Determinants of Fasting Blood Sugar Levels Among U.S. Adults Aged 18 to 80 Years:

Analysis of Sociodemographic, Behavioural, and Health Factors

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Applied Regression

Contents

Introduction

Fasting blood sugar refers to the level of glucose in the blood after an individual has fasted (not eaten or drunk anything except water) for at least 8 hours. Given that normal levels are usually 70-100 mg/dL, it is an essential diagnostic tool for determining diabetes or prediabetes. Increased FBS levels could be a sign of impaired glucose metabolism, necessitating more medical evaluation (Martin et al., 2024).

The American Heart Association's *Heart Disease & Stroke Statistics 2024 Update* highlights the epidemiology of diabetes in the United States based on 2017-2020 data, revealing that 9.7 million adults have undiagnosed diabetes, 29.3 million adults have been diagnosed diabetes, and 115.9 million adults have prediabetes. These figures highlight the significant impact that diabetes and prediabetes have on public health, underscoring the urgent need for better screening, prompt diagnosis, and efficient preventative measures to deal with this expanding health issue. (Martin et al., 2024).

Fasting blood sugar (FBS) levels are among the most significant indicators of adult glucose metabolism and diabetes risk. The challenge is to comprehend the various elements that influence FBS levels in American adults aged 18 to 80. These variables, which can be divided into four groups—socioeconomic, behavioural, health, and sociodemographic—all significantly affect blood glucose management (Kollannoor-Samuel et al., 2011).

The research question guiding the analysis of fasting blood sugar (FBS) levels among U.S. adults aged 18 to 80 years is: What are the key sociodemographic, behavioral, and health factors that determine fasting blood sugar levels in U.S. adults aged 18 to 80 years? This research question aims to investigate the various determinants that influence FBS levels in the adult U.S. population. The hypothesis underlying this research question is that multiple factors, including age, education, income, sedentary lifestyle, body mass index, total cholesterol, and smoking significantly impact fasting blood sugar levels in adults

The study of fasting blood sugar (FBS) levels in American individuals between the ages of 18 and 80 has significant societal implications since it clarifies the complex interrelationships between socioeconomic status, health, and structural inequities. Diabetes and impaired glucose metabolism disproportionately affect marginalized communities, with cascading effects that extend beyond individual health to impact broader societal outcomes such as increased risk of chronic disease complications, lower worker productivity, and higher healthcare costs. The sociodemographic, behavioural, and health factors that affect FBS levels can be carefully examined by researchers to develop targeted interventions that address the root causes of metabolic dysfunction. This may alleviate the financial burden of controlling diabetes, enhance population health outcomes, and decrease health inequities. Policymakers and medical professionals can use this information to tailor educational programs and interventions to the specific needs of different populations, including those who are at risk of developing diabetes or struggle to control their blood sugar levels. (Gobena & Kassie, 2022).

Data Selection

The National Health and Nutrition Examination Survey (NHANES) is a program of studies designed to assess the health and nutritional status of adults and children in the United States. The survey is unique in that it combines interviews and physical examinations. NHANES is a major program of the National Center for Health Statistics (NCHS). NCHS is part of the Centers for Disease Control and Prevention (CDC) and has the responsibility for producing vital and health statistics for the Nation.

The National Health and Nutrition Examination Survey (NHAES) 2021–2023 is the source of our data set, which we chose due to its comprehensiveness and capacity to address our study questions: Which major behavioural, socioeconomic, and demographic factors affect fasting blood sugar levels in American people between the ages of 18 and 80?

The variety of demographic, socioeconomic, behavioural, and clinical data that NHANES offers on American adults enables us to select the factors that best fit our research. The data set is pertinent to the research issue because it includes measurements of fasting blood sugar as well as other critical characteristics that help us determine the factors impacting fasting blood sugar levels, such as age, income, race, education, sedentary lifestyle, and total cholesterol.

NHANES used a stratified multistage probability sampling design to collect the survey The sample for the survey is selected to represent the U.S. population of all ages. To produce reliable statistics, ensuring that the findings are generalizable to the U.S. adult population.

In 1999, the survey became a continuous program that changed its focus to a variety of health and nutrition measurements to meet emerging needs. Availability of Recent Data The 2021-2023 dataset provides up-to-date information, allowing the study to reflect current trends and factors influencing FBS levels in the U.S. population.

The research question emphasizes on understanding how demographic (e.g. age, gender, race), socioeconomic (e.g., income, education level) behavioural (e.g. smoking, sedentary lifestyle, sleep hour) and clinical (total cholesterol, HDL) factors interact to influence fasting blood sugar levels. The data set we chose captures all these variables which enables us to analyze its impact on blood sugar regulation.

Researchers may effectively identify and analyse the primary behavioural, socioeconomic, and demographic factors influencing fasting blood sugar levels in Americans aged 18 to 80 with the aid of this dataset.

Methodology

Our analysis focuses on the following variables

Dependant Variable

Fasting blood sugar level: the level of glucose in the blood after an individual has fasted. It ranged from 70 to 150 in our data set.

Independent Variables

Demographic variables include

Gender- gender of a participant, classified as male and female.

Age at screening: Age in years at the time of the screening interview for survey participants between the ages of 18 and 80 years of age.

Education level: the highest grade or level of education completed by adults 18 years and older. Categorized as Less than 9th grade, 9-11th grade(12 with no graduation), High school graduate/GED or equivalent, Some college or AA degree, College graduate or above.

Race: race of the participant. Classified as Mexican American, Other Hispanic, Non Hispanic White, Non Hispanic Black, Non Hispanic Asian and other races. The classification is based on dietary feeding style and lifestyle, which are highly related to their fasting blood sugar levels.

Socio economic Variables

Income: based on the the federal poverty guideline we classified the income of the household as low, middle and high income. To classify income levels using the income-to-poverty ratio, consider a household as "low income" if their income-to-poverty ratio is below 1, "middle income" if it falls between 1 and 2, and "high income" if it is 3 or above; essentially, dividing the household's total income by the federal poverty level for their family size to determine their ratio (*Federal Poverty Level (FPL) - Glossary*, n.d.).

Type of work done work experience of the participant at the time of survey. It is classified as working at a job or having a business, With a job or business but currently not at work, Looking for work, Not working at a job or business.

Behavioural Variables

Sleep hours: the hours spent sleeping in a day. We classified it into three categories normal sleeping hours 7 to 9 hours, less than 7 hours, and greater than 9 hours (CDC, 2024).

Sedentary lifestyle: This variable is about sitting at school, at home, getting to and from places, or with friends including time spent sitting at a desk, traveling in a car or bus, reading, playing cards, watching television, or using a computer. Do not include time spent sleeping. We classified it into four categories “low” less than 4 hours, “moderate” 4-6 hours, “high” 7-18 hours, and “extreme” when it is greater than 18 hours (Barlow, 2016).

Smoking Status: this variable describes whether the participant smoked at the time of the survey. It is classified as smoking every day, sometimes, and not at all.

Clinical Variables

BMI- Body mass index of the participant which is weight over height square. It ranged from 11.1 to 74.8.

Total cholesterol- It is the amount of cholesterol in your blood which mainly consist of low-density lipoprotein (LDL) and triglyceride refers as “bad cholesterol” which ranged from 63 to 405 in our data set.

High-Density Lipoprotein: Known as "good cholesterol," HDL helps remove cholesterol from the bloodstream, it ranges from 23 to 159 in our dataset.

After cleaning the dataset by recoding and renaming the variables, we did the summary statistics for both continuous and categorical variables then we proceeded to **Bi variant analysis.**

Pairwise Correlation- to determine the correlation coefficient between two continuous variables in the dataset. In our dataset, we used to test each continuous variable (BMI, Total Cholesterol, HDL) with the dependent variable (fasting blood sugar level).

ANOVA- to determine if there is a significant difference between the means of three or more groups. In our dataset, we used Race which has six categories and fasting blood sugar to perform the ANOVA.

Ttest- used to determine whether there is a significant difference between the means of two groups. In our dataset, we used the variable gender to test it with fasting blood sugar level.

We performed a **linear regression model** to determine the relationship between the dependent variable which is a continuous variable with the dependant variables. The model assumes this relationship can be expressed as a straight line.

To evaluate how well our model explains the variation in the data and if it met the assumptions we run the **post estimation tests** like Multicollinearity test (VIF), Information criteria test, and Wald test. On the final model we checked for heteroskedasticity and Normality of residuals.

Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Fasting Blood Sugar (mg/dL)	3079	102.127	13.053	70	150
Body Mass Index (kg/m2)	3040	29.365	7.271	11.1	74.8
Age	3079	52.452	18.148	18	80
Direct High Density Lipoprotein (mg/dl)	2954	55.381	14.627	23	159
Total Cholesterol (mg/dL)	2954	187.024	42.146	63	405

The fasting blood sugar has 3079 observations. The values range from 70 mg/dl to 150 mg/dl, with a mean of 102.12 mg/dl and a standard deviation of 13.05. The Body mass index ranges between 11.1 to 74.8 kilogram per meter square with a mean of 29.37 and a standard deviation of 7.27. Age ranges between 18 and 80 years with an average of 52 and a standard deviation of 18. The Direct High Density lipoprotein ranges between 23 and 159 with a mean of 55.38 and a standard deviation of 14.63. Total cholesterol ranges between 63 and 405 with a mean of 187.02 mg/dl with a standard deviation of 42.14.

Race	Freq.	Percent	Cum.
Mexican American	226	7.34	7.34
Other Hispanic	309	10.04	17.38
Non-Hispanic White	1,840	59.76	77.14
Non-Hispanic Black	342	11.11	88.24
Non-Hispanic Asian	173	5.62	93.86
Other	189	6.14	100.00
Total	3,079	100.00	

Most of the population is Non-Hispanic White, comprising 59.76 percent of the total. The next largest group is Non-Hispanic Black, accounting for 11.11 percent. Hispanic individuals make up 10 percent of the population, followed by Mexican Americans at 7.34 percent. Non-Hispanic Asians comprise 5.62 percent of the population, while the remaining 6.14 percent belong to other ethnic groups. In the data set 45 percent are male and 55 percent are female.

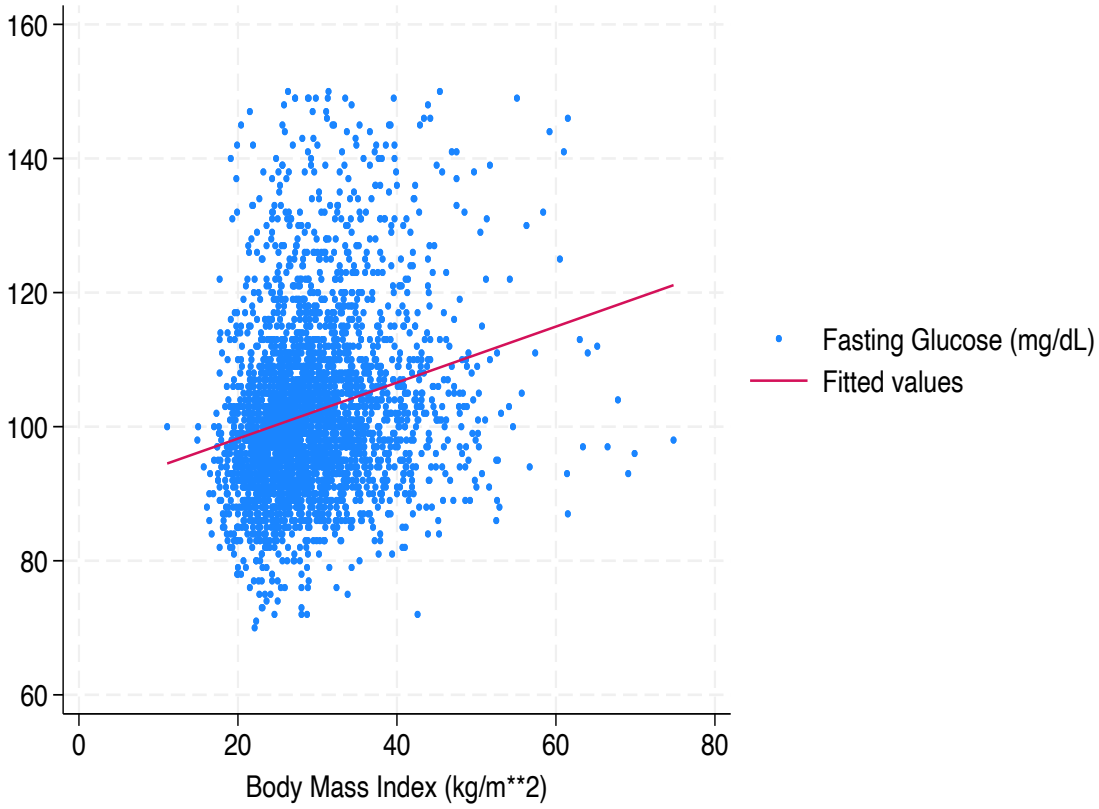
Smoking Status	Freq.	Percent	Cum.
Everyday	283	24.59	24.59
Someday	79	6.86	31.45
Not at all	789	68.55	100.00
Total	1,151	100.00	

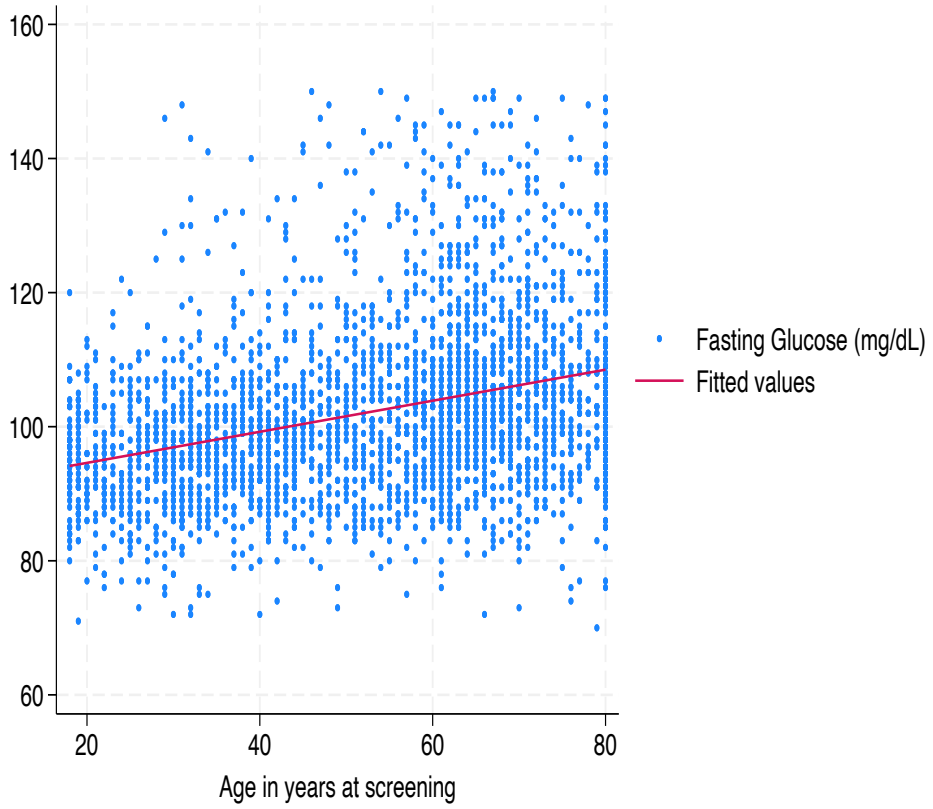
In the survey, 24.59% smoke daily, 6.86% smoke occasionally, and the rest don't smoke. Around 53.72% work, 3.38% are unemployed, 3.61% are job seekers, and 39% are unemployed. Only 4.59% have a 9th-grade education or less, 6.55% are between 9th and 11th grades, including those who didn't graduate, 20.2% have a 12th-grade degree or GED, 29.97% have college-level education or an AA degree, and 38.68% are college graduates. 68.82% get enough sleep, 20% have short sleep, and 10.69 have long sleep. High-income are 56.45%, middle-income are 30.92%, and low-income are 12.63%. 38.58% have low sedentary hours, 24.49 have moderate sedentary hours, 36.64 have high sedentary hours, and only 0.29 have extreme sedentary hours.

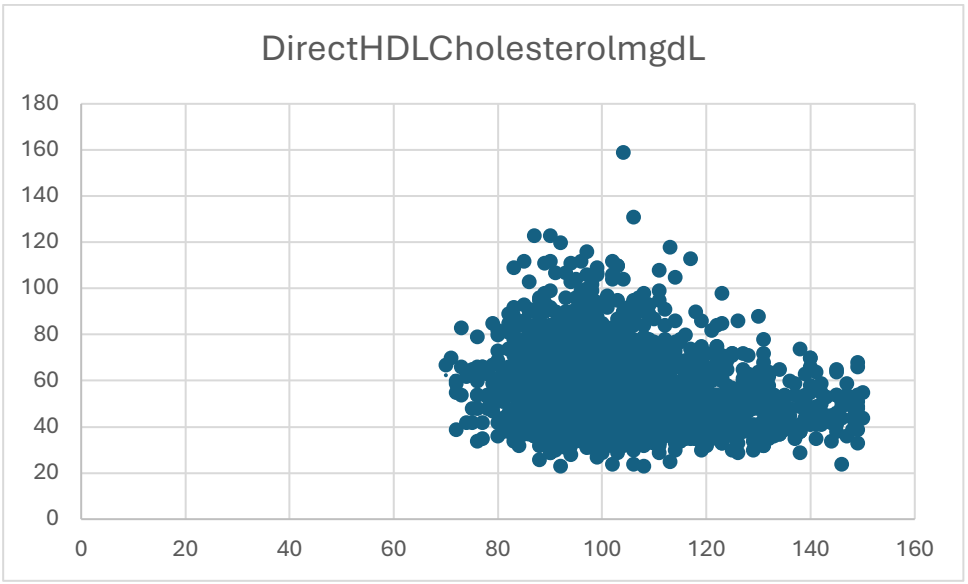
V. Data Analysis

Bivariate Analysis

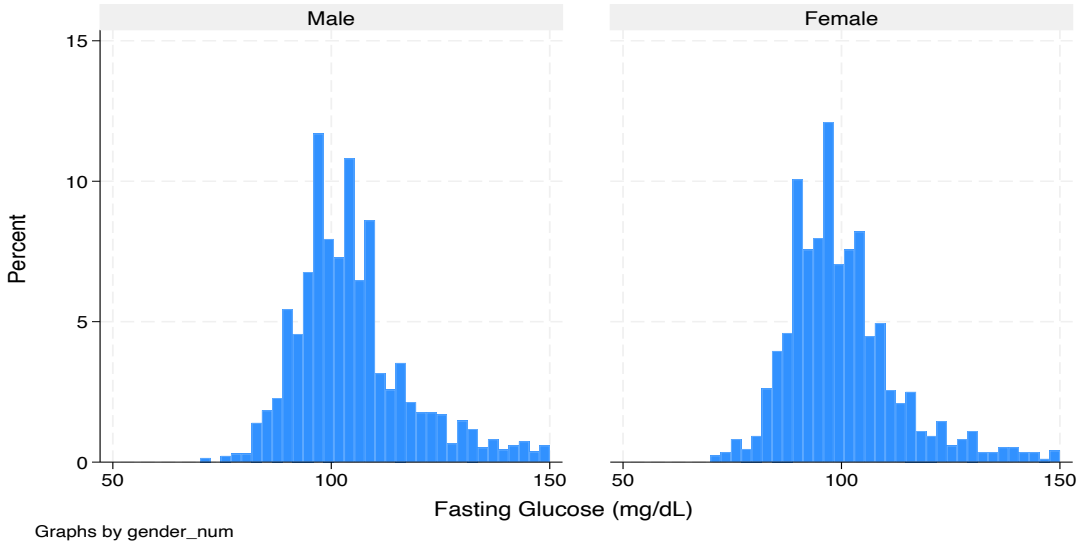
Significant positive correlations were observed between fasting glucose and age (r = 0.3221) and BMI (r = 0.2333), suggesting that older individuals and those with higher BMIs tend to have higher fasting glucose levels. Fasting blood sugar also has a significant negative correlation(r=-0.1940), which means as the direct high-density lipoprotein increases the fasting blood sugar level decreases.







Notably, gender showed a significant difference, with males having higher fasting glucose levels.



The Anova test for Education yielded a significant P value of 0.03, indicating that there is a significant difference in fasting blood sugar levels at least between a group. Education also showed a significant P value of 0.00, suggesting that there is at least a significant difference between one group. The Anova for sleep hours was significant, but the Bonferroni test revealed no significant relationship between any groups. The type of work done also had a significant P value in the Anova test. Notably, the retired individuals (who are not employed) exhibited a significant correlation with the other groups, compared to whom they had higher fasting blood sugar levels. This made us question if it is the age rather than the type of work that caused the association in type of work done .However, there were no significant differences in fasting glucose levels based on smoking, sedentary hours, or income category.

Regression Analysis

The final Robus model of our regression analysis is written below

Linear regression	**Number of obs = 1,088**
	F(15, 1072) = 21.96
	Prob > F = 0.0000
	R-squared=0.2113
	Root MSE = 12.227

Fasting Blood Glucose	**Coefficient** **std. err.**	**t**	**P>t**	**[95% conf.**	**interval]**
Gender **Female**	-4.230533 .7972255	-5.31	0.000	-5.794833	-2.666234
Age	.2655482 .0228837	11.60	0.000	.2206463	.3104502
Race **Other Hispanic**	-6.874296 2.469188	-2.78	0.005	-11.71929	-2.029306

Non-Hispanic White	-6.643314 2.101903	-3.16	0.002	-10.76762	-2.519004
Non-Hispanic Black	-5.594959 2.41023	-2.32	0.020	-10.32426	-.8656553
Non-Hispanic Asian	-2.153497 3.331664	-0.65	0.518	-8.690819	4.383825
Other	-6.164661 2.468009	-2.50	0.013	-11.00734	-1.321985
Education **9-11th grade (**Includes 12th grade without graduation)	-5.069402 2.64112	-1.92	0.055	-10.25175	.1129488
High school graduate/GED or equivalent	-1.732165 2.420042	-0.72	0.474	-6.480722	3.016393
Some college or AA degree	-.8725294 2.407134	-0.36	0.717	-5.595758	3.850699
College graduate or above	-2.392909 2.442795	-0.98	0.328	-7.186111	2.400293
BodyMassIndexkgm2	.4900979 .0635975	7.71	0.000	.3653082	.6148876
Direct HDL (mg/d)	-.1237598 .0255388	-4.85	0.000	-.1738715	-.0736481
smoking status **Someday**	-.5861984 1.709382	-0.34	0.732	-3.940312	2.767915
Not at all	-1.157588 .9380376	-1.23	0.217	-2.998186	.6830102
_cons	91.59193 3.976327	23.03	0.000	83.78966	99.3942

Results and Discussion

Linking back to our research question which is factors determining fasting blood sugar we have reached our final regression model. After running our unrestricted regression model we started dropping variables starting from the highest p value where we first dropped sleep hours with the p value of 0.9, then we dropped income with p value of 0.8 for high income and 0.6 for middle income, the next highest value is sedentary with p value of 0.7 for extreme sedentary and 0.6 for high sedentary, then the highest p value is smoking which we ended up putting it up because we found it important which will be discussed later on this paper, finally we dropped type of work which have p value of 0.14 for people who are looking for a job but for people who have a job have a significant value with p value of 0.03 then we test it for Wald test which is not significant we ended up dropping it. One of the primary reasons for dropping the type of work done is that the relationship may imply that the significant relationship between fasting blood sugar increase and retirement may be due to age rather than the work type. Since the Wald test was non-significant even when other variables like sleep and sedentary life were considered, it does not provide any significant value. Evidence suggests that the type of work an individual performs may have a limited direct correlation with fasting blood sugar (FBS) levels, while retirement age and the aging processes exert a more pronounced impact.(Takata et al., 2002),(Kirkman et al., 2012)

Gender with a coefficient of -4.23, on average being female is associated with 4.23 units (mg/dl) lower fasting blood sugar level compared to male. Age with the coefficient of 0.26, on average for every one-year increase in age there is an increase of 0.27 in blood sugar level.

Using Mexican Americans as a reference on average other Hispanics have 6.87 lower blood glucose levels, the Non-Hispanic white has 6.64 lower blood glucose levels, the Non-Hispanic black has 5.59 lower blood glucose levels, the Non-Hispanic Asian has 2.15 lower blood glucose level and the other race has 6.16 lower blood glucose levels.

On education one of the categories which is 9-11 graders has a significant p value but not the other categories then after testing it using the Wald test, we found it to be significant in which we decided to incorporate it in the final model of our regression. Using below 9 grades as a reference, as the education level increases the fasting blood sugar decreases.

High-density lipoprotein has a coefficient of -0.12, which shows for every one-unit increase in HDL blood glucose level will decrease by 0.12 units which is expected because it's known as a “good cholesterol”. The BMI can be explained as for every one-unit increase in BMI the blood glucose level increase by 0.49 units.

Smoking has a non-significant p-value in our regression model, but we decided to incorporate it in our final model because it has a significant effect on blood sugar levels as stated in different literature. The effect of cigarette smoking on glycemia was investigated in 26 diabetic patients and 24 normal controls, all smokers. Blood glucose levels were measured before smoking and 15, 30, and 60 minutes after smoking two cigarettes. After smoking, glycemia increased in both

groups, but it was more pronounced in the diabetic group (Bornemisza & Suciu, 1980). This can be compared to our dataset that non-smokers have lower blood glucose levels than smokers.

Different studies show the relationship between smoking and glucose metabolism. Smoking causes inflammation and oxidative stress in tissues causing insulin insensitivity which in turn causes hyperglycemia. Nicotine is believed to play a central role in the metabolic disturbance (Górna et al., 2020).

Following confirmation that there was no multicollinearity among the independent variables (all VIF values were less than 10), we moved on to model estimation. The results of subsequent diagnostic analyses showed heteroskedasticity, which denotes non-constant variance in the error terms. We addressed this by performing robust test, which ensured that our statistical conclusions were reliable.

Sedentary has a non-significant relationship within our model. Which is an unexpected finding. The reason for this finding could be Sedentary behavior is more complex than total hours alone, as breaks during sedentary periods may significantly impact biological and metabolic outcomes. The majority of study emphasizes negative consequences following 1-2 hours of inactivity, but it frequently ignores the significance of interruptions. Because our data was based on self-reported measures, it was unable to identify these breaks, which limited its capacity to capture their possible impact. This implies that the pattern of sedentary behaviour—including breaks—may have greater biological significance than the overall amount of time spent inactive. A study by Dunstan et al. (2012) found that breaking up prolonged sitting with short bouts of light activity significantly improved postprandial glucose and insulin responses compared to uninterrupted sitting. Limitations of Self-Reported Data.

Multiple studies have showed significant difference exists in fasting blood sugar between men and female. Some even suggest oestrogen has a protective effect in metabolic disease and cardiovascular illness in women. In a study of young adults' men had significantly higher fasting blood sugar level than women (Mauvais-Jarvis, 2018),(Ciarambino et al., 2023).

The differences in fasting blood sugar in different races are complex and multifactorial involving genetic, environmental, physiological, cultural and nutritional factors. In one study we found Non-Hispanic Black and Mexican individuals have the highest diabetes prevalence, while non-Hispanic Whites have the lowest. Non-Hispanic Asians exhibit higher diabetes prevalence at lower BMI levels, while the "Others" category reflects disparities influenced by social, economic, and genetic factors. In our regression since we compared them with Mexican Americans, we found significant difference with other races (Spanakis & Golden, 2013),(Zhu et al., 2019).

Various research has shown a clear relationship between fasting blood sugar and BMI. A study that analysed a large cohort study has found that individuals with higher BMI have a higher fasting blood sugar level(Guo et al., 2022). Lower HDL is associated with higher fasting blood sugar levels. In one study analysing the general adult population triglyceride and HDL cholesterol were significantly correlated to the fasting blood sugar level (Yang et al., 2024).

Having a better education is associated with a better knowledge of health promoting behaviour including nutrition, physical activity and self-care practice. Research has shown that people with better education are high likely to involve in privative measures (Shirvani et al., 2021).

Exemplar

Let us consider a random person and use this model to predict the Fasting blood sugar

Example person

Gender= Female

Age= 43

Race= Non-Hispanic White

Education= some collage or AA degree

BMI=37

Direct HDL= 37

Smoking not at all

Applying the Model:
Fasting Blood Glucose= 91.59 -4.23(Female)+0.26(Age)-6.64(Non-Hispanic White)-0.12(Direct HDL)-1.15(Nonsmoker)
Variable Coding

Gender: Female = 1, Male = 0
Race: Needs to be specified based on the categories from the sources (Mexican American, Other Hispanic, Non-Hispanic White, Non-Hispanic Black, Non-Hispanic Asian, Other).
Education: Less than 9th grade = 0, 9-11th grade = 1, High school graduate/GED or equivalent = 1, Some college or AA degree = 1, College graduate or above = 1
Smoking Status: Everyday = 0, Someday = 1, Not at all = 1

We used 0 to show the absence of a characteristics and 1 for the presence of the characteristics.

Fasting Blood Glucose = 91.59 - 4.23(1) + 0.26(43) - 6.64(1) - 0.87(1) + 0.49(37) - 0.12(37) - 1.15(0)
Fasting Blood Glucose ≈ 100.78 mg/dL

In the data set the real Fasting Blood sugar of this individual is 99mg/dl.

Another example

Gender= Male

Age= 60

Race= Non-Hispanic White

Education= High School graduate

BMI=32.2 Kg/m2

Direct HDL= 53

Smoking Everyday

FBS = 91.59 - 4.23(0) + 0.26(60) - 6.64(1) - 1.73(1) + 0.49(32.2) - 0.12(53) - 1.15(1)
= 105.67 mg/dL (approximately)
The real Fasting blood sugar in the data set is 106 mg/dl

Conclusion

This analysis of the dataset from national health and nutrition examination survey (NHANES) of 2021to 2023 has well explained the key demographic, socio economic, behavioural and clinical factors affecting fasting blood sugar level of adults aged 18 to 80. The results show how intricately these variables interact to shape blood glucose regulation and emphasize the necessity of focused interventions to reduce inequities in diabetes risk and care.

The regression model developed in this study revealed several significant associations between independent variables and FBS levels. Higher FBS levels were shown to be strongly predicted with age and BMI. This is consistent with earlier studies and highlights the need of using lifestyle modifications to address these modifiable risk factors, especially as the American population ages and struggles with rising obesity rates.

Our dataset analysis shows a significant relation between gender and FBS, females having a lower level compared to male. Given the distinct physiological and hormonal disparities between men and women, this study supports the need for gender-specific approaches to diabetes prevention and care. The difference of race, the non-Hispanic white, Non-Hispanic Blacks, non-Hispanic Asians, and other races have lower fasting blood sugar compared to Mexican Americans. These discrepancies could be due to disparities in food habits, social variables that affect health behaviours, genetic predisposition, and access to healthcare. While education level shows significance in some of its categories but not the other performing Wald test makes education significant, indicating other factors like income, health literacy, and resource access may play a role.

Smoking and a sedentary lifestyle show a non-significant association in this data set, in contrast to research that associates them with poor metabolic health. Data limitations including self-reported smoking and unmeasured patterns of sedentary activity may be the cause of this.

This research has significant public health and clinical implications. By understanding the factors effective interventions could be developed to decrease its public health hazard. Clinically, better-targeted screening could be implemented by identifying people with the highest risk factors. Public policymakers could design a better program that addresses health disparities, promotes a healthy lifestyle, and supports individuals to make informed decisions.

Appendix

VARIABLES	Unrestricted model	model_1	model_2	model_3	model_4	model_5	model_6	Model C-robust
2.Gender (Female)	-4.339*** (0.802)	-4.338*** (0.801)	-4.287*** (0.798)	-4.298*** (0.798)	-3.560*** (0.474)	-4.357*** (0.796)	-4.231*** (0.793)	-4.231*** (0.797)
Age	0.226*** (0.0293)	0.226*** (0.0292)	0.226*** (0.0286)	0.229*** (0.0285)	0.241*** (0.0154)	0.231*** (0.0285)	0.266*** (0.0250)	0.266*** (0.0229)
2.Other Hispanic	-6.678*** (2.107)	-6.682*** (2.104)	-6.775*** (2.100)	-6.937*** (2.098)	-3.161*** (1.089)	-6.955*** (2.098)	-6.874*** (2.098)	-6.874*** (2.469)
3.Non-Hispanic White	-6.614*** (1.835)	-6.616*** (1.833)	-6.742*** (1.821)	-6.869*** (1.812)	-3.098*** (0.929)	-6.857*** (1.812)	-6.643*** (1.807)	-6.643*** (2.102)
4.Non-Hispanic Black	-5.711*** (2.108)	-5.721*** (2.099)	-5.822*** (2.093)	-5.895*** (2.081)	-3.575*** (1.099)	-5.781*** (2.078)	-5.595*** (2.078)	-5.595** (2.410)
5.Non-Hispanic Asian	-1.840 (2.812)	-1.850 (2.805)	-1.915 (2.803)	-1.970 (2.797)	0.919 (1.284)	-2.101 (2.795)	-2.153 (2.795)	-2.153 (3.332)
6.Others	-6.283*** (2.193)	-6.293*** (2.185)	-6.308*** (2.183)	-6.425*** (2.178)	-3.222** (1.268)	-6.407*** (2.178)	-6.165*** (2.173)	-6.165** (2.468)
2.9-11th (with no graduation)	-5.407** (2.167)	-5.407** (2.165)	-5.431** (2.161)	-5.294** (2.158)	-2.637* (1.362)	-5.227** (2.157)	-5.069** (2.159)	-5.069* (2.641)
3.High school graduates	-1.791 (1.957)	-1.788 (1.953)	-1.819 (1.944)	-1.640 (1.939)	-1.946* (1.162)	-1.648 (1.939)	-1.732 (1.939)	-1.732 (2.420)
4.Some collage/AA degree	-0.682 (1.938)	-0.681 (1.932)	-0.709 (1.916)	-0.628 (1.908)	-1.172 (1.144)	-0.643 (1.908)	-0.873 (1.909)	-0.873 (2.407)

5. Collage graduate or above	-2.051 (2.013)	-2.048 (2.008)	-2.215 (1.973)	-2.126 (1.960)	-2.562** (1.137)	-2.149 (1.960)	-2.393 (1.961)	-2.393 (2.443)
Body Mass Index (kg/m2)	0.496*** (0.0602)	0.496*** (0.0599)	0.496*** (0.0599)	0.494*** (0.0593)	0.365*** (0.0329)	0.493*** (0.0593)	0.490*** (0.0594)	0.490*** (0.0636)
Direct HDL(mg/dL)	-0.114*** (0.0276)	-0.114*** (0.0276)	-0.114*** (0.0276)	-0.113*** (0.0275)	-0.125*** (0.0175)	-0.121*** (0.0264)	-0.124*** (0.0264)	-0.124*** (0.0255)
2.Smoking someday	-0.374 (1.622)	-0.375 (1.621)	-0.376 (1.619)	-0.475 (1.615)		-0.401 (1.613)	-0.586 (1.614)	-0.586 (1.709)
3.Smoking not at all	-1.217 (0.952)	-1.217 (0.951)	-1.266 (0.944)	-1.216 (0.944)		-1.104 (0.938)	-1.158 (0.936)	-1.158 (0.938)
Total Cholesterol (mg/dL)	-0.00928 (0.00883)	-0.00929 (0.00882)	-0.00952 (0.00881)	-0.00945 (0.00880)	-0.00718 (0.00555)			
1.Shortsleep-hours	-0.0574 (0.921)							
3.Long sleep hours	0.00154 (1.220)							
1.Working at a job	-2.006** (0.927)	-2.007** (0.920)	-2.044** (0.888)	-2.128** (0.886)	-1.057* (0.543)	-2.168** (0.886)		
2.Employed but not working	-0.490 (2.569)	-0.489 (2.558)	-0.497 (2.545)	-0.511 (2.545)	-1.029 (1.255)	-0.656 (2.541)		
3.Looking for work	-3.102	-3.103	-3.140	-3.247	-2.009	-3.318		
2.Middle-income	0.562 (1.196)	0.558 (1.193)						
3.High income	-0.206 (1.239)	-0.208 (1.237)						
2.Moderate sedentary	1.257 (0.980)	1.258 (0.978)	1.208 (0.976)					

3.High sedentary	-0.407 (0.897)	-0.406 (0.895)	-0.453 (0.892)					
4. Extreme sedentary	2.148 (5.579)	2.132 (5.567)	2.145 (5.562)					
Constant	95.66*** (3.900)	95.65*** (3.895)	96.03*** (3.864)	96.00*** (3.863)	94.20*** (2.136)	94.58*** (3.630)	91.59*** (3.445)	91.59*** (3.976)
Observations	1,088	1,088	1,088	1,088	2,813	1,088	1,088	1,088
R-squared	0.220	0.220	0.220	0.217	0.215	0.216	0.211	0.211
AIC	8561.221	8557.225	8554.077	8551.247	21810.29	8550.422	8551.476	8551.476
BIC	8696.00	8682.02	8668.89	8651.01	21917.10	8645.3	8631.4	8631.4

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Summary statistics for categorical variables

Variables	Freq.	Percent	Cum.
Gender			
Male	1,360	44.17	44.17
Female	1,719	55.83	100.00
Total	3,079	100.00	
Race			
Mexican American	226	7.34	7.34
Other Hispanic	309	10.04	17.38
Non-Hispanic White	1,840	59.76	77.14
Non-Hispanic Black	342	11.11	88.24
Non-Hispanic Asian	173	5.62	93.86
Other	189	6.14	100.00
Total	3,079	100.00	
Education			
Less than 9th grade	136	4.59	4.59
9-11th grade (Includes 12th grade with	194	6.55	11.15
High school graduate/GED or equivalent	598	20.20	31.35

Some college or AA degree	887	29.97	61.32
College graduate or above	1,145	38.68	100.00
Total	2,960	100.00	
Type of Work Done			
Working at a job	1,654	53.72	53.72
Employed But not working at the survey	104	3.38	57.10
Looking for work	111	3.61	60.70
Not Working at Job (Retired)	1,210	39.30	100.00
Total	3,079	100.00	
Smoking Status			
Everyday	283	24.59	24.59
Someday	79	6.86	31.45
Not at all	789	68.55	100.00
Total	1,151	100.00	
Sedentary hours in a day			
Low Sedentary	1,188	38.58	38.58
Moderate Sedentary	754	24.49	63.07
High Sedentary	1,128	36.64	99.71
Extreme	9	0.29	100.00
Total	3,079	100.00	
Income			
Low Income	389	12.63	12.63
Middle Income	952	30.92	43.55
High Income	1,738	56.45	100.00
Total	3,079	100.00	
Sleeping hours in a day			
Short Sleep	631	20.49	20.49
Adequate Sleep	2,119	68.82	89.31
Long Sleep	329	10.69	100.00
Total	3,079	100.00	

Summary statistics for continuous variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Fasting Blood Sugar (mg/dL)	3079	102.127	13.053	70	150
Body Mass Index (kg/m2)	3040	29.365	7.271	11.1	74.8
Age	3079	52.452	18.148	18	80
Direct High Density Lipoprotein (mg/dl)	2954	55.381	14.627	23	159
Total Cholesterol (mg/dL)	2954	187.024	42.146	63	405

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