Type 2 diabetes mellitus in Pakistan: Current prevalence and future forecast

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Abstract

Diabetes mellitus is a chronic health problem of all age groups, both gender, involves rural and urban areas and developing and developed countries globally. The aim of this study was to assess the prevalence of type 2 diabetes mellitus in Pakistan.

Systematic bibliographic search of scientific databases including PubMed, ISI-web of science and Google Scholar was conducted with key words of "type 2 diabetes mellitus" "prevalence", "incidence", "occurrence". A total of 22 peer reviewed papers published in ISI and PubMed indexed journals were selected and examined. All the epidemiologic and experimental studies reporting the diabetes prevalence in Pakistan were included. Lastly, we analyzed 18 publications and remaining 04 papers were excluded.

The current prevalence of type 2 diabetes mellitus in Pakistan is 11.77%. In males the prevalence is 11.20% and in females 9.19%. The mean prevalence in Sindh province is 16.2% in males and 11.70 % in females; in Punjab province it is 12.14% in males and 9.83% in females. In Baluchistan province 13.3% among males, 8.9% in females; while in Khyber Pakhtunkhwa (KPK) it is 9.2% in males and 11.60% in females. The prevalence of type 2 diabetes mellitus in urban areas is 14.81% and 10.34% in rural areas of Pakistan.

The prevalence of type 2 diabetes mellitus in Pakistan is11.77%. The prevalence is higher in males than females and more common in urban areas compared to the rural areas. Pakistan must include diabetes preventive measures in their national health policy to minimize the burden of the disease.

Keywords: Diabetes Mellitus, Prevalence, Pakistan.

Introduction

Diabetes mellitus (DM) is an emerging public health concern with multiple complications and an increasing prevalence. In spite of amazing improvement in both basic and clinical medical sciences, diabetes mellitus is still an incurable life-long disease and is speedily increasing among all age groups and in both genders.[1] It involves many anatomical, physiological functions[2] and body systems[3] and is associated with wide ranging and devastating complications.[4] The prevalence of diabetes mellitus is vastly increasing globally and involves both urban and rural areas of the world. Its incidence is rising all over the world especially in the Middle East and South Asian countries.

Pakistan is a South Asian country, with an area of 796,095 km^2, and an approximate population of 185.044 million people.[5] Pakistan is the sixth most populous country and is the 36th largest country in the world.[5] In Pakistan, majority of the population lives in rural areas, Pakistan has endured marked economic and epidemiologic transitions. Growing urbanization has led to sedentary lifestyle, advanced calorie food intake, eating more and consuming less and also the stressful conditions added to the increasing prevalence of DM.[6] Furthermore, in the urban areas of Pakistan, people are exposed to polluted environment which results in metabolic disorders and diabetes mellitus. As per International Diabetic Federation (IDF) report 2015,[7] 415 million people have diabetes mellitus and the figure will reach to 642 million by year 2040. Moreover, one in two adults with diabetes is undiagnosed. Diabetes caused 5 million deaths in 2015; it shows that, in every six seconds a person dies due to the complications of diabetes mellitus. The prevalence of type 2 diabetes is globally increasing, One third of the people with diabetes are in low and middle-income countries. The WHO estimated a rising occurrence of diabetes mellitus in developing countries. The aim of this study was to assess and highlight the prevalence of type 2 diabetes mellitus in Pakistan.

Research Methodology

The systematic analytic study was conducted in the Department of Physiology, College of Medicine, King Saud University, Riyadh, Saudi Arabia from Jan 2015 to June 2015.

Selection of studies: In this study, a systematic search of bibliographic scientific databases including ISI-web of

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science and PubMed was conducted by using key words of "diabetes mellitus" "type 2 diabetes", "hyperglycaemia", "prevalence", "incidence", "occurrence", "epidemiology" etc. We also entered the basic key terms in the Google Scholar search engine and after getting any related article, we again entered the title of that article in the ISI-Web of Science and PubMed.

The abstracts were thoroughly studied and evaluated to consider the eligibility for inclusion. The original studies in which diabetes mellitus, hyperglycaemia, prevalence, incidence, epidemiology in Pakistan were discussed, were considered eligible for inclusion. After the selection of studies full papers were downloaded or obtained through various library sources. No restrictions on publication prestige, study strategy or language of publication were imposed. We did not add secondary reports without the synthesis of novel data such as editorial, review articles, brief communications and non-observational correspondence. Moreover, we also excluded the studies with small sample size (less than 500) and which were published in non ISI Indexed journal. The inclusion criteria required that the study inhabitants must be of Pakistan. All the studies were re-checked against pre-determined inclusion and exclusion criteria. We reviewed 22 papers, finally we included 18 studies and remaining 04 papers were excluded from the study.

Ethics statement: In the present study, we reviewed and analyzed the data base literature and research papers on the prevalence of type 2 diabetes mellitus in Pakistan; hence, we did not require the ethical approval.

Data analysis: The extracted data for prevalence of type 2 diabetes mellitus was entered into the computer, data was analyzed by using Microsoft Excel 2013, and the prevalence rate was analyzed descriptively.

Results

Table-1 highlights the prevalence of type 2 diabetes mellitus (T2DM) in Pakistan. The mean prevalence of T2DM in Pakistan was 11.77%. However, in males the prevalence was 11.20% and in females 9.19%%. The prevalence of type 2 diabetes mellitus was 13.50% in 1999, and in another study again 13.46% in 1999, 7.18% in 2002; 9.52% in 2004; 8.74% in 2007, 19.21% in 2009, 10.85% in 2010; 10.95% in 2011 and 13. 10% (Table-1).

Considering the various regions of Pakistan, the mean prevalence in Sindh Province was 16.2%, in males and 11.70 % in females; in Punjab Province, it was 12.14% in males and 9.83% in females. In Balochistan province, it was13.3% among males and 8.9% in females; while in

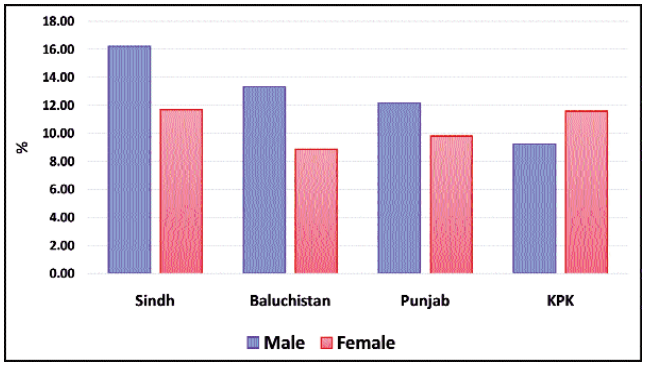

Figure-1: Prevalence of type 2 diabetes mellitus in various regions of Pakistan.

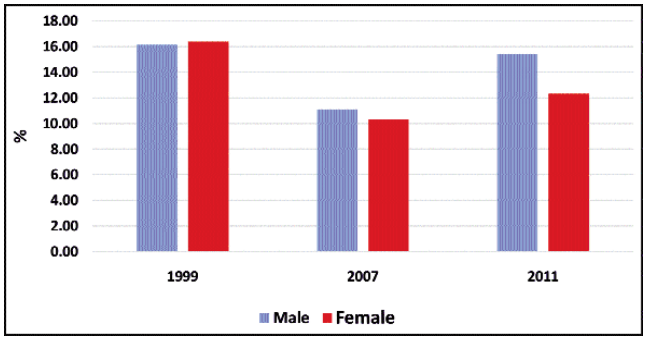

Figure-2: Type 2 diabetes mellitus in male and females in urban areas of Pakistan.

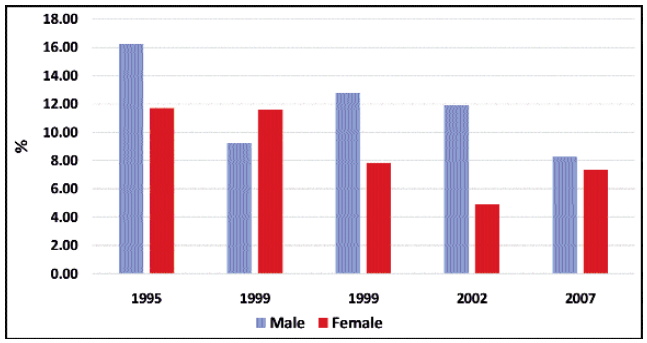

Figure-3: Type 2 diabetes mellitus in male and females in the rural areas of Pakistan.

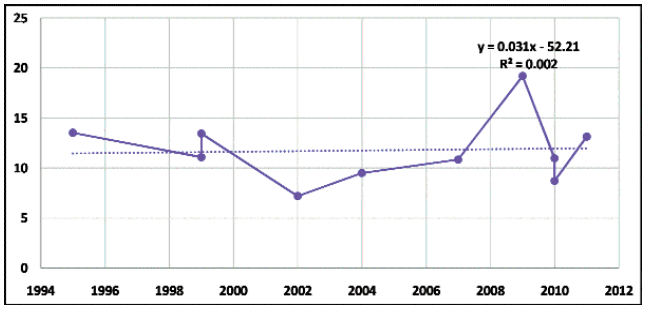

Figure-4: Prevalence of type 2 diabetes mellitus in Pakistan.

Table-1: Epidemiological studies in Pakistan during the period [1995-2014].

Author / year of publication	Urban / Rural	Sample size	Mean age (Years)	Method	Prevalence
Shera et al., 1995[8]	Rural	967 M/F	>25 years	OGTT	13.54%
					M: 16.2%
					F: 11.7%
Shera et al., 1999[9]	Rural	1035 M/F	>25 years	OGTT	11.1%
					M: 9.2%
					F: 11.6%
Shera et al., 1999[10]	Rural / Urban	1404 M/F	>25 years	OGTT	13.46%
					M:14.71%
					F: 12.89%
Basit et al., 2002[11]	Semi- rural/sub urban	2032 M/F	>25 years	FBG	7.2%
					M:11.9%
					F: 4.9%
Jafar et al., 2004[12]	Urban Rural	9442 M/F	>15 years	FBG	9.52%
					M: 4.26%
					F: 5.26%
Shera et al., 2007[13]	Urban / Rural	5433 M/F	2-70 years	OGTT	10.85%
					M: 5.80%
					F:5.05%
Rifat-uz-Zaman 2009[14]	Urban	1161 M/F	20-70 years	OGTT	19.21%
Shera et al., 2010[15]	Urban / Rural	1852 M/F	>25 years	OGTT	10.98%
					M:12.14%
					F: 9.83%
Mahar et al., 2010[16]	Rural	19211 M/F	>30 years	RBG/OGTT	8.73%
Zafar et al., 2011[17]	Urban	1091 M/F	30-70 years	FBG	13.14%
					M: 15.41%
					F: 12.31%
Total Mean%					11.77%
					M: 11.20%
					F: 9.19%

DM=Diabetes Mellitus; U/R=Urban /Rural; M=Male; F=Females; FBG=Fasting blood sugar, OGTT=Oral Glucose Tolerance Test; Reference has been mentioned against each study.

Table-2: Epidemiological studies in urban areas of Pakistan during the period [1999-2014].

Author / year of publication	Sample size	Mean age (Years)	Method	Prevalence
Shera et al., 1999[10]	1404 M/F	>25 years	OGTT	16.30%
				M: 16.15%
				F: 16.37%
Shera et al., 2007[13]	1982 M/F	2-70 years	OGTT	10.59%
				M: 11.09%
				F:10.33%
Rifat-uz-Zaman 2009[14]	1161 M/F	20-70 years	OGTT	19.21%
Zafar et al., 2011[17]	1091 M/F	30-70 years	FBG	13.14%
				M: 15.41%
				F: 12.31%
Total Mean%				14.81%
				M: 14.21%
				F: 13.00%

DM=Diabetes Mellitus; U/R=Urban /Rural; M=Male; F=Females; FBG=Fasting blood sugar, OGTT=Oral Glucose Tolerance Test; Reference has been mentioned against each study

Table-3: Epidemiological studies in rural areas of Pakistan during the period [1995-2014].

	Author / year of publication	Sample size	Mean age (Years)	Method	Prevalence
	Shera et al., 1995[8]	967 M/F	>25 years	OGTT	13.54% M: 16.2% F: 11.7%
	Shera et al., 1999[9]	1035 M/F	>25 years	OGTT	11.10% M: 9.2% F: 11.6%
	Shera et al., 1999[10]	1404 M/F	>25 years	OGTT	13.84% M: 12.75% F: 7.84%
	Basit et al., 2002[11]	2032 M/F	>25 years	FBG	7.20% M:11.9% F: 4.9%
	Shera et al., 2007[13]	3451 M/F	2-70 years	OGTT	7.67% M: 8.27% F:7.35%
	Mahar et al., 2010[16]	19211 M/F	>30 years	RBG/OGTT	8.73%
Total Mean%					10.34% M: 11.66% F: 8.67%

DM=Diabetes Mellitus; U/R=Urban /Rural; M=Male; F=Females; FBG=Fasting blood sugar, OGTT=Oral Glucose Tolerance Test; Reference has been mentioned against each study.

Khyber Pakhtunkhwa (KPK) it was 9.2% in males and 11.60% in females. (Figure-1). However, comparing urban and rural areas, the prevalence of type 2 diabetes mellitus was 14.81 in urban areas (Table-2) and 10.34% in the rural areas of Pakistan (Table-3). The prevalence rate gradually increased during the period 1995-2011 (Table-1).

Discussion

Pakistan is an agricultural country has an estimated population of 185.044 million people.[5] In various provinces of Pakistan, dozens of population based studies and national surveys have been conducted to investigate the prevalence of type 2 diabetes mellitus (T2DM). These studies include Shera et al., 1995;[8] Shera et al., 1999;[9] Shera et al., 1999;[10] Basit et al., 2002;[11] Jafar et al., 2004;[12] Shera et al., 2007;[13] Rifat-uz-Zaman et al., 2009;[14] Shera et al., 2010;[15] Mahar et al., 2010;[16] Zafar et al., 2011[17] (Table-1). In the current study, we found that, Pakistan has a mean prevalence of11.77% of type 2 diabetes mellitus and the prevalence has been fluctuating and gradually increasing in Pakistan (Table-1). In our discussion section, we considered the studies conducted in the various provinces of Pakistan to provide better understanding about the prevalence of type 2 diabetes mellitus in the various provinces of Pakistan.

Sindh Province: Shera et al., (1995)[8] conducted a survey on the prevalence of diabetes mellitus in the rural town of Shikarpur, Sindh Province, Pakistan. Oral glucose tolerance tests were performed in 967 adults (387 males, 580 females) aged more than 25 years. The prevalence of diabetes was 16.2% (9.0% known, 7.2% recently diagnosed) in males, and 11.7% (6.3% known, 5.3% newly diagnosed) in females.

Similarly, Mahar et al., 2010[16] conducted a community based study in both genders to examine the figures of type 2 diabetes mellitus in the rural inhabitants of Gaddap town, Karachi Pakistan. The subjects aged 30 years and above were included; out of 19211 subjects, 1677 subjects were found to be diabetic, adding the prevalence of diabetes as 8.73%, with 1258 (6.55%) known and 419 (2.18%) newly diagnosed cases.

Baluchistan Province: Shera et al., (1999)[10] investigated the prevalence of type 2 diabetes mellitus in the metropolitan and metropolitan zones of Baluchistan, Pakistan. They recruited 1404 males and females. The overall prevalence in both urban and rural regions was 13.46% and it was 14.71% in males and 12.89% in females. Shera et al.,[8-10] studies have some limitations including small sample size and in first study they included rural population only, however, in the second survey they included both urban and rural population but their sample size was very small. As per World Bank report, the population of Pakistan in 1995 and 1999 was 122.59 and 135.15 million[5] respectively. Considering the statistical power of the studies, the sample size investigated by Shera et al.,[8-10] studies may not characterize an actual representation of the prevalence of type 2 diabetes

mellitus in Pakistan.

In early new millennium, Basit et al., 2000[11] reported the occurrence of diabetes mellitus from Pakistan. They recruited 2032 (670 males and 1362 females) from sixteen villages from Lasbella district of Baluchistan. The population was semi-rural and suburban. Prevalence of diabetes was determined by using the American Diabetic Association (ADA) FBG criteria. They found the overall prevalence of diabetes including previously and newly diagnosed diabetes was 7.2 %, however, the prevalence was 11.9% in males and 4.9% in females. Basit et al., 2000[11] study also had similar limitations as Shera et al., including small sample size, representation of semi-rural and semi urban population of Lasbella district of Baluchistan.

Punjab Province: Punjab is the most populous province of Pakistan. Shera et al., 2010[15] conducted a population-based survey on the prevalence of diabetes mellitus and impaired glucose tolerance (IGT) in Punjab, Pakistan. Oral glucose tolerance tests were performed in 1852 people aged 25 years and more. The prevalence of diabetes was 12.14% in males and 9.83% in females. The mean prevalence of diabetes mellitus was 10.98%. Congruently, Zafar et al,. 2011[17] in a cross sectional study investigated the prevalence of diabetes mellitus in the urban population of Rawalpindi, Punjab, Pakistan. There were 1091 respondents who were selected, 293 were males and 798 were females. 15.41% of the males and 12.31% of females were found to have diabetes with a total prevalence of 13.14%.

As per International Diabetes Federation (IDF) report 2015,[17] in Pakistan, 7 million people are diabetics. However, in the present study, we found that, in Pakistan, the mean prevalence of type 2 diabetes is 11.77%. In males the prevalence is 11.20% and in females 9.19%.

Khyber Pakhtunkhwa Province: Khyber Pakhtunkhwa (KPK) formerly known as North West Frontier Province (NWFP). In this state, Shera et al., (1999)[9] estimated the prevalence of type 2 diabetes mellitus in the rural areas of Khyber Pakhtunkhwa. They recruited 1035 adults aged 25 years and above. Oral glucose tolerance tests were performed and the diabetes diagnosis was made as per WHO criteria. The prevalence of type 2 diabetes in both genders was 11.1%. The gender-specific prevalence of diabetes was 9.2% in males and 11.6% in females.

All provinces of Pakistan: Shera et al., 2007[13] conducted a cross-sectional study in the rural and urban areas of all Pakistan provinces. They examined 5433 subjects, males 1893 (1208 in rural and 685 in urban) and 3540 females (2243 in rural and 1297 in urban areas). The prevalence of diabetes mellitus in urban population was 6.0% in males and 3.5% in females (9.5%) against the 6.9% rural male and 2.5% in female population (9.4%). The prevalence of diabetes in both urban and rural population was 12.9% and in rural population it was 6%. Moreover, recently diagnosed diabetes was 5.1% in males and 6.8% in females in urban areas and 5.0% in men and 4.8% in women in rural areas. Diabetes prevalence was significantly higher in urban areas when compared with rural areas. Similarly, Naeem et al., 2008[18] demonstrated, the prevalence of type 2 diabetes mellitus in a rural area of Pakistan. 2119 rural individuals aged 20 and above were included in the study. The prevalence of diabetes in males was 3.7%, in females 6.9% and in total it was 5.8%.

Jafar et al., 2004[12] studied 9442 individuals with age more than 15 years. The sample size represents various ethnic subgroups including Muhajir, Punjabi, Sindhi, Pashtun, and Baluchi. They reported highest prevalence of diabetes mellitus among the Muhajirs (males 5.7%, females 7.9%), Punjabis (males 4.6%, females 7.2%), Sindh's (males 5.1%, females 4.8%), Pashtuns (males 3.0%, females 3.8%), and lowest among the Baluchi (males 2.9%, females 2.6%). Diabetes mellitus was more prevalent in urban compared to rural residents. The mean prevalence of diabetes mellitus was 9.52% in all the ethnic groups. However, it was 4.26% in males and 5.26% in females. The strength of Jafar et al., 2004[12] study was an adequate sample size, multiple ethnic groups from all the provinces of Pakistan.

Study strengths and limitations: The strong points of this study are: we examined the literature from highly trustworthy sources including Institute of Scientific Information (ISI) Web of Science (Thomson Reuters) and PubMed. The population of most of the studies selected had diverse geographical distribution with an appreciable representation from difference province of Pakistan. However, the limitations of the present study are: sometimes search tools may be unable to find a paper. We tried to search the similar type of studies such as randomized, cohort, community based, large sample size studies which followed either ADA or WHO criteria, but we encountered some research methodological challenges; the method of assessment of glycaemic status of population in the selected studies was inconsistent. Moreover, the sample size was small compared to the population of Pakistan. Furthermore, limited ISI-web of science and PubMed indexed studies were published from Pakistan, therefore we selected limited number of cross sectional, community and hospital based studies which followed either ADA or WHO criteria to confirm diabetes among the subjects. Moreover, we did not

discuss more about type 1 diabetes mellitus and gestational diabetes mellitus (GDM). Owing to the heterogeneity in the available literature, we were unable to give future forecast of the prevalence of type 2 Diabetes in Pakistan although the number of patients with diabetes is increasing with population increase.

Conclusion and Suggestions

The mean prevalence of type 2 diabetes mellitus in Pakistan is 11.77%. The prevalence is higher among males than in females and more common in urban areas compared to the rural areas. Keeping in view the total population of Pakistan, Pakistan needs largesample size studies that represent both genders, rural and urban population with different age groups to highlight the actual prevalence of type 2 diabetes mellitus from all the provinces of Pakistan. In Pakistan, diabetes mellitus is gradually increasing, therefore, it is suggested that, Pakistani health officials should include the diabetes preventive measures in their national health policy to minimize the burden of the disease. Public education, regular physical exercise, nutritional knowledge of foods must be provided to the community to control diabetes in the country. Diabetes and its complications should be frequently discussed in scientific, academic assemblies and both in electronic and print media to improve public awareness to minimize the prevalence of the disease.

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References

1. Meo SA. Diabetes Mellitus: Health and Wealth Threat. Int J Diab Mellitus. 2009; 1: 42.
2. Meo SA, Asim H, Khan M. Risk assessment calculator for diabetic patients who fast during Ramadan. Diabetes Technology & Therapeutics. 2015; 17:A-1-A-180.
3. Vasilyeva ON, Frisina ST, Zhu X, Walton JP, Frisina RD. Interactions of hearing loss and diabetes mellitus in the middle age CBA/ CaJ mouse model of presbycusis, Hear Res. 2009; 249:44-53.
4. James RG, Alberti K, Mayer BD, Ralph AD, Allan D, Steven G. Report on the expert committee on the diagnosis and classification of diabetes mellitus. Diabetes Care. 2002; 25:S5-S20.
5. The World Bank. Data, Population total. Pakistan. [Online] [Cited 2015 August 12]. Available from: URL:http://data.worldbank.org/indicator/SP.POP.TOTL.
6. Hu FB. Globalization of Diabetes: The role of diet, lifestyle, and genes. Diabetes Care. 2011; 34:1249-57.
7. IDF-Diabetes Atlas7th Edition.[Online] [cited2016May 3]. Available from: URL: http://www.diabetesatlas.org.
8. Shera AS, Rafique G, Khwaja IA, Ara J, Baqai S, King H. Pakistan national diabetes survey: prevalence of glucose intolerance and associated factors in Shikarpur, Sindh Province. Diabet Med. 1995; 12:1116-21.
9. 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 Res Clin Pract.1999; 44:49-58.
10. Shera AS, Rafique G, Khwaja IA, Baqai S, Khan IA, King H. Pakistan National Diabetes Survey prevalence of glucose intolerance and associated factors in North West at Frontier Province (NWFP) of Pakistan. J Pak Med Assoc. 1999; 49:206-11.
11. Basit A, Hydrie MZ, Ahmed K, Hakeem R. Prevalence of diabetes, impaired fasting glucose and associated risk factors in a rural area of Baluchistan province according to new ADA criteria. J Pak Med Assoc. 2002; 52:357-60.
12. Jafar TH, Levey AS, White FM, Gul A, Jessani S, Khan AQ, et al. Ethnic differences and determinants of diabetes and central obesity among South Asians of Pakistan. Diabet Med.2004;21:716-23.
13. Shera AS, Jawad F, Maqsood A. Prevalence of diabetes in Pakistan. Diabetes Res ClinPract. 2007; 76:219-22. .
14. Rifat-uz-Zaman. High Prevalence of Diabetes mellitus and Promoting Factors among Human Urban Population of Bahawalpur-district, Pakistan: Cross-sectional Study. Res J Med Sci. 2009; 3:62-9.
15. Shera AS, Basit A, Fawwad A, Hakeem R, Ahmedani MY, Hydrie MZ, Pakistan National Diabetes Survey: prevalence of glucose intolerance and associated factors in the Punjab Province of Pakistan. Prim Care Diabetes. 2010; 4:79-83.
16. Mahar PS, Awan MZ, Manzar N, Memon MS. Prevalence of type-II diabetes mellitus and diabetic retinopathy: the Gaddap study. J Coll Physicians Surg Pak. 2010;20:528-32.
17. Zafar J1, Bhatti F, Akhtar N, Rasheed U, Bashir R, Humayun S. Prevalence and risk factors for diabetes mellitus in a selected urban population of a city in Punjab. J Pak Med Assoc.2011;61:40-7.
18. Naeem Z, Bjørgulf C, Akhtar H. Diabetes & Metabolic Syndrome.Clin Res Reviews. 2008; 2:125-30.