Exploring the Prevalence of Gout Amongst Underrepresented Type 2 Diabetes

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INTRODUCTION

Underserved and underrepresented communities in the United States often experience a lack of access to quality healthcare and affordable, nutritious food, both of which contribute to a higher prevalence and incidence of type 2 diabetes (T2D) and gout. Risk factors for these conditions are particularly prominent in racial minorities and low-income communities.[1] To investigate the frequency of these conditions, student researchers traveled to three low-income senior housing communities in Philadelphia and Harrisburg, PA and Clinton, MD. Individuals who reside in these communities come from a diverse set of racial and ethnic backgrounds and are generally active and independent.

Diabetes is a chronic disease that affects the ability of tissues to uptake glucose from the bloodstream.[2] It can arise due to a genetic abnormality in the functioning of β cells in the pancreas that produce insulin, known as type 1 diabetes, or due to the denaturation of the insulin receptor, known as type 2 diabetes. The development of T2D is frequently associated with obesity, poor diet, and a genetic predisposition.[2] Screening modalities for T2D include measurement of blood glucose, which varies based on food consumption, and Hemoglobin A1c (HbA1c), which represents an individual's glucose intake over the past three months.[2] An HbA1c <5.7% is within normal limits, and >6.5% warrants medical intervention.[3]

Gout is a chronic, inflammatory arthritis that primarily presents in the big toe and joints of the lower limb.[4] It results from chronic hyperuricemia, which causes an accumulation of uric acid crystals in the joints and surrounding synovial fluid.[4] Proteins, including red meats and seafood, are high in purines, which when metabolized by the body, produce uric acid. Alcohol, especially beer, and beverages with a high concentration of sugar, also increase uric acid levels in the blood.[4] Hyperuricemia is defined as >6 mg/dL in females and >7 mg/dL in males.[4]

METHOD

This is a multisite cross-sectional study conducted in partnership with Beacon Communities LLC, at three different low-income senior residential communities spanning across the mid-Atlantic United States region. Inclusion criteria include any participant of any gender and ethnicity between the ages of 35 and 92 who resides in the communities. Exclusion criteria include a personal history of cancer, organ transplantation, or current pregnancy. A total of 88 participants were surveyed on their dietary habits, relevant medical, social, and family histories, and current medications following the obtention of their informed consent.

Student researchers collected participants' random non-fasting blood glucose, uric acid, and HbA1c by fingerstick using commercially available meter devices. In addition, anthropometric measurements were recorded. Educational materials were distributed to participants and their results were discussed. At-risk individuals were advised of ways to reduce their risk of diabetes and gout.

RESULTS & DISCUSSION

The collected data underwent analysis using multiple logistic regression models, with a 95% confidence interval. Variance was calculated through Analysis of Variance (ANOVA). The statistical analyses used include chi square, cross-tabulation, and comparing longitudinal data. Self-report was used to determine the current use of anti-diabetic medication and diagnosis of gout and/or T2D.

Our tests confirmed diabetes in 34 participants and indicated diabetes in 12 individuals with no previous T2D diagnosis. Additionally, 28.4% of participants had an HbA1c >6.5%, and 15.9% had a blood glucose level >200 mg/dL, meeting the criteria for diabetes. Our tests confirmed gout in 5 individuals and indicated gout in 22 participants with no previous gout diagnosis. 30.6% of participants had elevated uric acid levels, which is a strong indicator of gout.
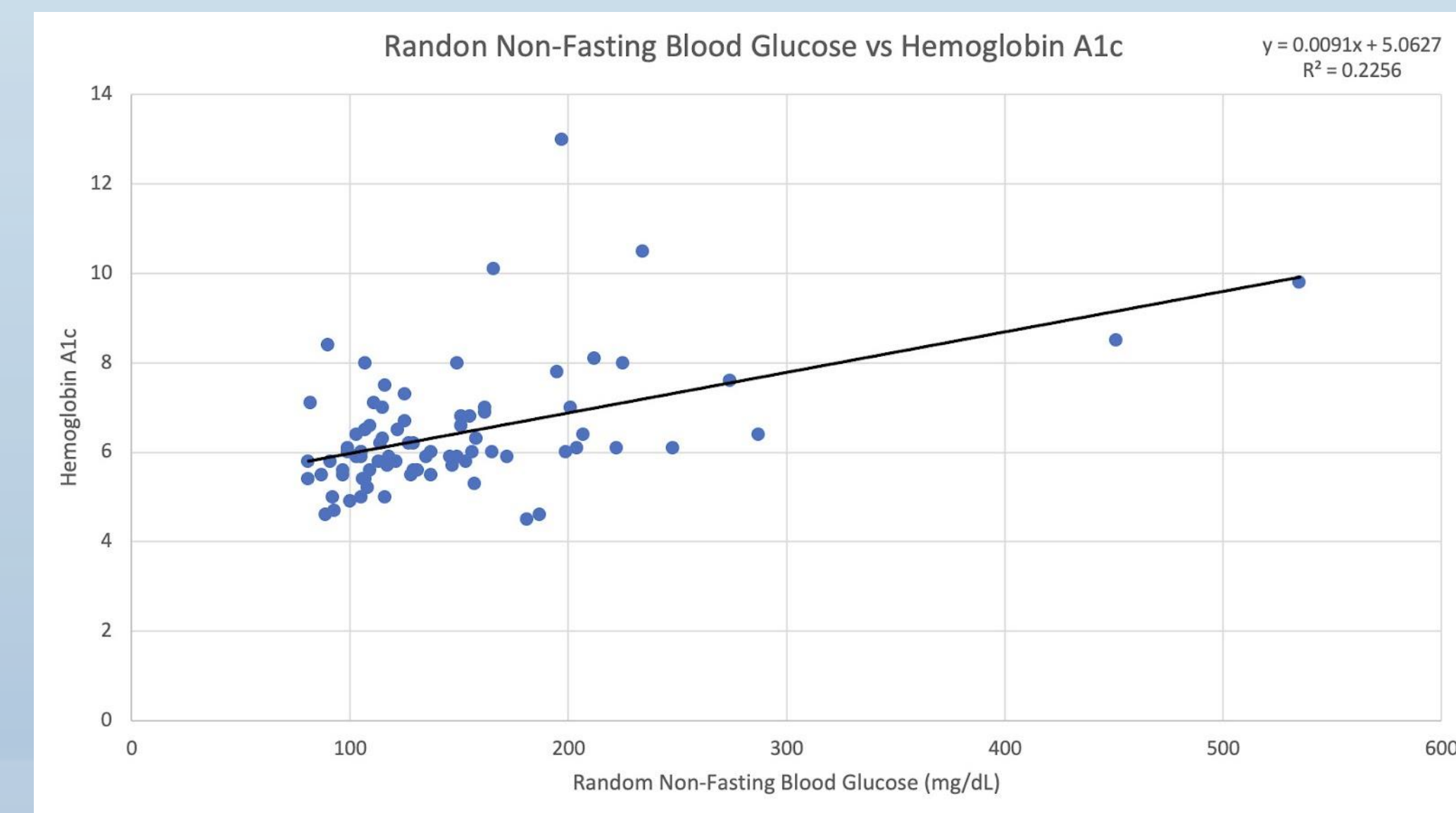

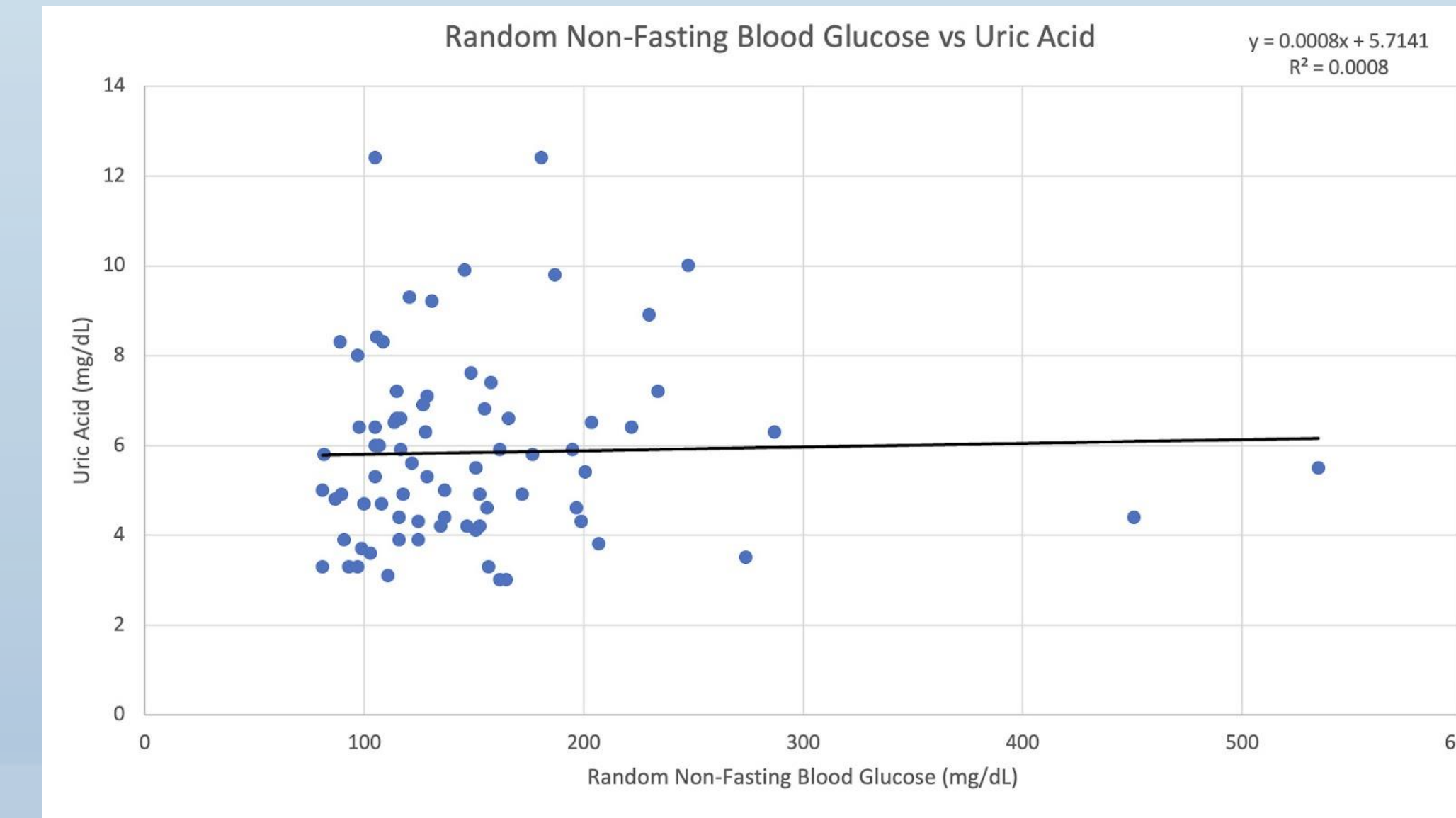Figure 1. Random Non-Fasting Blood Glucose vs Hemoglobin A1c

Figure 2. Random Non-Fasting Blood Glucose vs. Uric Acid

Measure	Average Value ± SD
Blood Glucose (mg/dL)	149.5 ± 71.7
Hemoglobin A1c (%)	6.2 ± 1.5
Serum Urate (mg/dL)	5.5 ± 2.2

Table 1. Average Blood Test Values

Hyperuricemia predicted a participant having a diabetic HbA1c level. HbA1c >6.5% accounted for 40% of the variability in uric acid levels (p<0.001). 27 participants (31%) had uric acid levels indicative of hyperuricemia, which is more than four times (4X) the national average, as 6-8% of adults experience asymptomatic hyperuricemia, and only 3.9% of adults experience symptomatic gout flare-ups.[5] Additionally, HbA1c was positively correlated with random non-fasting blood glucose. Study participants who smoked cigarettes were more likely to have hyperuricemia compared to nonsmokers.

The main objective of this study was to investigate the relationship between diet and hyperuricemia. In this underserved population, a main proponent of poor diet came from a lack of education on the classification of food types such as protein, fat, and carbohydrates. Many individuals were unaware that the consumption of red meat, alcoholic beverages, and fatty foods could accelerate gout development due to high purine content and lactic acid accumulation. For this reason, community-based educational efforts on lifestyle modifications are critical to decrease the incidence of gout and its related comorbidities. Recent literature reviews attest that interactive and patient-centered educational efforts enhance patient understanding and medication adherence.[6]

CONCLUSION

Of the population studied, 31% of participants had a serum urate level indicative of hyperuricemia, which is more than four times higher than the national average. Our results suggest smoking is a risk factor for hyperuricemia, and that increased uric acid levels increase the risk for developing T2D. Contrary to current research, we did not find a correlation between the frequency of red meat consumption and uric acid levels. This is a limitation of the small sample size. 52% of participants were obese, which may reflect their lack of access to affordable, healthy food choices. Preventative educational efforts surrounding diet and lifestyle are necessary to combat the established prevalence of gout and T2D in low-income senior populations.

REFERENCES

1 – McCormick et al., 2022
2 – American Diabetes Association, 2013
3 – Damjanov et al., 2014
4 – Borghi et al., 2020
5 – Liu et al., 2022
6 – Fields et al., 2018

ACKNOWLEDGEMENTS