

DIABETES DIET INVESTIGATION BY USING MACHINE LEARNING TECHNIQUES

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Abstract

Machine learning techniques seems to be increasing every day, like never before, the motivation behind this work is to change all accessible data into significant data. Diabetes mellitus is a type of metabolic problem, creating an impact on human health around the world and the main cause for this is hereditary. Patients should know how much sugar content present in their meal and what provokes the sugar level. Diabetes is a major metabolic disease that can seriously affect the whole human body. Nowadays, diabetes has become a common disease to mankind from young to old. The number of reported diabetic patients is escalating day by day, due to innumerable reasons toxic or chemical contents mixed with the food, obesity, working culture and bad diet plan, unusual life style, eating food habits and environmental factors.

Keywords: Machine learning, Diabetes, diet plan.

Introduction

Diabetes prevalence has risen sharply with the aging of the global population and changes in dietary patterns. There will be approximately 537 million diabetics globally by 2022. Diabetes causes a slew of secondary consequences, including cardiovascular disease, kidney damage, retinopathy, foot damage, etc. Diabetes is expected to be the seventh greatest cause of death worldwide by 2030, according to the International Diabetes Federation, while the epidemic is escalating and placing a substantial economic burden on healthcare systems. Previous research has linked diabetes to lifestyle risk factors, such as

BMI, unhealthy diet, alcohol, smoking, and physical inactivity. For example, the BMI was consistently related to diabetes incidence in a meta-analysis of 32 studies. The smoking, both actively and passively, significantly increased the incidence of type 2 diabetes in a meta-analysis of 88 prospective trials. According the survey, moderate drinking helps prevent diabetes in both men and women in a meta-analysis of 20 cohort studies. A meta-analysis of 28 prospective studies, higher levels of physical activity were linked to a considerably decreased incidence of diabetes. Machine learning is becoming increasingly popular as a model-building tool in recent years, and it has also been widely discussed in the medical field. Machine learning has demonstrated its powerful predictive capabilities and parallel processing capabilities for handling large numbers of variables. Furthermore, machine learning has derived variable screening mechanisms that can detect and interpret complex relationships between variables. Previous studies have well demonstrated that machine learning may be employed as an effective research method for predicting diabetes. Current status of facilities and treatment in health sectors doesn't give a complete solution or a possible treatment for curing the disease,

the patients need to live an uncommon way of life with an effective treatment for different sort of diabetes; There are three types of diabetes Type1 (T1D), Type2 (T2D) and Gestational diabetes, and these metabolic disorders can be described as, T1D is total lack of insulin production by pancreatic glands, and T2D is inability to produce sufficient amount of required insulin. This work focuses on identifying the sugar levels in food intake and also to instruct the patient about sugar levels that food contains. To perform this experiment, the data is collected from diabetes patient and also took survey on food intake, this helped to identify what kind of food causes the increase in the blood sugar level. Leveraging machine learning algorithms, the research is performed to find the best model that is suitable for this process by comparing the accuracies of different algorithms.

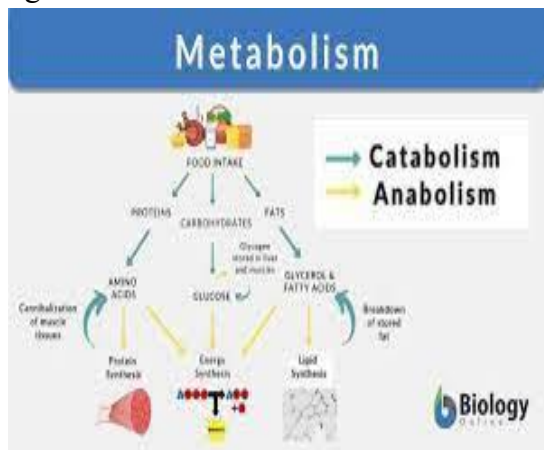


Figure 1: The process of metabolism
Overview of Diabetes

Patients with diabetes need to control their blood glucose levels. Insulin or other medicine might be utilized to control blood glucose levels. In the event that blood glucose levels are not sufficiently controlled, the drawn-out difficulties can be very expensive as far as both health and

money. Such intricacies incorporate expanded risk for coronary illness and stroke, visual impairment, kidney disappointment, and even demise. Regularly, patients with T2DM can control their blood glucose levels through medicine, work out, and appropriate eating routine. Patients with T1DM expect insulin to endure, either from injection or from a siphon. Numerous patients with T1DM utilize an insulin siphon related to Continuous Glucose Monitoring (CGM). The insulin siphon permits the patient to control any measure of insulin. For patients utilizing Medtronic siphons, this sum is picked with the assistance of the Bolus Wizard. There are numerous variables which impact the viability of insulin for the patient that the Bolus Wizard considers. Insulin affectability, which shifts from patient to understanding, is a proportion of the patient's responsiveness to insulin.

Methodology

The variation in glucose levels is reason for diabetes. Insulin adjusts the blood glucose level in the body, inadequacy of which cause diabetes. For the expectation of blood glucose levels AI is utilized, these have numerous means like picture pre-preparing/data preprocessing followed by an element extraction and afterward grouping. We can utilize any of the referenced AI classifiers to predict this illness. In the above area we have finding out about numerous arrangement algorithms, we can either utilize any of these to predict the disease or we can investigate the procedures to utilize the half breed philosophy to improve the precision over utilizing a solitary one.

Dataset Selection

The Dataset has been collected from a diabetic patient (Type 2 diabetic) by recording day to day meal intake and blood sugar levels. The data has been collected over a period of 6 months. The motive behind this research is to identify the blood sugar level and the sugar level in the food consumed. Since data collected from an Asian origin individual, the dietary contains more spicy foods compared to other cuisines of the world. The intention of this work is to find the correlation between spiciness and sugar level in the food. Blood sugar levels are recorded in the morning and evening, and the meal intake is recorded in morning and evening as well, to predict at which time the sugar intake in more.

Data preprocessing

Data preprocessing is most important part of this analysis. Generally data from health care services contain missing values and different conventional values that may cause ambiguity in analysis of data. In order to improve quality and viability acquired subsequent to mining measure, data preprocessing is done on the dataset. To utilize Machine Learning techniques on the dataset feasibly a value is basic unit for precise outcome and effective forecast. For the dataset used in this research, data preprocessing is completed as two stage process.

Random Forest

It is sort of outfit learning strategy and furthermore utilized for arrangement and regression assignments. The precision it gives is grater at that point contrasted with different models. This strategy can undoubtedly deal with huge datasets. Random Forest is created by Leo Bremen. Random Forest Improve Performance of

Decision Tree by decreasing change. It works by developing a huge number of decision trees at preparing time and yields the class that is the method of the classes or classification or mean forecast (regression) of the individual trees.

Results

Using Machine Learning Algorithms, the desired output was obtained for this dataset. The data is segregated the based on the morning and evening food intake, the model identifies different parameter in the food, like, the spiciness, sugar level, natural sugar and the external sugar. In our regular dietary there are foods that contains natural sugar, which is highly dangerous for the patients to consume. Based on the food consumption the blood sugar rate changes which can be identified by the running different test. In order to prevent the patient from dangerous foods that mi ght risk their health, it is prominent to identify the food that has high sugar level. Also, in the low sugar patients, doctor advised that they should consume more amount of sugar than the normal consumption.

Sugar level and level of risk

Diabetes comes with some extreme notable symptoms in the body, the patients must be aware what will happen if the blood sugar level increases in their body. For every level sugar the symptoms and the level risk vary. For the sugar level of 50 mg, it is considered as the low sugar level which is extremely dangerous, the patient is advised to seek medical help in this case, 90- 120 is the normal blood sugar that everyone should maintain in their body. On the other hand the high sugar level which is above 240 mg, people with this level of blood sugar level should be highly diet conscious.

| Fasting blood sugar level | Risk level and suggested action |
|------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| 0 50 mg/dl or under | Dangerously low: Seek medical attention |
| 1 70-90 mg/dl Possibly too low: Consume sugar upon experiencing symptoms of low blood sugar, or seek medical attention | |
| 2 90-120 mg/dl | Normal range |
| 3 120-160 mg/dl | Medium: Seek medical attention |
| 4 160-240 mg/dl | Too high: Work to bring down blood sugar levels |
| 5 240-300 mg/dl | Much too high: This could be a sign of ineffective glucose management, so see a doctor |
| 6 300 mg/dl or above | Very high: Seek immediate medical attention |

Figure: Blood sugar level and risk level

| Blood Glucose Chart | | | |
|---------------------|---------|--------------|------------------------|
| Mg/DL | Fasting | After Eating | 2-3 Hours After Eating |
| Normal | 80-100 | 170-200 | 120-140 |
| Impaired Glucose | 101-125 | 190-230 | 140-160 |
| Diabetic | 126+ | 220-300 | 200+ |

Figure: Blood sugar chart

Analysis

The statistical analysis in the project involves both morning and evening reading of the blood sugar level in the patients. The below table gives the mean, standard and maximum value of the blood sugar level.

| | count | mean | s |
|------------------------|-------|------------|---------|
| Morning Reading | 246.0 | 226.203252 | 15.0101 |
| Evening Reading | 249.0 | 250.128514 | 16.7259 |

Analyzing how low spiciness influences blood sugar level

To analyze the spice in the food, this research analyzed the food intake and noted the spice composition in those food which is depicted in the below chart. The spice composition is portrayed on the bases of very good. Based on the below chart found

that low spiciness food such as brown rice, vegetables, black lentils, yellow peas leads to high sugar level.

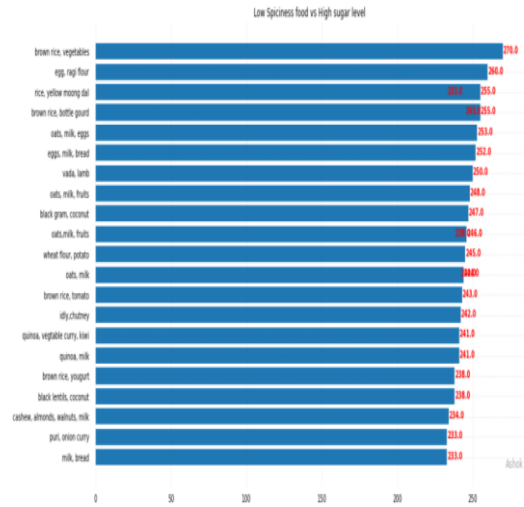


Figure: Low spiciness food vs high sugar level

Like the above graph, it is necessary to calculate the low spiciness vs normal sugar level, in order to advice the people to consume the right food for their blood sugar level. Based on the above chart found that low spiciness food such as upma, idly, dosa, tomato rice would help to maintain normal sugar level as per the blood sugar chart shown above.

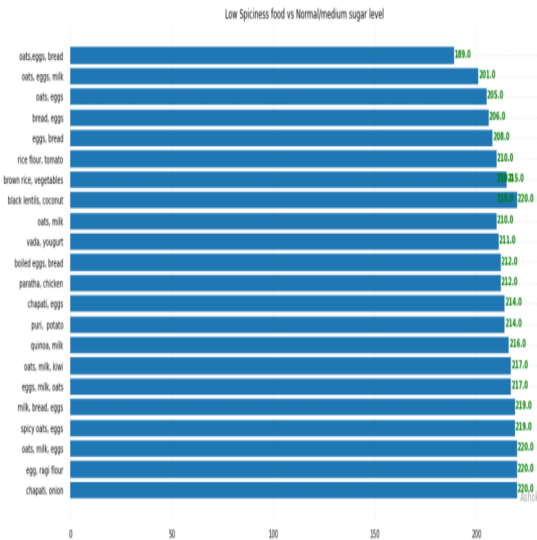


Figure: Low spiciness food vs Normal/medium sugar level
Analyzing how medium spiciness influences blood sugar level

The below chart represents the classification of medium spiciness vs high sugar level in the food intake and Based on the above chart found that black lentils,yellow peas,dosa ,chapathi rises sugar level to high.

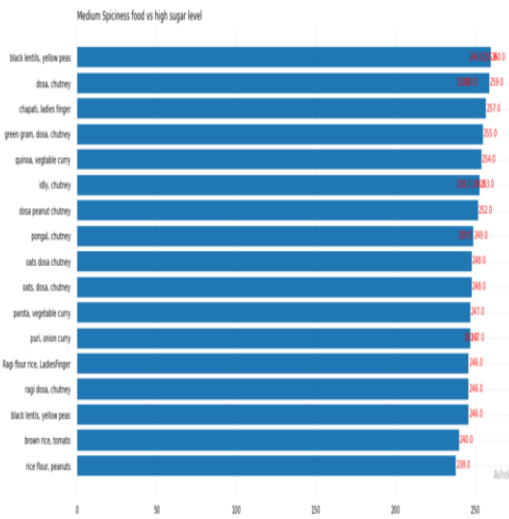


Figure: Medium spiciness food vs high sugar level

Like the above chart, I have predicted the medium spiciness vs normal sugar level present in the meal. Based on the above chart combination of (oats,egg,bread),(pongal sambar), (oats,egg) helps to maintain normal sugar level.

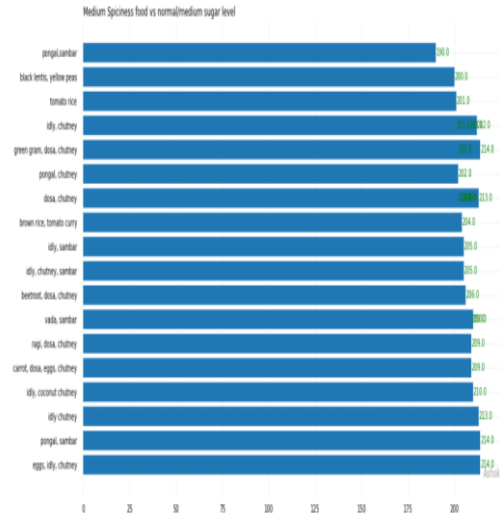
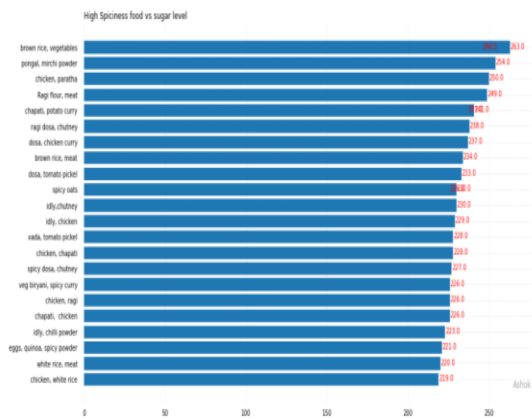


Figure: Medium spiciness food vs normal/medium sugar level
Analyzing how high spiciness influences blood sugar level

The below graphs depict the graph for high spiciness vs sugar level in the food. This is most prominent area compared to other two. As per various reports it is donated a high spice is directly proportional to the high sugar level. From observation and based on the below two charts found that high spiciness food lead to high sugar level.



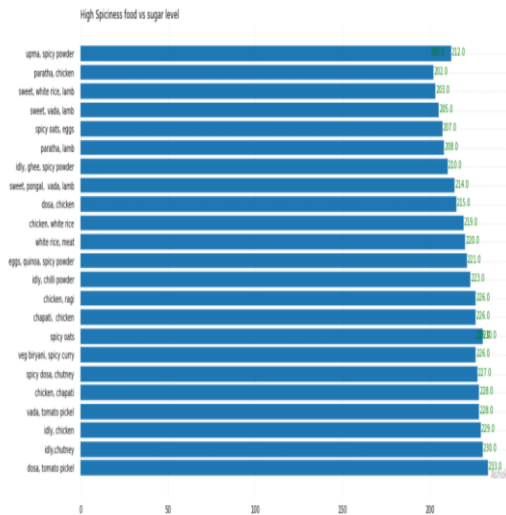


Figure: High spiciness vs sugar level

There are many factors in a food that is consumed can impact the sugar levels in the blood, one of the factor is spiciness of the food, so analysis has been made by identifying the spiciness from the food and categorizing into High, Medium, Low levels. In Explanatory data analysis it is identified that the food that has low spiciness has not increased the blood sugar levels. The Natural sugars of the food are one of the reasons that contributes the sugar levels, the natural sugars cannot be avoided, for an example a fruit has natural sweetness and when it is consumed the sugar level gets increased, the estimations of the natural sugars are done by understanding the diet information. And it is observed that natural sugars and external sugars follows a pattern in the diet.

Conclusion

Diabetes is considered be one of the serious diseases which made numerous suffer across the world. According world health organization, people above the age of 60 seems to suffer more. Also, there is no cure found yet for this disease. Once someone is tested with low or high blood sugar level, the respective person should undergo

lifelong medication and be on a strict diet. Diabetes also leads various other health complication, in the worst-case heart disease tend to occur. People lack awareness on the serious of this disease and also in the diet that needs to be followed. To address this issue, this research is conducted on one patient, the dataset is prepared by collecting the diet information from the patient.

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