Prevalence of Type-II Diabetics Association with PM 2.5 and PM 10 in Central Region of Tamil Nadu, India

Dr. L. Arockiam, S. Sathyapriya, V.A. Jane, A. Dalvin Vinoth Kumar

Abstract: Diabetes mellitus is a non-communicable disease, however it may lead to other health problems such as blood pressure, heart attack, vision problem, slow healing sores to patients with arthritis etc. Diabetes disease is caused due to lifestyle, food habits, and low level of fabrication of insulin and pedigree factors of individual. According to the study, there will be 552 million people around the world will be affected by diabetes at 2030. This paper estimates the total populations of type 2 diabetes patients in the central region (Cuddalore, Thanjavur, Perambalur, Tiruchirappalli, Ariyalur, Karur, Nagapattinam, Thiruvarur, Pudukottai, and Karaikal) of Tamil Nadu. Diabetes patients have been diagnosed with the help of various parameters such as blood pressure, body mass index, dietary history, physical activity and pollution level in the air. The Honeywell HPm series particle sensor is used to access the PM 2.5, PM 10 levels in the air. Considering the air quality as a parameter, there are lots of illnesses caused by air pollutants and also cause additional problems for people who are already suffering due to disease. This review work provides the knowledge about the prevalence of type-2diabetes and it will help people to take precautions about diabetes disease and its risk.

Index Terms: Diabetes, Air Quality, Sensor, PM2.5, PM10.

I. INTRODUCTION

Diabetes mellitus is one type of non-communicable disease. The prevalence of diabetes is rapidly increasing all over the world at a tremendous rate [1].It occurs when the glucose level increases in the blood. Blood glucose is the main source which produces energy to human body. The high blood sugaris defined as a medical syndrome, which is also called as hyperglycemia, which is caused due to an inadequacy of insulin in the human body. The level of blood sugar is standardized by a hormone, which is done by the insulin generated by the pancreas. The pancreas is a very tiny organ which is placed between the stomach and liver that helps to digest the food. According to the report of

World Health Organization (WHO)[2], the highest number of diabetes affected people are living in India. The total number of diabetes patients in the year 2016 is 7.8 million it will exceed 79.4 million by 2030. The International Diabetes Federation (IDF)[3] in the world has reported on diabetes that it has proved 425 million adults living with diabetes. According to the report of IDF, 5.2 % of Indian people are not aware that they are suffering from high blood sugar. In specific, the Madras diabetes research [4] foundation instructed that about 42 lakhs individuals are suffering from diabetes and 30 lakh people are in pre-diabetes.

A. *Types of diabetes disease:*

There are various ways to detect the presence of diabetes in the human body. There are three categories in diabetes mellitus. They are Type-1 diabetes, Type-2 diabetes and Gestational diabetes[5]. The early stage of diabetes is identified using the following factors such as long-lasting blood sugar, blood sugar fasting, diabetes history of genes, measuring waist and the ratio of height waist of individuals. In this paper type 2 diabetes is considered.

a. Type 2 Diabetes

Type 2 diabetes is called as non-insulin dependent diabetes[6]. In type 2 diabetes, pancreas produces sufficient insulin but the beta cells do not use it properly and that's why insulin resistance is caused. In such case, insulin tries to get glucose into the cell but it can't maintain instead of this the sugar level may increase in the blood. People may get affected by the type 2 diabetes at any age even in childhood. Type 2 [7] diabetes is caused by overweight and inactivity which leads to insulin deficiency. These types of diabetes can be controlled by weight management, regular exercise and nutrition. The symptoms of type2 diabetes are same as type 1diabetes except itching skin and the problem in vision. This type of diabetescan'tbe cured but can be controlled by medicine and injection which is given for diabetes, physical exercise, blood monitoring and glucose controlling.

B. *PubMed NCBI*

Over the past few years, awareness about diabetes is growing and the possibility also growing in this field. According to PubMed NCBI, referred as a journal for publishing MEDLINE papers, indexed by PubMed has computed diabetes related details which are surveyed from the year of 1983 and 2018 by using the keyword "Prediction and Diabetes". The surveyed results are shown in the form of graph, which is displayed in Fig1. The count for 2018 is extrapolated till June 27, 2018.
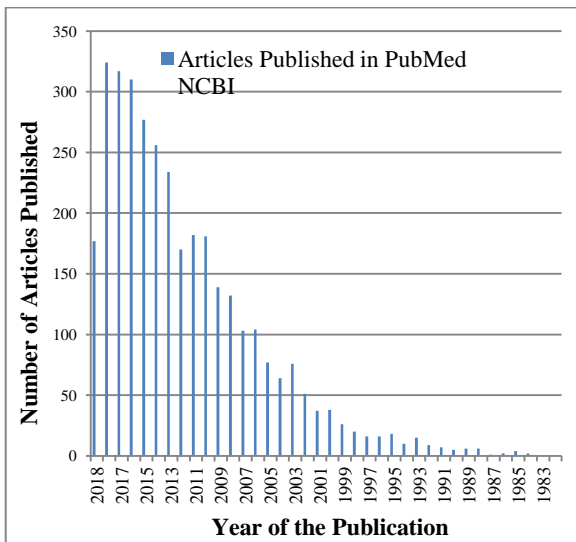
Fig 1: Number of publications index by Pub Med with keywords "Predictive and Diabetes." The 2018 count is extrapolated based on the number from June 27, 2018

II. REVIEW OF LITERATURE

Cheng lin et al [8]discussed about the classification and prediction in data mining by analyzing the information based on diabetes data. This paper partitioned the sets of data for classifying by using decision tree and data prediction was done through the linear regression, multiple regressions and non-linear regression whereas evaluated the classification accuracy. The process of classification and prediction of data mining also discussed about similarities and differences between them.

K.Lakshmi et al [9] proposed a System Architecture for diagnoses diabetes disease using clustering and classification algorithm such as decision tree and KNN. The proposed system has stored data into a server which was collected based on different diseases of patients. Here, they considered 11 attributes of diabetessuch as Age (years), Sex, Body mass index, Blood Pressure (mm Hg), Plasma Glucose Concentration (Glucose tolerance test) Triceps Skin fold 2-Hour serum insulin Diabetes Pedigree function, Cholesterol Level, Weight (kg) and Class variable (0 or 1) to predict the diabetes.The proposed method consists of some basic components such as admin, user (doctor, patient, physician etc), server, database, application, and data mining techniques. In the first step of the proposed system, KNN and Decision tree were applied for training the dataset after receiving the request from the user, which are like a supervised classification model.Admin received the inputs from requestor. In the final step DM approach was used to predict the result and send back to the user. Time and cost are reduced to diagnoses in this approach.

Dr.Prof.Neeraj et al [10] described the J48 algorithm for predicting recurrence of cancer-based data set to breast cancer. Recurrent cancer can be analyzed in three ways and they are: cancer comes back after treatment or it is in the same place, where it started first whether in any portion of the body. Hereafter J48 algorithm was used on the data set of breast cancer and implemented by WEKA tool and generated the decision tree by using 10 fold cross-validation method to predict the recurrent event due to its attributes such as tumor size, the degree of malignancy, age, node-caps, menopause etc.UCI machine learning repository provided the data set for predicting recurrence cancer of undergone treatment to patients. A result of experiment was tabulated and the decision tree was shown in the figure. Furthermore, results were concluded accurately and specific range value was used to find out the changes of recurrence cancer.

Manal Abdullah et al [11] proposed a method for finding five types of anemia is one of the hematological diseases and predicted what type of anemia hold by patient using classification algorithms. This paper proposed an algorithm for classification with the help of complete blood count test. The data sets were collected from patients and were filtered. Multiple experiments were conducted using various algorithms namely naive Bayes, neural network, J48 decision tree, and SVM. Compared with other algorithms J48 decision tree provided the best potential classification of anemia types. J48 decision tree algorithm provided better performance with accuracy, recall, true positive rate, false positive rate, precision and F-measure and it was proved by weka experiment. The tested results were tabulated in percentage (like 20%, 40%,60%). The anemia types can be detected with the help of given algorithms but this paper concentrated only on five types of anemia for finding accuracy and prediction of preferred results.

Himansu Das et al [12] focused on Diabetes Mellitus Disease. They used two data mining technique such as J48 and Navie Bayesian for predicting diabetes. The proposed technique was quicker and efficient for diagnosis the disease. The dataset was collected from medical college hospital by providing set of questions that about particular patient name, age, sex, blood, sugar level, and plasma glucose and as well as online repository. After thatthe data cleaning was performed to remove the unnecessary data and was stored in the warehouse. The proposed method predicted whether the patient has diabetes or not, by classification technique. The two classification techniques were implemented through WEKA software and the experimental results were tabulated. Navie Bayes better than J48 and also the outcome was proved by its productivity.

N.Vijayalakshmi and T.Jenifer [13] worked on data mining and statistical analysis for identifying diabetes disease. The data source contained pertaining diabetes which has taken from nursing home research center. The collected data divided as diabetic patients and non-diabetic patients. WEKA tool was used for analyzing the most important factors causing diabetics and also used to perform statistical analysis method on every single attribute. Tow classification techniques such as J48 pruned tree technique and the Random tree provided the validation result and the detailed accuracy on datasets by class. Hence this paper proved J48 pruned tree is a better technique compared with other classifying techniques and the accuracy of the predicted result was 81%.

III. SURVEY AREA

Tamil Nadu is one of the states in India. Based on the direction of the districts located, it is divided into 4 Regions namely central region, western region, southern region and Chennai city region. Each region has at least more than 4 districts.

The central region has 10 districts such as Cuddalore, Thanjavur, Perambalur, Tiruchirappalli, Ariyalur, Karur, Nagapattinam, Thiruvarur, Pudukottai, and Karaikal. The western region has 6 districts which are Coimbatore, Erode, Nammakal, Salem, Dharmapuri and the Nilgiris. The southern region has 9 districts that are Dindigul, Madurai, Theni, Sivaganga, Virudunagar, Ramanathapuram, Tirunelveli, Thoothukudi and Kanyakumari. Finally, Chennai, Thiruvalluvar, Kancheepuram, Vellore, Tiruvannamalai, and Puducherrydistricts have come under the Chennai city region.

A. *Central region*

According to the census report at 2011, the Central region's total population is 12,212,084 where the men and women are in the frames of 7,031,520 and 7,194,867 . The total taluk in the central region of all districts are 66 whereas total revenue villages and panchayat villages are 4638 and 3154 respectively. From the report, the total number of literate people in that region is 7,369,787. Men and women in this category are 3,982,437 and 3,432,656. The total number of children (age between 0-6) in this region is 1,042,373, from this total number of male children and female children are 3,982,437 and 3,432,656.

IV. MATERIALS AND METHODS

All the study samples were randomly collected from states in the central region of Tamilnadu. The total study population is 10115 among them 5566 were male and 4549 femlae which is 55.1% and 44.9% respectively. The population was screened for blood pressure (diastolic and systolic) and blood sugar along with their screening data, the body mass index (BMI), dietary history, physical activity, pattern and Pm2.5 (pm & Pm10). The population screened for diabetics by random Blood Sugar Meter(RBS). The Blood pressure is screened using Arm Bp digital monitor. The dietary history, physical activity are assessed by a set of stored questions. The air pollutants (Pm2.5 & Pm10) are assured using Honeywell HPm series particle sensor. The number of total study population for male and female percentage has separated based on their age wise and listed in the table 1.

Table 1: Age and sex wise distribution of the study population

Age	No. Male Population (%)	No. Female Population (%)	Total Population (%)
< 30 years	1422 (72.9)	526 (27.1)	1948 (100)
30-35 years	1658 (60.7)	1071 (39.3)	2729 (100)
36-40 years	1427 (69.3)	632 (30.7)	2059 (100)
41-50 years	612 (36.25)	1076 (63.75)	1688 (100)
51-60 years	376 (23.7)	1213 (76.3)	1589 (100)
>60 years	71 (69.7)	31 (30.3)	102 (100)

V. RESULTS AND DISCUSSION

According to the report of total study population, people have separated based on their age and sex. From this, the total number of male and female has displayed in Fig2 in the form of graph. The age of both gender classified as, Below 30, 30 to 40, 41 to 50, 51to 60 andAbove 60.
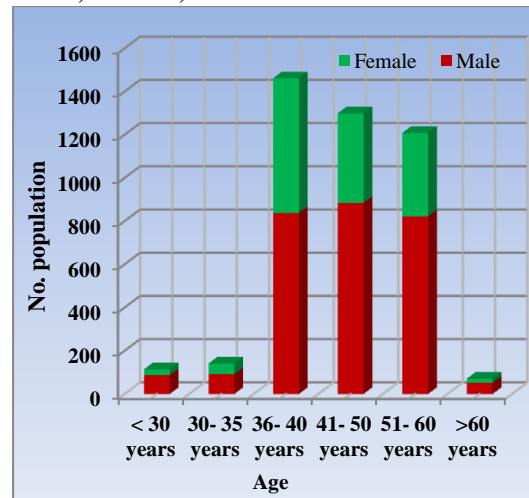

Fig 2: Distribution of Age and Sex

A. *Diabetic and Age*

Among the major factors of diabetes, age is considered like one kind of major factor. The total number of diabetes patients derived from total study population has given in the graph with its percentage. Fig3 represents the above mentioned details as a graph.
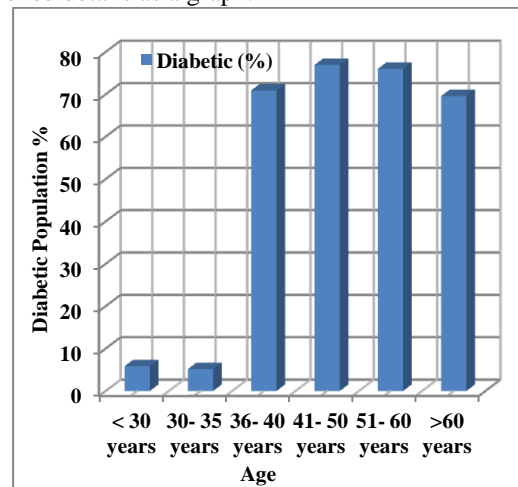

Fig 3: Diabetic and Age

B. *Education and Diabetic*

Diabetes awareness between literate and illiterate were surveyed. Totally 36.50 % percentage of illiterate people has lived in Tamilnadu, 41% percentage of people completed their schooling,22.50% percentage completed graduation. The comparison is between these categories of people represented in the form of graph in Fig4.
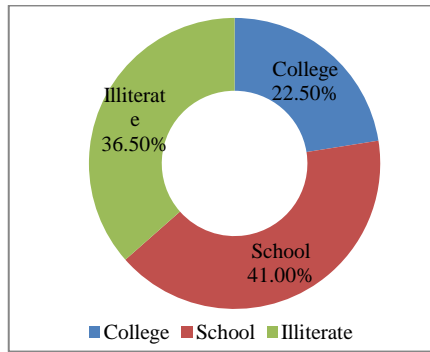
Fig 4: Education and Diabetic

C. *Air Pollution and Diabetic*

When the pancreas function decreases, the function of insulin is reduced. Diabetes occurs when the pancreas does not produce sufficient insulin. Today Air pollution is increasing throughout the world, and the air is most often polluted by the urban area so air pollution may affect the pancreas as well as the **livelihood may be affected to diabetic patients.** Here using Honeywell HPm series particle sensor, the air pollution(Pm 2.5 and Pm10) detail was collected and displayed. An average of air pollutants level is given as a graph in fig 5.
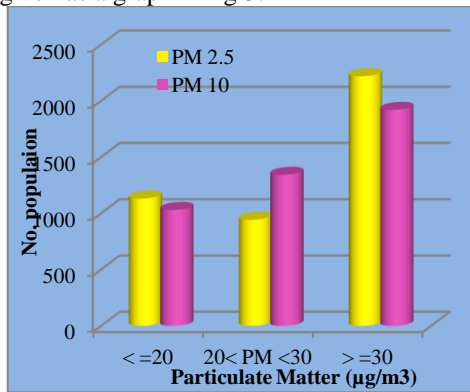

Fig 5: Air Pollution and Diabetic

D. *Diabetic Control measure*

According to this study, diabetes people have followed insulin or treatment taken from required government hospital or have followed any diet to control their diabetes or awareness about HCA1C test and carbohydrate count. In order to the study of total population has described and the number of population based on diabetic control measures which is represented in fig 6 as a graph.
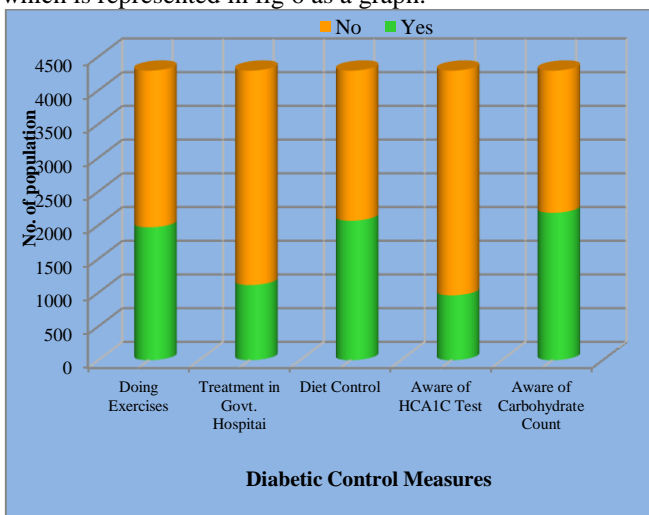

Fig 6: Diabetic Control measure

VI. CONCLUSION

Diabetes Mellitus is a chronic disease that can affect human life. Massive data was collected from census report at 2011, questionnaire and IoT devices. Tamilnadu has been separated into four regions with respect to the location. This study concentrated mainly on the central region of Tamilnadu and total population was surveyed in that region. From this, total number of male and female population was also reviewed. The number of people living with diabetes in the central region was calculated by using various parameters. The results of experiments exhibited the number of diagnosis made for diabetic patient and were computed individually on the basis of their age, education, physical activity, dietary history, and air pollution. This paper will help to spread the awareness about diabetes among people. In future, these experiments may be conducted all over Tamilnadu and it may improve the accuracy level with the help of various parameters

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Retrieval Number: F2262037619/19©BEIESP
DOI: 10.35940/ijrte.F2262.078219
Journal Website: www.ijrte.org

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