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Review Article **Open Access**

CURRENT STATUS OF DIABETES MELLITUS: A LIFE THREATENING DISEASE

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Abstract

Diabetes mellitus, commonly referred as diabetes is a chronic non-communicable disease that causes high blood sugar (glucose) levels. Hyperglycemia condition is due to defects in insulin secretion, insulin action or both. Retinopathy, neuropathy and nephropathy are some of the major long term complications of diabetes. This disease is among the leading cause of death and results in increase in mortality rate. The prevalence of this disease is increasing at a very fast and alarming rate and by 2035, 592 million people will be diabetic worldwide. Majority of diabetic people live in low and middle income countries and India is at second position in diabetes prevalence. A better understanding about the causes and prevalence of this disease will be very helpful in future to lessen the burden of this life threatening disease. In the present work, focus is given on the current status of diabetes mellitus worldwide and mainly in India. Diabetes mellitus related incidences in India have also been reviewed.

Keywords: Diabetes mellitus; Type 1 diabetes mellitus (TIDM); Type 2 diabetes mellitus (T2DM); Gestational diabetes mellitus (GDM); Hyperglycemia.

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Introduction

Diabetes mellitus is a metabolic disorder characterized by increased blood glucose levels resulting from defective insulin secretion and action. Diabetes mellitus may results in complications like retinopathy, neuropathy, kidney failure, ulceration and cardiovascular problems (Hungley, 1997) and its symptoms include weight loss, blurry vision, frequent urination, increased thirst and hunger. Hyperlipidaemia is also linked with diabetes mellitus and can cause mortality (Shahwan, 2014). Diabetes mellitus is mainly of three types, type 1 diabetes mellitus (TIDM), type 2 diabetes mellitus (T2DM) and gestational diabetes mellitus (GDM). In T1DM, there is a loss of the insulin producing beta cells of the islets of Langerhans in the pancreas leading to insulin deficiency. T1DM is insulin dependent and is conventionally treated with exogenous insulin. T2DM is non-insulin dependent and is more prevalent than T1D. T2DM is characterized by insulin resistance and insufficient insulin production leading to hyperglycemia and is treated with oral hypoglycemic agents like sulphonylurea and biguanides among others (Felig et al., 1995, Rosak, 2002). In GDM, insulin receptors dysfunction leading to high blood glucose levels during pregnancy. T2DM is the most common form of diabetes and makes up more than 90% of all diabetes cases. Side-effects of T2DM include high blood levels of triglycerides which may lead to atherosclerosis, less production of high density lipoproteins (HDL) which are required to remove fat molecules from cells, over production of very low density lipoproteins (VLDL) which act as body's internal lipid transport mechanism (Ginsberg, 1991) and increased cholesterol levels in the blood (Florey et al., 1973). Oxidative stress is also the major cause and consequence of T2DM (Kaneto et al., 2005). Physical inactivity, increased obesity, population growth, urbanization and ageing are the causes of this rapid increase in the prevalence of diabetes (Chan et al., 2009, International Diabetes Federation, 2009, Ramachandran et al., 2010).

Worldwide, around 171 million people were diabetic in 2000 (World Health Organisation, 2008), the number was 285 million people in 2010 (90% T2D individuals) and in 2013, around 382 million people were sufferer (International Diabetes Federation, 2014, Muhammadi, 2014) who were living with diabetes with maximum number of diabetic people in Western Pacific (138.2 million) followed by South-East Asia (72.1 million) and Europe (56.3 million) and by 2035, people of Western Pacific will be mostly diabetic (201.8 million) followed by Europe (68.9 million) and Middle East and North Africa (67.9 million) (Figure 1, 2). Diabetes mellitus is a major cause of death worldwide and its prevalence is increasing very rapidly. Around 1.5 million people died due to diabetes in 2012 and in 2013, the number reached to 5.1 million (World Health Organization, 2013, International Diabetes Federation, 2014). Africa is at the top with maximum number of deaths due to diabetes (76% deaths) followed by South-East Asia (55%) and Middle East and North Africa (50%) (Figure 1, 3). People of North America and Caribbean spent maximum on diabetes (263 billion USD) followed by Europe (147 billion USD) and Western Pacific (88 billion USD) (International Diabetes

Federation, 2014) (Figure 1,4). In Asian countries, young to middle-aged adults have higher chances of getting affected by diabetes while older persons are mostly affected in Western countries (Chan et al., 2009, Ramachandran et al., 2010). Around 438 million people (7.8%) in the 20-79 year age will be diabetic by 2030 worldwide (International Diabetes Federation, 2009).

In 2004, India occupied the topmost position with around 31.7 million T2D patients, followed by China (20.8 million T2D patients) and the US (17.7 million T2D patients) and by 2030, this number is expected to be doubled with India (79.4 million), China (42.3 million) and US (30.3 million) (Wild et al., 2004). However, according to IDF 2014, China leads with 98.4 million diabetic people followed by India (65.1 million), U.S.A. (24.4 million), Brazil (11.9 million), Russian Federation (10.9 million), Mexico (8.7 million), Indonesia (8.5 million), Germany (7.6 million), Egypt (7.5 million) and Japan (7.2 million) and by 2030, the number of people with diabetes will be China (142.7 million), India (109 million), U.S.A. (29.7 million), Brazil (19.2 million), Mexico (15.7 million), Indonesia (14.1 million), Egypt (13.1 million), Pakistan (12.8 million), Turkey (11.8 million) and Russian Federation (11.2 million) (Figure 5).

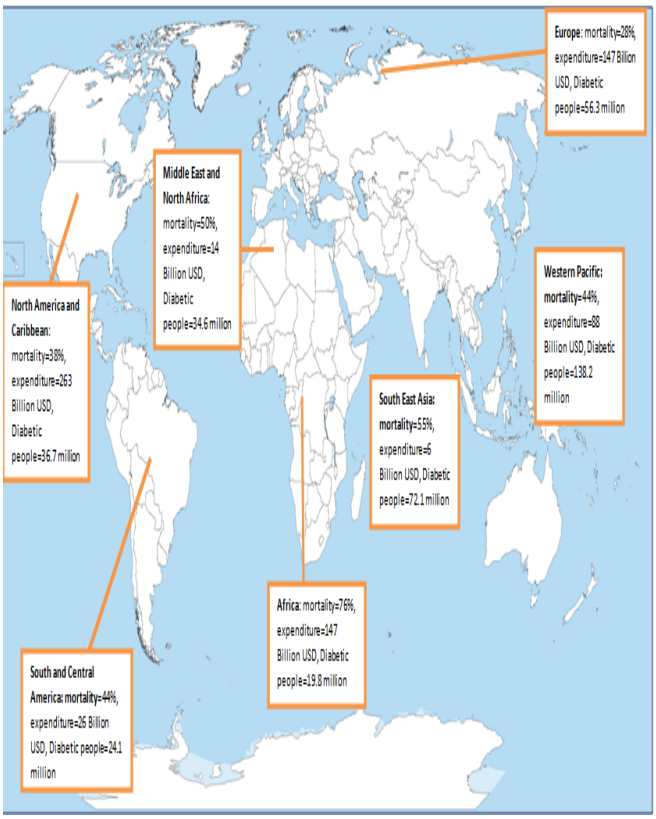


Fig. 1. Global prevalence of Diabetes mellitus (International Diabetes Federation, 2013).

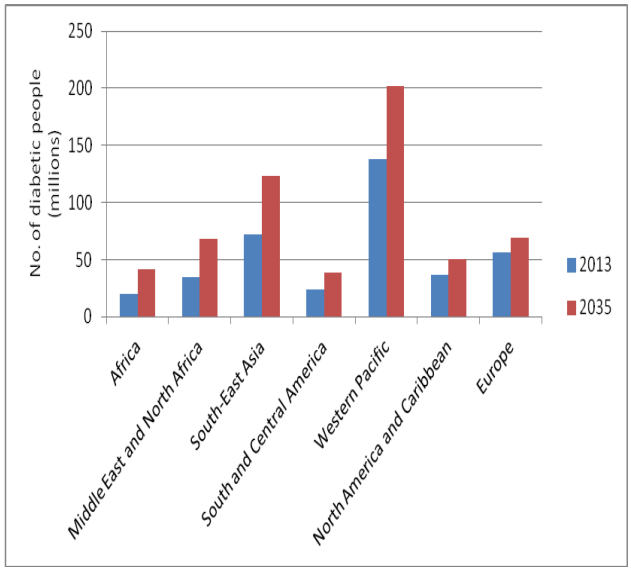


Fig. 2. Global prevalence of diabetes mellitus (International Diabetes Federation, 2013).

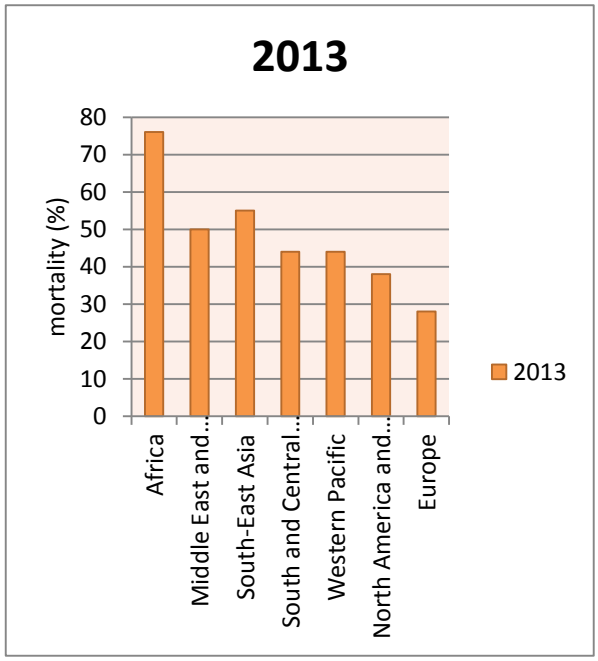


Fig. 3. Percentage of deaths worldwide due to diabetes mellitus (International Diabetes Federation, 2013).

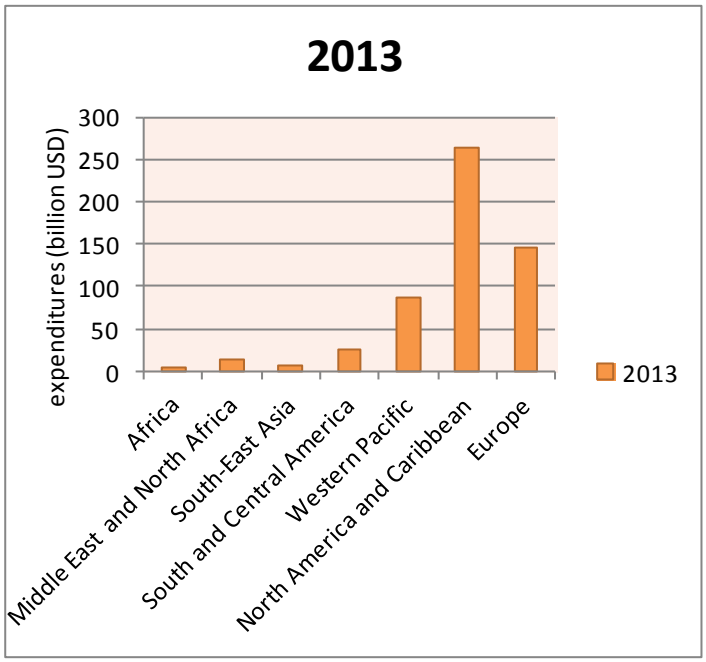


Fig. 4. Expenditure on health (USD) due to diabetes mellitus (International Diabetes Federation, 2013).

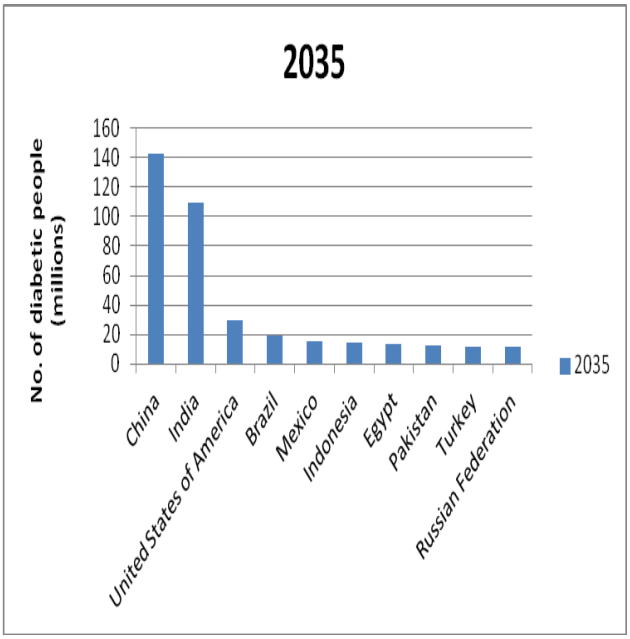
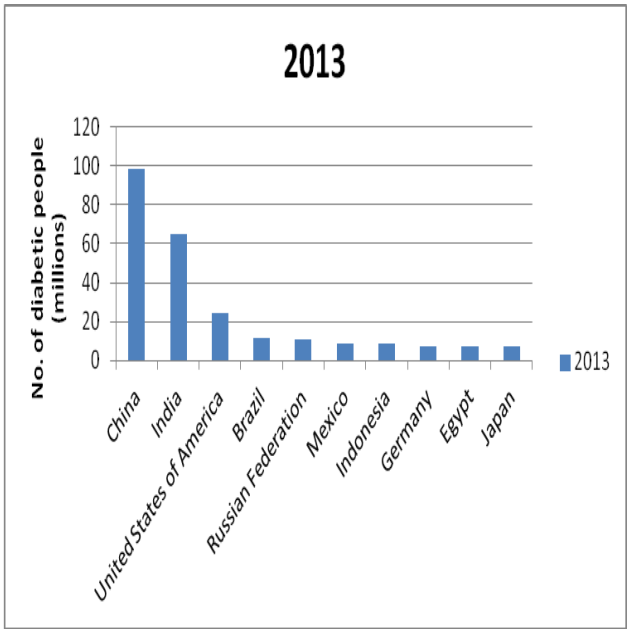


Fig. 5. Diabetes mellitus prevalence in different countries (International Diabetes Federation, 2013).



Diabetes in India

People of Asia and eastern Pacific region are particularly affected by diabetes mellitus. India leads the world (Mohan and Deepa, 2006) with more than 62 million diabetic people. In 2010, India had around 50.8 people with diabetes and by 2030, around 87 million people are expected to be diabetic (International Diabetes Federation, 2009, Kachhap, 2011). In India, diabetes prevalence is rapidly increasing in both in rural and urban areas, mainly in regions with well developed economies **(**Mohan and Pradeepa, 2009). But diabetes incidences show, its prevalence in rural areas is one-quarter that of urban areas in countries like India, Nepal, Bangladesh, Bhutan, and Srilanka **(**Wild et al., 2004, Anjana et al., 2011).

In India, maximum diabetes incidences were found in South India (13.5% in Chennai, 16.6% in Hyderabad and 12.4% Bangalore) **(**Ramachandran et al., 2001), followed by Eastern India (11.7% in Kolkata), Western India (9.3% in Mumbai), Northern India (6.1% in Kashmir Valley, 11.6% in New Delhi) **(**Zargar et al., 2000). States of Northern India are less affected (0.12 million diabetic cases in Chandigarh, 0.96 million diabetic cases in Jharkand) **(**Anjana et al., 2011). The difference in diabetes incidences in different geographical regions is due to migration. Populations of North India are migrants (non-indigenous) whereas South Indian populations are host (indeginous) **(**Arora et al., 2010). Similarly, indigenous people from New Zealand and Australia were found to be more diabetic than non-indigenous people **(**Bramley et al., 2004, Sukala et al., 2012). However latest reports claim Sikkim state (13.67%) to have maximum percentage of diabetes suspected followed by Karnataka (9.36%), Punjab (9.36%), Gujarat (9.10%) and Andhra Pradesh (7.42%) **(**Alexander, 2013) (Figure 6). Some other diabetes related recent studies in India are shown in Table 1.

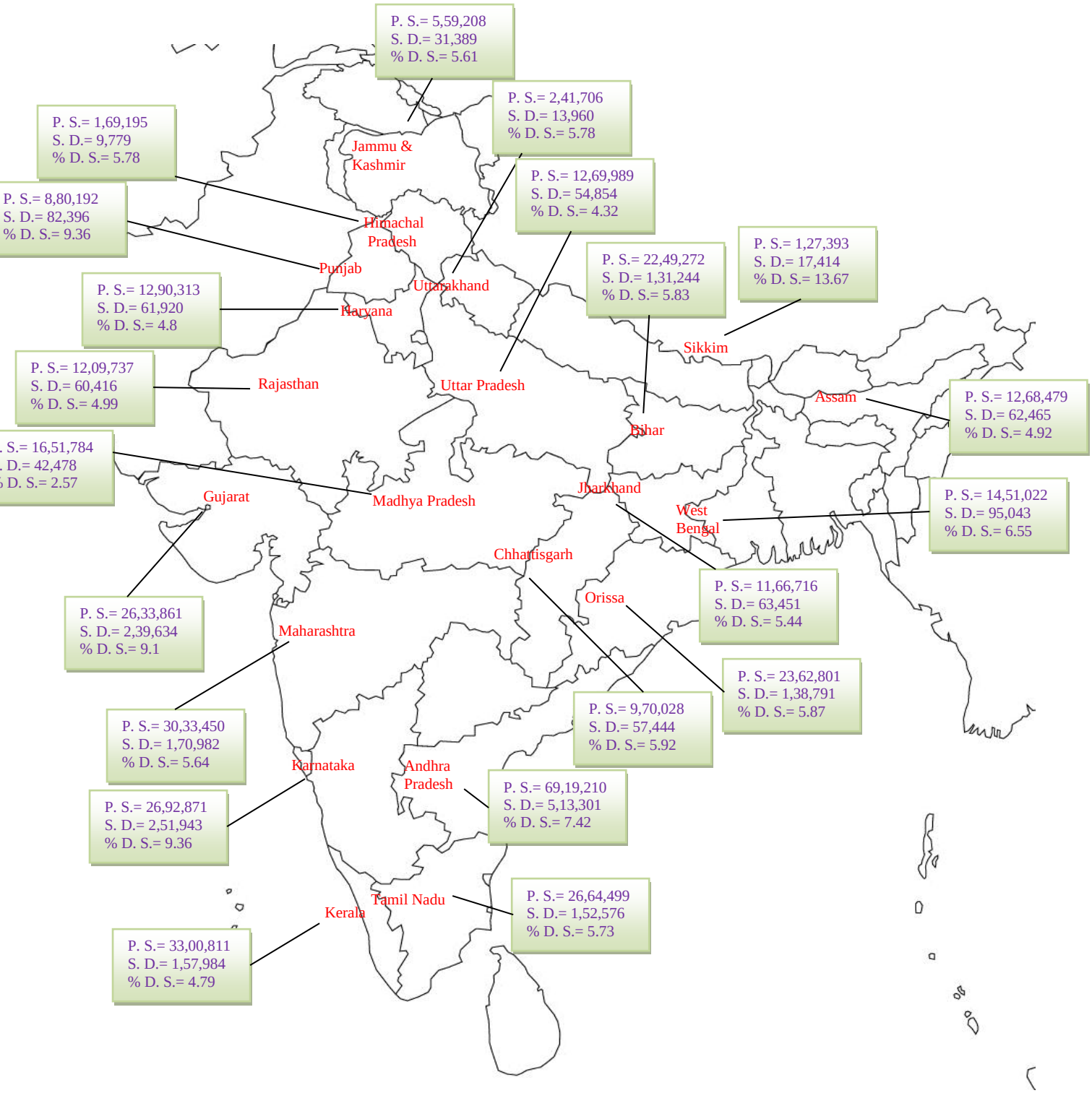


Fig. 6. Diabetes prevalence in different states of India (P.S.: persons screened; S. D.: suspected for diabetes; % D: percentage of diabetes suspected) (Alexander, 2013).

Table 1: Recent studies related to diabetes mellitus in different regions of India

Authors	Diabetes mellitus related studies
Gupta et al. 2012	In Chennai, diabetes prevalence in urban population in the year 2009 and 2010 was 12% and 12.11% respectively. Pre-diabetic prevalence in 2009 and 2010 was 13.5% and 14.3% respectively.
Patel et al. 2015	In Gujarat, during early adolescence stage: In boys, body fat percentage and fat mass index and in girls, body mass index are positively correlated with fasting blood sugar, while in late adolescence stage, waist circumference is strongly positively correlated in both genders.
Lodha and Yadav, 2015	In Jamnagar district, diabetes mellitus was more prevalent in lower class and almost two third diabetic patients were above the age of 50 years.
Jindal et al. 2012	In Karakhadi village, the crude prevalence rate of diabetes was 7.2% (all type 2) in which cholesterol level was >200 mg/dl in 14%, triglyceride level was >150 mg/dl in 25%, creatinine level was >1.1 mg/dl in 6%, and Hb A1c level was >6.5% in 45% diabetic patients.
Kumar and Mukherjee, 2014	In Hisar district, highest expenditure was incurred on medication (47.3% of total) due to type 2 diabetes mellitus.
Rajput et al. 2013	In Haryana, prevalence of gestational diabetes mellitus was found to be 7.1% in women. Factors like pre-pregnancy weight, BMI, weight gain, family history, age, educational levels were found to be strongly associated with gestational diabetes mellitus.
Kalra et al. 2010	In Karnal district, type 1 diabetes mellitus prevalence was found to be 10.20/100,000 population with a higher prevalence in urban areas and in males.
Bharadwaj, 2014	In Shimla city, people with type 2 diabetes mellitus had higher prevalence of periodontal disease.
Jose et al. 2013	In Neyyattinkara taluk of South Kerala, type 2 diabetes mellitus prevalence was found to be 27.11% in adults of age 30 years and above.
Appajigol et al. 2015	In Northern Karnataka, point of care blood glucose testing tool improved screening of diabetes mellitus type 2.
Kumar et al. 2013	High prevalence rate of thyroid dysfunctions was found in type 2 diabetes mellitus patients in Karnataka.
Kodali and Alberti, 1995	In Karnataka, influence of diabetes mellitus in rural-rural migrants was analyzed. Ins adult population of age above 30 years, diabetes prevalence more in the rural-rural migrants than the indigenous population.
Panat et al. 2013	In Maharashtra, inheritance pattern of type 2 diabetes was found to be male sex specific and in females, diabetes incidences were coinciding with the menopause period.
Chaudhary et al. 2013	In Manipur, lean Type 2 Diabetes Mellitus had low prevalence among diagnosed diabetic patients.
Nagar et al. 2015	In Bhopal, patients of tuberculosis had high prevalence rates of diabetes mellitus.
Singh et al. 1998	More diabetes incidences were found in urban population of North India than rural population.
Bhadada et al. 2011	In North India, celiac disease prevalence is higher in patients of type 1 diabetes mellitus (11.1%).
Grover et al. 2005	In North India, treatment of diabetes mellitus is expensive and rupees 14,508 was expenditure annually for its treatment.
Sengupta et al. 2010	In Ludhiyana, diabetes mellitus prevalence was 20.0% in urban population and 11.0 % in rural population.
Santoshkumar et al. 2015	In Kanyakumari district, diabetes mellitus type 2 patients of age more than 30 years had higher micro vascular problems (neuropathy) than micro vascular problems.
Hasan and Khatoon, 2012	In Haridwar, diabetes mellitus prevalence was found to be 11%. Males had higher prevalence of diabetes mellitus (11.12%) than females (10.87%)
Taksande et al. 2012	In Central India, sensitivity and Specificity of Indian Diabetes Risk Score (IDRS) which consists of factors like age, physical inactivity, family history and abdominal obesity was 97.50% and 87.89% respectively in predicting diabetes mellitus.
Jonas et al. 2010	In the rural population of Central India, evidences of diabetes were 5.6% ± 0.5% in patients of age above 30 years which were lower than urban population.

Worldwide, around 376 billion U.S. Dollars (USD) were expenditure to treat and prevent diabetes and by 2030 the expected expenditure is projected to exceed 490 billion U.S. Dollars (USD). In India, the estimated net loss in national income from diabetes and cardiovascular disease is 336.6 billion between 2005 and 2015.

In India, obesity **(**Rao et al., 2011), poor glycaemic control **(**Unnikrishnan et al., 2007) and development of coronary artery disease are the major risk factors for diabetes. In India, obesity rate is lower as compared to other western countries, even than there is high prevalence of diabetes in India suggesting its equal risk in people with low body mass index **(**Zargar et al., 2000; Rao et al., 2011; Mohan and Deepa, 2006). In India, diabetic people have poor glycaemic control **(**Unnikrishnan et al., 2007) which may lead to diabetic myonecrosis and muscle infarction **(**Rastogi et al., 2011). Indians of early age group (20-40 years) have higher chances of complications due to development of

coronary artery disease which is due to low levels of high density lipoproteins and dyslipidaemia **(**Misra and Khurana, 2011). Combined efforts of government and stakeholders of the society are required to reduce the diabetic prevalence in India **(**Kumar et al., 2013). Diabetes detection at early stage, especially in pregnant women, children and adults with BMI may reduce its incidences. HbA1c test is conducted for insulin initiation and intensification but is available to a limited Indian population **(**Kumar, 2010).

Conclusion

Diabetes mellitus is a life threatening disease and caused 5.1 million deaths in 2013 and its prevalence is increasing very fast. In 2013, 382 million people were diabetic and by 2035, 592 million people are predicted to be diabetic. To minimize its prevalence, better understanding about the causes and pattern of prevalence of this disease will be very beneficial in future. In low and middle income countries like India, combined efforts of government and stakeholders of the society will be very helpful reduce its burden.

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