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Analyzing the influence of lifestyle and diet on type 2 diabetes prevalence in Tiruppur city

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Abstract
A happy and fulfilling life depends on having good health and wellness. Diabetes mellitus is a chronic, non-communicable disease that poses a significant global health challenge. This study focuses on diabetic patients in Tirupur City, aiming to analyze the factors influencing diabetes, including demographic variables, lifestyle choices, and genetic predisposition. A primary data collection method was employed through structured questionnaires and interviews. Statistical tools such as chi-square analysis, correlation analysis, regression analysis, and clustering techniques were utilized for data analysis. The findings indicate a significant relationship between diabetes prevalence and factors such as physical inactivity, dietary habits, and genetic susceptibility. Notably, exercise, BMI and dietary modifications emerged as the most crucial factors in diabetes management. This study underscores the urgent need for awareness programs and lifestyle interventions to reduce the burden of diabetes and improve the quality of life for affected individuals.

Keywords: EDA, BMI, diabetes, lifestyle, sugar level, clustering

Introduction
Taking care of our bodies and minds is essential to leading a healthy lifestyle. It includes maintaining a healthy diet, exercising, getting adequate rest, controlling stress, and looking after our mental well-being. You obtain greater energy, sharper focus, better discipline, and more productivity when you maintain optimal health through regular exercise, healthy eating, and better sleep. To live a happy life and meet our necessities, we must be in good health. Encouraging everyone to live a healthy life is a global objective. Your body uses glucose as its primary energy source. It is also the primary energy source for the brain. Although the body can produce glucose, it can also be obtained through diet. The pancreas produces the hormone insulin, which facilitates glucose uptake by your cells for energy production. Your body either doesn't produce enough insulin or doesn't use it correctly if you have diabetes. After that, glucose remains in your bloodstream rather than entering your cells.

Diabetes is a metabolic condition brought on by an insulin shortage. The blood sugar level is kept steady between 70 and 120 mg of glucose per 100 milli litres. The two most crucial hormones in the maintenance of diabetes are glucagon and insulin, while other hormones also play a role. Diabetes is brought on by a loss of the hormones' balanced effects, which typically results in decreased insulin production. Sugar begins to build up in the blood, raising blood sugar levels, and passing through the urine along with other minerals. Hyperglycaemia is a high blood sugar level, while glucosuria is the presence of sugar in the urine. Approximately 10% of people worldwide have diabetes. By 2030 and 2045, this number is expected to increase from 537 million adults to 643 million and 784 million, respectively. Most of these individuals reside in low- and middle-income nations. Numerous other severe health issues, such as obesity, hypertension, heart disease, and stroke, are associated with diabetes.

Review of Literature
Diabetes is a growing global health concern, with prevalence expected to rise significantly by 2045. Lifestyle modifications, including diet and exercise, plays a crucial role in diabetes prevention and management (Gupta *et al*., 2009) [12].

Classified diabetes into five subgroups using cluster analysis, emphasizing the need for personalized treatment. Ali & Ahmed *et al*. (2021) analyzed that diabetes leads to severe complications such as cardiovascular diseases, kidney failure, and nerve damage. Assessed that physical activity, a balanced diet, and medication adherence improve diabetes control and reduce complications. Utilized K-means clustering and hierarchical clustering to analyze patient subgroups based on blood sugar levels, BMI, and other factors.

Materials and Methods

Data Description

The major source of the data is the questionnaire, which was used to gather information from respondents using the convenience sampling approach. The study's geographic areas are different parts of Tirupur city, with 180 samples.

Results and Discussion

The age distribution of these samples is as follows: 10.6% of the respondents are between the ages of 30 and 45, 55.6% are between the ages of 45 and 60, 26.7% are between the ages of 60 and 75, and 7.2% are over the age of 75. In terms of respondents' gender, 57.8% are men and 42.2% are women. Additionally, 36.7% of respondents do not have a family history of diabetes, while 63.3% have a family history. The percentage of respondents who are aware of diabetes is 86.1%, while the remaining 13.9% are not.

Table 1: Demographic characteristics of the respondents

Variable	Number of Participants	Percentage
Age in years		
30-45	19	10.6
45-60	100	55.6
60-75	48	26.7
75 Above	13	7.2
Gender		
Female	76	42.2
Male	104	57.8
Occupation		
Accountant	8	4.4
Business	31	17.2
Cashier	7	3.9
Daily wage	12	6.7
Driver	18	10.0
Engineer	16	8.9
Farmer	4	2.2
Housewife	65	36.1
Manager	12	6.7
Teacher	2	1.1
Watchman	5	2.8
Food habits		
Vegetarian	52	28.9
Non-vegetarian	103	57.2
Vegan	25	13.9

Interpretation

Table 1 suggests that most participants are middle-aged or older, with a slight male majority. A significant proportion are housewives, followed by business professionals and drivers. The majority follow a non-vegetarian diet, though vegetarianism is also fairly common. The data could be useful in understanding lifestyle patterns and dietary preferences in different age and occupational groups.

Table 2: Health and lifestyle assessment survey of the respondents

Variable	Number of Participants	Percentage
Doing Exercise		
No	31	17.2
Yes	149	82.8
Frequency of Doing Exercise		
4 times a week	62	34.4
Less than 4 times a week	37	20.6
None	31	17.2
Regularly	50	27.8
Duration of Exercise		
1 hour	77	42.8
2 hours	2	1.1
Half an hour	70	38.9
None	31	17.2
Awareness About Diabetes		
Yes	155	86.1
No	25	13.9
Family History of Diabetes		
No	114	63.3
Yes	66	36.7
Checking Blood Sugar Level		
Once in 3 months	18	10.0
Once in 6 months	6	3.3
Once a month	156	86.7
Intake of Insulin/Medications		
No	5	2.8
Yes	175	97.2
Other Health Problems		
Blurry Vision	33	18.3
Heart Disease	5	2.8
High/low Blood pressure	107	59.4
Kidney Disease	6	3.3
None of these	29	16.1

Table 2 shows that the majority of participants (82.8%) engage in exercise, and 86.1% are aware of diabetes. Most of the participants monitor their blood sugar monthly (86.7%) and are on medication or insulin (97.2%), indicating good disease management. However, many also suffer from related health issues, particularly high or low blood pressure (59.4%). This suggests a need for continued education on regular physical activity and integrated care to manage both diabetes and associated conditions.

Table 3: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.873ᵃ	.763	.761	4.222

Table 4: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	155.669	3.326		46.809	.000
	BMI	2.833	.118	.873	23.927	.000

Interpretation

The regression model shows that BMI is a strong and significant predictor of the dependent variable sugar level, with a high correlation (R=0.873) and an R^2 of 0.763, indicating that 76.3% of the variance is explained by BMI. The adjusted R^2 (0.761) confirms the model's reliability, and the standard error (4.222) suggests a relatively low average deviation of predicted values. Overall, the model demonstrates strong predictive power and a good fit.

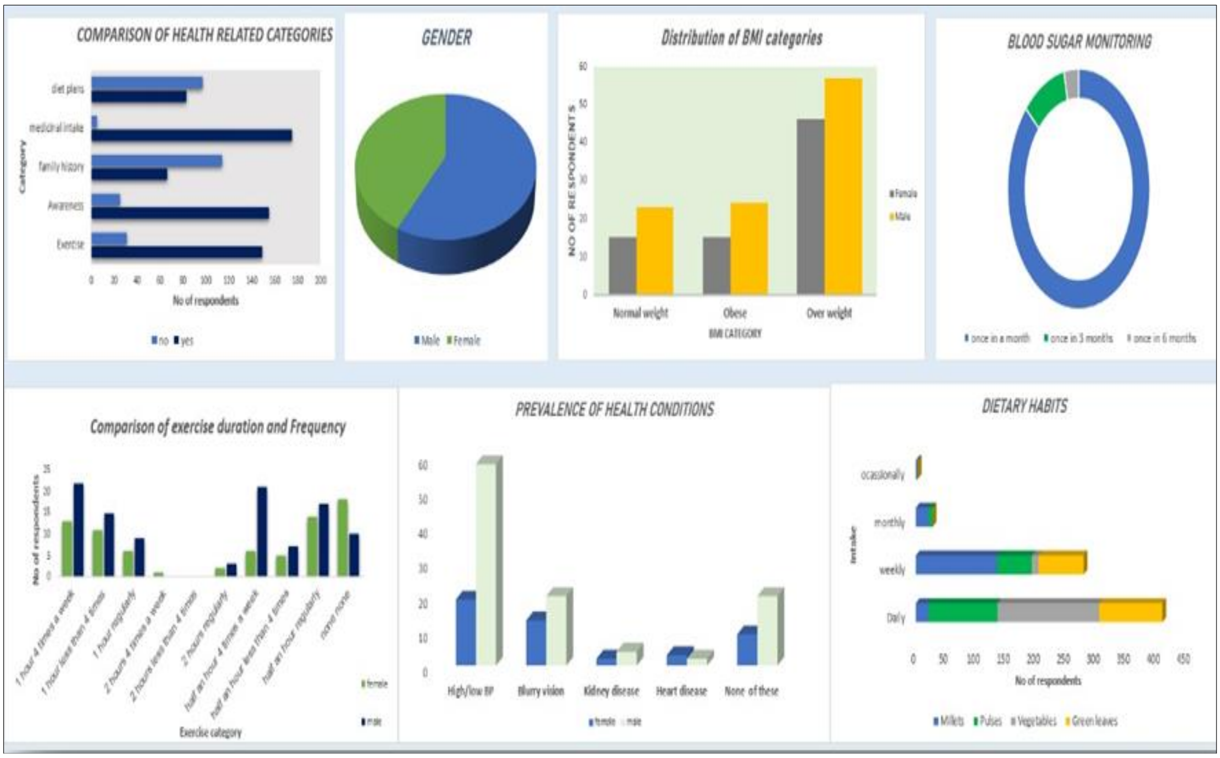

Fig 1: Health, fitness and lifestyle patterns overview

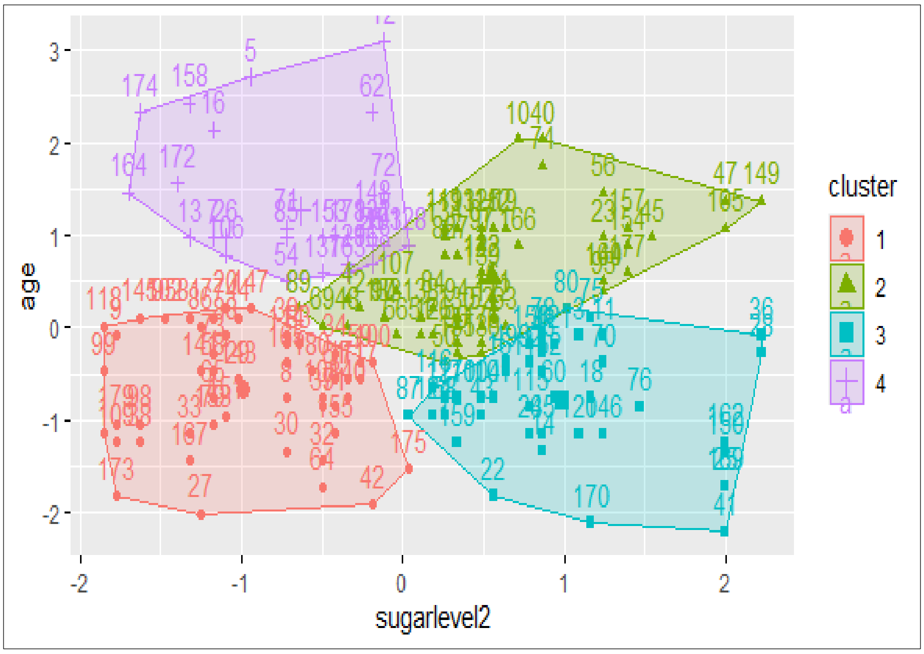

Fig 2: Cluster Plot

The cluster plot identifies four distinct groups categorized by age and sugar levels. Cluster 1 (red) consists of younger individuals who have lower sugar levels (54 cases), whereas Cluster 2 (green) is made up of older individuals with moderate to high sugar levels (34 cases). Cluster 3 (blue) features younger individuals displaying higher sugar levels (37 cases), and Cluster 4 (purple) comprises older individuals with lower sugar levels (55 cases). This segmentation uncovers clear patterns, indicating that the combination of age and sugar levels can effectively distinguish different population groups, which could be beneficial for targeted health interventions or risk assessments.

The distance matrix shows a distance value corresponding to the colour intensity of each cell. Lower distance (beginning at 0) are represented by green on the colour scale, moderate distance (up to30) are represented by white and higher distance (up to 60 or more) are represented by blue. An instant visual evaluation of patterns or groupings within the data is made possible by this gradient. Overall, this matrix offers a helpful visual synopsis for locating trends, connections, or clusters in a complicated dataset.

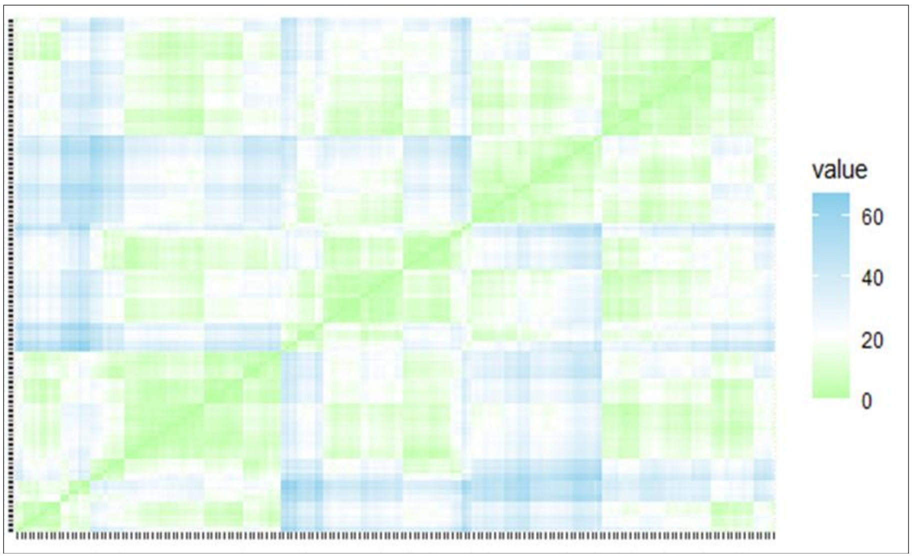

Fig 3: Distance Matrix

Conclusion

The study of diabetes prevalence in Tiruppur City reveals that lifestyle choices, particularly diet and physical activity, along with genetic factors, play a significant role in the development and management of diabetes. Most participants were middle-aged or older, and a majority had a family history of the disease. While awareness levels and medication adherence are high, related health issues like blood pressure problems remain common.

Regression analysis showed BMI as a strong predictor of blood sugar levels, and cluster analysis identified clear patterns based on age and sugar levels, useful for targeted health strategies. These findings emphasize the need for sustained public health efforts focused on lifestyle changes, early detection, and personalized interventions to effectively reduce the burden of diabetes in the community.

By promoting regular exercise, balanced nutrition, and regular health check-ups, the community can significantly reduce the risk and impact of diabetes, ultimately improving the quality of life for affected individuals.

Suggestions

Maintaining a healthy weight, exercising regularly, and eating a diet rich in fruits and vegetables. Prioritize eating a well-balanced diet of whole grains, lean meats, fruits, and veggies. Limit your intake of processed foods, sugary beverages, and foods high in fat. Select foods that are higher in fiber and lower in calories and fat. On most days of the week, try to get in at least 30 minutes of moderate activity. Exercise decreases blood sugar, increases insulin sensitivity, and aids with weight control. Check your blood sugar at least once every month. To stay hydrated, sip on lots of water throughout the day. Engage in stress-reduction practices like yoga, meditation, etc. Blood sugar levels can be impacted by stress, so controlling stress is crucial for diabetes care.

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