. Diabetic neuropathies: a statement by the American Diabetes Association. Diabetes care. 2005 Apr 1;28(4):956-62.
24. 24. Anjana RM, Deepa M, Pradeepa R, Mahanta J, Narain K, Das HK, Adhikari P, Rao PV, Saboo B, Kumar A, Bhansali A. Prevalence of diabetes and prediabetes in 15 states of India: results from the ICMR–INDIAB population-based cross-sectional study. The lancet Diabetes & endocrinology. 2017 Aug 1;5(8):585-96.
25. 25. Shera AS, Rafique G, Khawaja IA, Baqai S, King H. Pakistan National Diabetes Survey: prevalence of glucose intolerance and associated factors in Baluchistan province. Diabetes research and clinical practice. 1999 Apr 1;44(1):49-58.
26. 26. King H, Aubert RE, Herman WH. Global burden of diabetes, 1995–2025: prevalence, numerical estimates, and projections. Diabetes care. 1998 Sep 1;21(9):1414-31.
27. 27. Shera AS, Basit A, Fawwad A, Hakeem R, Ahmedani MY, Hydrie MZ, Khwaja IA. Pakistan National Diabetes Survey: prevalence of glucose intolerance and associated factors in the Punjab Province of Pakistan. Primary care diabetes. 2010 Jul 1;4(2):79-83.
28. 28. Raghavendra AH, Chabra P, Sharma AK, Madhu SV. Prevalence of diabetes mellitus in an urbanized village of East Delhi. National Journal of Community Medicine. 2016 Apr 30;7(04):302-6.
29. 29Mohan V, Mathur P, Deepa R, Deepa M, Shukla DK, Menon GR, Anand K, Desai NG, Joshi PP, Mahanta J, Thankappan KR. Urban rural differences in prevalence of self-reported diabetes in India—The WHO–ICMR Indian NCD risk factor surveillance. Diabetes research and clinical practice. 2008 Apr 1;80(1):159-68.
30. 30. Zafar J, Bhatti F, Akhtar N, Rasheed U, Bashir R, Humayun S, Waheed A, Younus F, Nazar M. Prevalence and risk factors for diabetes mellitus in a selected urban population of a city in Punjab. JPMA-Journal of the Pakistan Medical Association. 2011 Jan 1;61(1):40.
31. 31. Purty AJ, Vedapriya DR, Bazroy J, Gupta S, Cherian J, Vishwanathan M. Prevalence of diagnosed diabetes in an urban area of Puducherry, India: Time for preventive action. International Journal of Diabetes in Developing Countries. 2009 Jan;29(1):6.
32. 32. Kokiwar PR, Gupta S, Durge PM. Prevalence of diabetes in a rural area of central India. Int J Diab Dev Ctries. 2007 Mar;27(1):8-10.
33. 33. Sayeed MA, Mahtab H, Khanam PA, Latif ZA, Ali SK, Banu A, Ahren B, Azad Khan AK. Diabetes and impaired fasting glycemia in a rural population of Bangladesh. Diabetes care. 2003 Apr 1;26(4):1034-9.
34. 34. Li S, Guo S, He F, Zhang M, He J, Yan Y, Ding Y, Zhang J, Liu J, Guo H, Xu S. Prevalence of diabetes mellitus and impaired fasting glucose, associated with risk factors in rural Kazakh adults in Xinjiang, China. International journal of environmental research and public health. 2015 Jan;12(1):554-65.
35. 35. Kalra S, Kalra B, Sharma A. Prevalence of type 1 diabetes mellitus in Karnal district, Haryana state, India. Diabetology & metabolic syndrome. 2010 Dec;2:1-3.
36. 36. Ravikumar P, Bhansali A, Ravikiran M, Bhansali S, Walia R, Shanmugasundar G, Thakur JS, Bhadada SK, Dutta P. Prevalence and risk factors of diabetes in a community-based study in North India: the Chandigarh Urban Diabetes Study (CUDS). Diabetes & metabolism. 2011 Jun 1;37(3):216-21.