

Study of Risk Factors and Preventions for Diabetes Using Statistical Methods: A Systematic Review

Nita Jivrag¹, Dr.OmprakashJadhav²,

Research Scholar, Department of Statistics, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad,
Maharashtra, India¹

Assistant Professor, Department of Statistics, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad,
Maharashtra, India²

ABSTRACT:In regard of type 1 diabetes mellitus(T1DM) & type 2 diabetes mellitus(T2DM) this paper reviews 33 papers in which studies were included from 1993-2015.and these papers were identified by searching through PubMed website, Excerpta Medica Data Base etc. study shows among all diabetes patients nearly 90% of cases are of T2DM and other 10% as T1DM. In these papers various data mining techniques are used for the prediction of diabetes. Data mining used for extracting the useful information from the huge amount of data set, Health monitoring is also used data mining concept for predict the diagnosis of disease. Also various statistical methods are used to study impact of risk factors on diabetes and prevention measures for diabetes.at the end of review paper conclude that risk factors causes for diabetes and diabetes can be prevent or controlled by prevention measures.

KEYWORDS: Type 1 DM, Type 2 DM, Risk factors, Data mining techniques, Regression, Parametric and non-parametric methods, Descriptive statistics, and Distributions.

I. INTRODUCTION

The world health organization (WHO) estimated that there were 135 million diabetic individuals in 1995 and it has been projected that this number will increase to 300 million by the year 2025 WHO has projected that the maximum increase in the number of diabetics would occur in India. The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030.

India has the dubious distinction of being the diabetic capital of the world. Home to around 33 million people with diabetes, 19% of the world's diabetic population is from India. Nearly 12.5% of Indian's urban populations have diabetes. The number is expected to escalate to an alarming 80 million by the year 2030. Amongst the chronic diabetic complications, diabetic foot is the most devastating result. Over 50,000 leg amputations take place every year due to diabetes in India⁽¹⁾. Diabetes patients can often experience loss of sensation in their feet. Diabetes slowly steals the person's vision. It is the cause for common blindness and cataracts⁽²⁾. Cardiovascular diseases are rising. Nearly 3.8 crore cases were detected in 2005 and experts believe the number will go up to 6.4 crore by 2015⁽³⁾In this review paper we present an overview according to research topic which included 33 papers on type 1 & type 2 diabetes having information from each study "study's characteristics (year of publication, author, topic title, study area, statistical analysis and conclusion of study)DM type 1 results when the pancreas no longer produces significant amounts of the Harmon insulin, usually owing to the autoimmune destruction of the insulin producing beta cells of pancreas and DM type 2 in contrast is now through to result from autoimmune attacks on the pancreas of a person with type 2 diabetes may be producing normal or even abnormally large amount of insulin.

We did a review search from 1993-2015 of Google search for the studies examining the association between risk factors and type 1, type 2 diabetes. This study population included men, women and children. And study carried out the risk

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 4, April 2016

factors such as diet, education, self- management, depression, hypertension, obesity, stress, economic burden, smart-phone application, insulin dependent and independent, vegetarian diet, dietary pattern, genetic etiology, diabetic ketoacidosis glucose monitory evaluation of serum vitamin B12 and comparative study has been included between type1 and type2 diabetes.For this primary and secondary data used inthat reference papers. All these papers collected from PubMed website, Excerpta Medica Data Base, EMBASE, Web of science and Scopus, IBSS, Econlit. Indian and international review papers are included in this review paper. Conclusion made on the basis of statistical analysis and data mining techniques that shows data mining technique helps in predicting diabetes and relation between risk factors and self- management for type1and type 2 diabetes.

II. RELATED WORK

This table present the summary of 33 reviewed papers with regard to diabetes analyses and statistical methods. Table included an individual conclusion and statistical methods of each study. In which most of the papers i.e. out of 33 papers 30 papers used statistical methodsand remaining 3 papers does not used statistical methods.

SR.NO	YEAR	AUTHOR	STATISTICAL METHODS	CONCLUSION
1	1993	Diabetes Control & Complication Trial Research Group	Wilcoxon Rank Sum Test, Chi-Square Test, Least Square Analysis, Life Table Method, Mantel(Long-Rank) Test Proportional Hazard Analysis, Log Linear Poisson Regression	This paper showed Intensive therapy effectively decay the onset and slows the progression of diabetic retinopathy, nephropathy and neuropathy in patients with IDDM
2	2004	Kurt Hoffmann, Matthias B. Schulze, Anja Schienkkiewitz, Ute Nothlings, Heiner Boeing	RRR-Reduced Rank Regression, PCA-Principal Component Analysis, PLS, Logistic Regression Model	This research showed RRR seems to be an appropriate and promising statistical method to determine which dietary patterns are associated with development of diseases by combining prior information and dietary information from the study
3	2005	Cathy Lloyd, Julie Smith, Katie Weinger	Waist-To-Hip Ratio Graphical Methods	Research has indicated that stressful experiences have an impact on diabetes. Stress may play a role in the onset of diabetes, it can have a deleterious effect on glycemic control and can affect lifestyle.
4	2006	Maik C Eppens, Maria E Craig, Janine Cusumano Stephen Hing, Albert K. F. Chan, Neville J. Howard, Martin Silink, Kim C. Donaghue	Descriptive Statistics, Chi-Square Test, Mann-Whitney U Test, Multivariate Analysis Generalized Estimating Equation(GEE)	The results of this study support recommendations for early complications screening and aggressive targeting of glycemic control in patients with type 2 diabetes
5	2007	Fu Jinlin, W Binyou, C. Terry	Factor Analysis Approach, Cluster Analysis, Reduced Rank Regression	This paper studied from the point of view of treatment and prevention of diabetes dietary therapy or dietary modification is an important measure and dietary patterns seem more effective because they may be easily understood and willingly accepted by the public.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 4, April 2016

6	2007	M. Rema & R. Pradeepa	Descriptive Statistics	Study of this paper suggest there is the Need for routine retinal screening of diabetic individuals annually to detect DR and prevent visual impairment. In addition, optimized control of systemic considerations, which affect onset and/or progression of DR, through anintensive,multidisciplinary, healthcare team-based approach, can markedly reduce impairment of vision due to DR.
7	2008	Lesley Jo Weaver, K. M. Venkat Narayan		This paper has asked and attempted to answerquestions about what particular features of Indian societies may have been responsible for the potential existence of T2DM in premodernIndia, and which among those features may be relevant tothe present occurrence of the disease
8	2009	Ms.S.Sapna Dr.A.Tamilarasi	Fuzzy systems, Genetic Algorithm, Multilayer Perceptron (MLP), Neural networks	This paper conclude that the Diabetic neuropathy can be controlled by regular check-upof blood sugar and proper usage of antibiotic. If the diabetes iscontrolled properly in a diabetic patient automatically immunity or resistance to fight disease increases. Monitoring regular nervefunction can be checked by Electromyography
9	2010	Amit Raval, EthirajDhanaraj, Anil Bhansali, Sandeep Grover&Pramil Tiwari	Descriptive Statistics unpaired <i>t</i> , Wilcoxon rank sum test, chi-square test or fisher exact test, Binary logistic regression model	This study showed high prevalence of depression in patients with T2DM. The risk factors for depression were age, central obesity, diabetic complications particularly neuropathy and diabetic foot disease and increased pill burden
10	2010	Sanjay Kalra, Bharti Kalra, Amit Sharma	Descriptive Statistics	This report highlights the urban-rural and male-female gradient in the prevalence of type 1 diabetes in Karnal north India
11	2010	Chythra R. Rao, Veena G. Kamath, Avinash Shetty & Asha Kamath	Two Stage, Stratified, Random Sampling Techniques, Chi-Square Test, Multiple Logistic Regression Analysis	Result of this study suggest The High Prevalence Of Diabetes In This Coastal Population Needs Further Evaluation
12	2011	Gary S. Collins, Susan Mallet, Omar Omar And Ly-Mee Yu	Resampling Forward Selection, Backward Elimination, Median	This paper showed the use of poor methods affects the reliability of the prediction model & ultimately compromises the accuracy of the probability estimates of having undiagnosed type 2 diabetes or the predicted risk of developing type 2 diabetes.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 4, April 2016

13	2011	Uma JyothiKommoju, Battini Mohan Reddy		This study concludes that T2DM is a complex disorder with gene-environment interactions, the genetic factors may be triggered by the non-genetic factors resulting from rapid urbanization/westernization leading to change in the socio-economic status and lifestyles.
14	2011	Juliet A. Usher-Smith, Matthew J. Thompson, Stephen J. Sharp, Fiona M Walter	Cochran's Q Test, I Square Statistics, Descriptive Statistics, Two Sample t-Test	This study showed multiple factors affect the risk of developing diabetic ketoacidosis at the onset of type 1 diabetes in children and young adults, and there is potential time, scope, and opportunity to intervene between symptom onset and development of diabetic ketoacidosis for both parents and clinicians.
15	2011	John C Pickup, Suzanne C Freeman, Alex J Sutton	Meta-Analysis, Linear Regression Model, Fixed Effect Model, Poisson Distribution With Log Link, A Generalized Linear Mixed Model	In this paper study conclude that the most cost effective or appropriate use of continuous glucose monitoring is likely to be when targeted at people with type 1 diabetes who have continued poor control during intensified insulin therapy and who frequently use continuous glucose monitoring
16	2012	Emily A Hu, An Pan, Vasanti Malik, Qi Sun	Hazard Ratio, Logistic Regression, Random Effect Model, Forest Plots, Cochran Q Statistic, I Square Statistic, Stratified Analysis, Beg Funnel Plots, Egger's Test	This paper concludes that the higher consumption of white rice is associated with a significantly increased risk of type 2 diabetes, especially in Asian (Chinese and Japanese) populations
17	2012	Ann Sarah Kashy, S Jaya Kumara, Vageesh Ayyar, Prasanna Kumar	Correlation Analysis, Descriptive Statistics, One-Sample t-Test, ANOVA, Pearson Correlation Coefficient	Results of this study show the presence of low serum b12 levels in type 1 diabetics. These findings merit further research on a larger population to investigate into the cause of deficiency and the benefit of b12 supplementation in these patients.
18	2012	Kamlesh Khunti, Laura J Gray, Timothy Skinner, Marian E Carey, Kathryn Realf, Helen Dallosso, Harriet Fisher, Michael Compbell, Simon Heller Melanle J Davies	Mean, S.D. Or Median Interquartile Range, Percentage. Robust Generalized Estimating Equation, Binomial Distribution, Normal Distribution.	The result of this study showed a single programme for people with newly diagnosed type 2 diabetes mellitus showed no difference in biomedical or lifestyle outcomes at three years although there were sustained improvements in some illness beliefs
19	2012	Frazetta D., Willet K. And Fairchild R.	Algorithms	The result of this study suggests smartphonetechnology seems well-suited for patients' self-management of type 2

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 4, April 2016

				diabetes. however, more studies with newer applications are needed before adoption for widespread use
20	2012	Mr. Naval K Yadav, Dr. BrijeshSathian, Ms. R S Kalai	Descriptive Statistics	In this paper study showed nationwide prevalence surveys of diabetes have never been undertaken in India and Nepal. thus, the true magnitude of diabetes has remained unknown in both the country
21	2013	Viswanathan Mohan, Yackoob K. Seedat, and RajendraPradeepa		This paper conclude that to meet the twin challenge of DM and HTN in developing countries, PHCs will have to be strengthened with a concerted and multipronged effort to provide promotive, preventive, curative, and rehabilitative services.
22	2013	Christinel Paul, Leon Piterman, Jonathan Shau Catherine Kirby, Robert W. Sanson Fisher, Mariko L Carey, Jennifer Robinson, PatricMcelduff, IsarapornThepwongs a	Two Sample t- Test	In this paper study provide valuable information regarding monitoring and improvement of healthcare using ongoing administrative data sets at a population level. the study also has potentially wide-reaching applications for evaluating guideline adoption free from bias associated with provider and participant non-consent
23	2013	Vaman V. Khadilkar, Lavanya S Parthosarathy, Basavraj B. Mallade, Anuradha V. Khadilkar, Shashi A Chiplonkar, Ashwin B Borade	Students t- Test, One Way ANOVA, Tuckey's Test	In this paper study conclude that growth was compromised in diabetic children in comparison to controls. Children diagnosed at younger age need more attention to optimize growth.
24	2014	Dana Dabelea, GiuseppinaImperator e, Angela Badaru, T. Merchant, Lawrence Dolan, Lenn L. Liu, Richard F. Hamman	Capture-Recapture Method, Global Logarithmic Linear Model & Maximum Likelihood Analysis	The result of this study showed between 2001 and 2009 in 5 areas of the united states, the prevalence of both type 1 and type 2 diabetes among children and adolescents increased. Further studies are required to determine the causes of these increases.
25	2014	Taruna Sharma, JuhiKalra, DC Dhasmana, HarishBasera	Morisky's instrument, simplepercentage ,chi-square test	The results showed that the rate of non-adherence to the treatment prescription was high. It stresses the need for constant motivation and one-to-one level education at frequent intervals to ensure better adherence.
26	2014	Mukeshkumari, Dr. Rajan Vohra ,Anshularora	Bayesian network, weka.	In this paper, Bayesian Network classifier was proposed to predict the persons whether diabetic or not.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 4, April 2016

27	2014	Sutapa Agrawal, Christophernj Millett, Preet K Dhillon, S V Subramanian, Shah Ebrahim	Multivariable Logistic Regression , Frequencies, Percentage, Pearson Chi- Square Test	In this paper study showed large sample of adults in India, variant of vegetarian diets were associated with lower risk of diabetes. These findings may assist in the development of interventions to address the growing burden of overweight/obesity and diabetes in Indian population. However, prospective studies with better measures of dietary intake and clinical measures of diabetes are needed to clarify this relationship
28	2014	Yoko Yoko Yama, Neal D Barnard, Susan M. Levin, Mitsuhiro Watanabe	Funnel Plot, Egger's Test, Pooled Analysis	This paper conclude that consumption of vegetarian diets is associated with improved glycemic control in type 2 diabetes.
29	2014	Charles AKYesudian, Marigrepstad, Erica Visintin& Alessandra Ferrario	Student t- Test, Wilcoxon Matched Pair Signed Rank Test, Chi –Square Test , Percentage Value	Result of this study suggestthere is a need to develop a robust methodology to perform methodologically rigorous and transparent cost of illness studies to inform policy decisions.
30	2015	Till Seuring, OlggArchangelidi, Marc Suhrcke	Exploratory Linear Regression Analysis	The reviewed studies indicate a large economic burden of diabetes, most directly affecting patients in LMICs. The magnitude of the cost estimates differs considerably between and within countries, calling for the contextualization of the study results. Scope remains large for adding to the evidence base on labour market effects of diabetes in LMICs. Further, there is a need for future COI studies to incorporate more advanced statistical methods in their analysis to account for possible biases in the estimated costs.
31	2015	M. Durairaj, G. Kalaiselvi	Artificial Neural Network (ANN), C4.5 Classifier, Support Vector Machine (SVM), K-Nearest Neighbour (KNN).	In this paper different data mining classification techniques and its applications were reviewed. Comparison results of different data mining techniques shows that the ANN gives more accurate prediction result than other similar techniques. The data mining techniques compared in this works are namely: ANN, SVM, K-NN, and C4.5. Then one with the highest accuracy above 89% is ANN.
32	2015	SrideivanaiNagarajan and R. M.Chandrasekaran	Simple K-means algorithm, The classification algorithms - Naive Bayes, Random Tree, Simple Cart and Simple Logistic	This paper demonstrates creation of expert clinical system for the diagnosis of the diabetic mellitus using clustering and classification techniques of data mining.
33	2015	Sukhjinder Singh, Kamaljit Kaur	Neural Network, Artificial neural fuzzy interference	In this paper, the various techniques are discussed for predict the diagnosis of

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 4, April 2016

			system, K-Nearest-Neighbor (KNN), Genetic Algorithm, Back Propagation algorithm, Principal Component Analysis (PCA)	diabetes. Using the data mining technique the health care management predicts the disease and diagnosis of the diabetes and then the health care management can alert the human being regarding diabetes based upon this prediction.
--	--	--	---	--

III. OBJECTIVE

To study causes of diabetes, prevention and awareness about diabetes with the help of statistical methods.

IV. SUMMARY OF STATISTICAL ANALYSIS

Summary of statistical analysis presents the statistical methods included in above table into 4 different categories and considered 3 parameters in which for T1DM & T2DM mostly parametric & non-parametric methods are used. And for comparison between T1DM & T2DM, distributions and parametric and non-parametric methods are equally used.

SR. NO.	PARAMETERS	DISCRIPTIVE STATISTICS	DISTRIBUTIONS	REGRESSION	PARAMETRIC & NON-PARAMETRIC METHODS
1	Type 1 DM	Mean, Standard Deviation	Poisson Distribution With Log Link	Meta-Analysis, Linear Regression Model, Meta Regression Analysis, Linear Mixed Model With Random Effect, Pearson Correlation Coefficient	Cochran's Q Test, I ² Statistics, Students t-Test, Two Sample t-Test, One Sample t-Test, One Way ANOVA With Post-Hoc, Tuckey's Test Random Effect Meta-Analysis, Random Effect, Fixed Effect Model, Bayesian Approaches, Funnel Plot, ANOVA
2	Type 2 DM	Standard Deviation, Mean, Median, Interquartile Range, Frequencies, Percentage, Graphical & Diagrammatic Representation	Log Link With A Binomial Distribution, Identity Link With A Normal Distribution	RRR-Reduced Rank Regression, PCA-Principal Component Analysis, PLS-Partial Least Square, Robust Generalized Estimating Equations, Least Square Analysis, Logistic Regression, Restricted Cubic Spline Regression Model, Multiple Logistic Regression, Multivariable Logistic Regression, Log Linear Poisson Regression Model, Exploratory Linear Regression Analysis	Two Sample t-Test, Factor Analysis, Cluster Analysis, Hazard Ratio, Proportional Hazard Ratio Test, Trim & Fill Method, Sensitivity Analysis, Forest Plot, Begg Funnel Plot, Egger's Test, Likelihood Ratio Test, Mantel(Log-Rank) Test, Stratified Analysis, Chi-Square Test, Pearson Chi-Square Test Students t-Test, Cochran's Q Test, I ² Statistics, Random Effect Model, Wilcoxon Rank Sum Test, Wilcoxon Matched Pair

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 4, April 2016

					Signed Rank Test
3	Comparison Between Type 1 & Type 2 DM	Median (Range Or Interquartile Range)	2-Sided Skew Corrected Inverted Score Test, Binomial Distribution	Global Logarithmic Linear Model	Mann-Whitney U Test, Maximum Likelihood Analysis

V. CONCLUSION

Result of this study showed as a universal predictor artificial neural network (ANN) gives more accurate prediction result which has 89% accuracy than other similar technique. Prevalence of type 1 & type 2 diabetes among children's & adulterants increased rate of diabetes varies in rural-urban and male-female wise. Diet plays an important role in preventions& treatment of diabetes especially vegetarian diet. Stress, hypertension, depression, obesity etc. also have an impact on diabetes. Also various factor are responsible for type 1 & type 2 diabetes. Like education, economic burden especially for lower and middle class. There is need to people aware about self-management and have a methodology which provide valuable information regarding improvement of healthcare using the application like smartphone also have a program for people which are newly diagnosed diabetes mellitus specially youth with type 2 diabetes have significantly higher rate .So with the help of newer statistical application there is need to more study the causes of increasing diabetes in people mostly in youth because diabetes have long term complications such as retinopathy, neuropathy & nephropathy in diabetic patients. And there is also need to use proper methods, because poor methods affect the reliability of prediction model & ultimately compromise the accuracy of result.

REFERENCES

- 1) Novo Nordisk, LEAD GROUP, "Diabetes and you your guide to living well with diabetes".
- 2) Dr. Patel Vinod, Department of Diabetes and Endocrinology George Eliot Hospital, UK, "How to cut out all Diabetic Problems by 50% -The Alphabet way".
- 3) Ms.Sapna S., Dr.Tamilarasi A., "Fuzzy Relational Equation In PreventingNeuropathy Diabetic", International Journal of Recent Trends in Engineering, Vol 2, No. 4, PP.126-128,2009.
- 4) Frazetta, D., Willet, K. and Fairchild R., "A systematic review of smartphone application use for type 2 diabetic patients". Online Journal of Nursing Informatics (OJNI), Vol 16 (3), PP.1-9, 2012.
- 5) Yesudian Charles AK, Grepstad Mari, Visintin Erica, and Ferrario Alessandra, "The economic burden of diabetes in India: a review of the literature" Globalization and Health, vol-10:80, PP.1-18, 2014.
- 6) Hoffmann Kurt, Schulze Matthias B., SchienkiewitzAnja, Nöthlings Ute and BoeingHeiner, "Application of a New Statistical Method to Derive Dietary Patterns in Nutritional Epidemiology" Am. J. Epidemiol, Vol. 159 (10), PP. 935-944,2004.
- 7) Paul Christine L, Piterman Leon, Shaw Jonathan, Kirby Catherine, Sanson-Fisher Robert W, Carey Mariko L, Robinson Jennifer, McElduff Patrick andThepwongsaIsaraporn, "Diabetes in rural towns: effectiveness of continuing education and feedback for healthcare providers in altering diabetes outcomes at a population level: protocol for a cluster randomised controlled trial" Implementation Science, Vol.8:30, PP.1-8. 2013.
- 8) Jinlin Fu, Binyou W., Terry C., "A new approach to the study of diet and risk of type 2 diabetes" Volume: 53, Page: 139-143, 2007.
- 9) Yokoyama Yoko, Barnard Neal D., Levin Susan M., Watanabe Mitsuhiro, "Vegetarian diets and glycemic control in diabetes: a systematic review and meta-analysis". CardiovascDiagnThe; Vol.4 (5), PP.373-382,2014.
- 10) The Diabetes Control and Complications Trial Research Group, "The Effect of Intensive Treatment of Diabetes on the Development and Progression of Long-Term Complications in Insulin-Dependent Diabetes Mellitus," N Engl J Med; Vol.329, PP. 977-986,1993.
- 11) Lloyd Cathy, Smith Julie and Weinger Katie, "Stress and Diabetes: A Review of the Links," Diabetes Spectrum Volume 18, PP.121-127, 2005.
- 12) Hu Emily A, PanAn, MalikVasanti, Sun Qi, "White rice consumption and risk of type 2 diabetes: meta-analysis and systematic review," BMJ; Vol.344:e1454, PP.1-9, 2012.
- 13) KhuntiKamlesh, Gray Laura J, Skinner Timothy, Carey Marian E, Realf Kathryn, Dallosso Helen, Fisher Harriet, Campbell Michael, Heller Simon, Davies Melanie J, "Effectiveness of a diabetes education and self -management programme (DESMOND) for people with newly diagnosed type 2 diabetes mellitus: three year follow-up of a cluster randomized controlled trial in primary care," BMJ, Vol.344,e2333, 2012.
- 14) RaoChyitra R., KamathVeena G., ShettyAvinash, and Kamath Asha, "A study on the prevalence of type 2 diabetes in coastal Karnataka," Int J Diabetes DevCtries, Vol.30(2), PP.80-85,2010.
- 15) Collins Gary s., mallett Susan, Omaromarand yuly-mee, "Developing risk prediction models for type 2 diabetes: a systematic review of methodology and reporting" BMC Medicine, Vol.9:103, PP.1-14, 2011.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 4, April 2016

- 16) Kalra Sanjay, Kalra Bharti and Sharma Amit, "Prevalence of type 1 diabetes mellitus in Karnal district, Haryana state, India," *Diabetology & Metabolic Syndrome*, Vol. 2:14, PP-1-3, 2010.
- 17) Kommoju Uma Jyothi & Reddy Battini Mohan, "Genetic etiology of type 2 diabetes mellitus: a review" *International Journal of Diabetes in Developing Countries*, Volume 31, Issue 2, PP. 51-64, 2011.
- 18) Dabelea Dana, Davis Elizabeth J. Mayer, Saydah Sharon, Imperatore Giuseppina, Linder Barbara, Divers Jasmin, Bell Ronny, Badaru Angela, Talton Jennifer W., Crume Tessa, Liese Angela D., Merchant Anwar T., Lawrence Jean M., Reynolds Kristi, Dolan Lawrence, Liu Lenna L., Hamman Richard F., "Prevalence of Type 1 and Type 2 Diabetes among Children and Adolescents from 2001 to 2009 FREE," *JAMA*; Vol. 311 (17), PP. 1778-1786, 2014.
- 19) Seuring Till, Archangiolid Olga, Suhrcke Marc, "The Economic Costs of Type 2 Diabetes: A Global Systematic Review" *PharmacoEconomics*, Volume 33, Issue 8, PP. 811-831, 2015.
- 20) Agrawal Sutapa, Millett Christopher J, Dhillion Preet K, Subramanian SV and Ebrahim Shah, "Type of vegetarian diet, obesity and diabetes in adult Indian population," *Nutrition Journal*, Vol. 13:89, PP. 1-18, 2014.
- 21) Khadilkar Vaman V., Parthasarathy Lavanya S., Mallade Basavraj B., Khadilkar Anuradha V., Chiplonkar Shashi A., and Borade Ashwin B., "Growth status of children and adolescents with type 1 diabetes mellitus", *Indian J Endocrinol Metab*; Vol. 17(6), PP. 1057-1060, 2013.
- 22) Usher-Smith Juliet A, Thompson Matthew J, Sharp Stephen J, Walter Fiona M, "Factors associated with the presence of diabetic ketoacidosis at diagnosis of diabetes in children and young adults: a systematic review", *BMJ*; Vol. 343:d4092, PP. 1-16, 2011.
- 23) Pickup John C, Freeman Suzanne C, Sutton Alex J, "Glycaemic control in type 1 diabetes during real time continuous glucose monitoring compared with self-monitoring of blood glucose: meta-analysis of randomised controlled trials using individual patient data", *BMJ*; Vol. 343:d3805, PP. 1-14, 2011.
- 24) Koshy Ann Sarah, Kumari S Jaya, Ayyar Vageesh, Prasanna Kumar Prasanna, "Evaluation of serum vitamin B12 levels in type 1 diabetics attending a tertiary care hospital: A preliminary cross-sectional study", Vol. 16(7), PP. 79-82, 2012.
- 25) Eppens Maiké C., Craig Maria E., Cusumano Janine, Hing Stephen, Chan Albert K.F., Howard Neville J., Silink Martin, and Donaghue Kim C., "Prevalence of Diabetes Complications in Adolescents With Type 2 Compared With Type 1 Diabetes", *DIABETES CARE journal*, VOLUME 29, NUMBER 6, PP. 1300-1306, 2006.
- 26) Nagarajan Srideivanai and Chandrasekaran R. M., "Design and Implementation of Expert Clinical System for Diagnosing Diabetes using Data Mining Techniques", *Indian Journal of Science and Technology*, Vol 8(8), PP. 771-776, 2015.
- 27) Yadav NK, Sathian B, Kalai RS, "Assessment of Diabetes Mellitus in India and Nepal", *Webmed Central BIOCHEMISTRY*, Vol. 3 (6), PP. 1-11, 2012.
- 28) Rema M. & Pradeepa R., "Diabetic retinopathy: An Indian perspective", *Indian J Med Res*, Vol. 125, PP. 297-310, 2007.
- 29) Durairaj M., Kalaiselvi G., "Prediction of Diabetes Using Soft Computing Techniques- a Survey" *International journal of scientific & technology research*, volume 4, ISSUE 03, PP. 190-192, 2015.
- 30) Singh Sukhjinder, Kaur Kamaljit, "A Review on Diagnosis of Diabetes in Data Mining", *International Journal of Science and Research (IJSR)*; Volume 4, Issue 6, PP. 2406-2408, 2015.
- 31) Weaver Lesley Jo, Venkat Narayan K. M., "Reconsidering the history of type 2 diabetes in India: Emerging or re-emerging disease?", *The national medical journal of India*, vol. 21, NO. 6, PP. 288-291, 2008.
- 32) Mohan Viswanathan, Seedat Yackoob K. and Pradeepa Rajendra, "The Rising Burden of Diabetes and Hypertension in Southeast Asian and African Regions: Need for Effective Strategies for Prevention and Control in Primary Health Care Settings", *International Journal of Hypertension*, Volume 2013, PP. 1-14, 2013.
- 33) Sharma Taruna, Kalra Juhi, Dhasmana DC, Basera Harish, "Poor adherence to treatment: A major challenge in diabetes", *JACM*; Vol. 15(1), PP. 26-29, 2014.
- 34) Raval Amit, Dhanaraj Ethiraj, Bhansali Anil, Grover Sandeep & Tiwari Pramila, "Prevalence & determinants of depression in type 2 diabetes patients in a tertiary care Centre", *Indian J Med Res*, Vol. 132, PP. 195-200, 2010.
- 35) Kumara Mukesh, Dr. Vohra Rajan, Arora Anshul, "Prediction of Diabetes Using Bayesian Network", *International Journal of Computer Science and Information Technologies*, Vol. 5 (4), PP. 5174-5178, 2014.