Insulin as a Predictor of 5-Year Type 2 Diabetes Risk: CARDIA Cohort Analysis

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Introduction

- 2020 CDC data on US individuals revealed:
  34.2 million with Type 2 Diabetes (T2D).
  88 million with prediabetes.[1]
- Current diagnostic criteria for T2D using fasting glucose, HbA1c, or oral glucose tolerance test have shown limitations in their predictive ability.[2-4]
- Hyperinsulinemia precedes glycemic changes and may be useful as a predictor of T2D.[5-8]

Objective

- **To assess the risk of progression to T2D over 5 years using the markers of fasting insulin and fasting glucose.**
- **To compare the risk of progression to T2D of glucose groups using insulin quartiles.**

Methods

- Data for years 25 and 30 from the Coronary Artery Risk Development in Young Adults (CARDIA) cohort database were used with an algorithm that sorted non-diabetic participants into glucose groups:
  - Normal glucose <100 mg/dL
  - Glucose 100-110 mg/dL
  - Glucose 111-125 mg/dL
- Glucose groups were further stratified into insulin quartiles:

Table 1: Fasting insulin values assigned to insulin quartiles.

Insulin Quartile Values (mIU/L)			
Q1	<5.4	Q3	8.7-14.2
Q2	5.4-8.6	Q4	>14.2

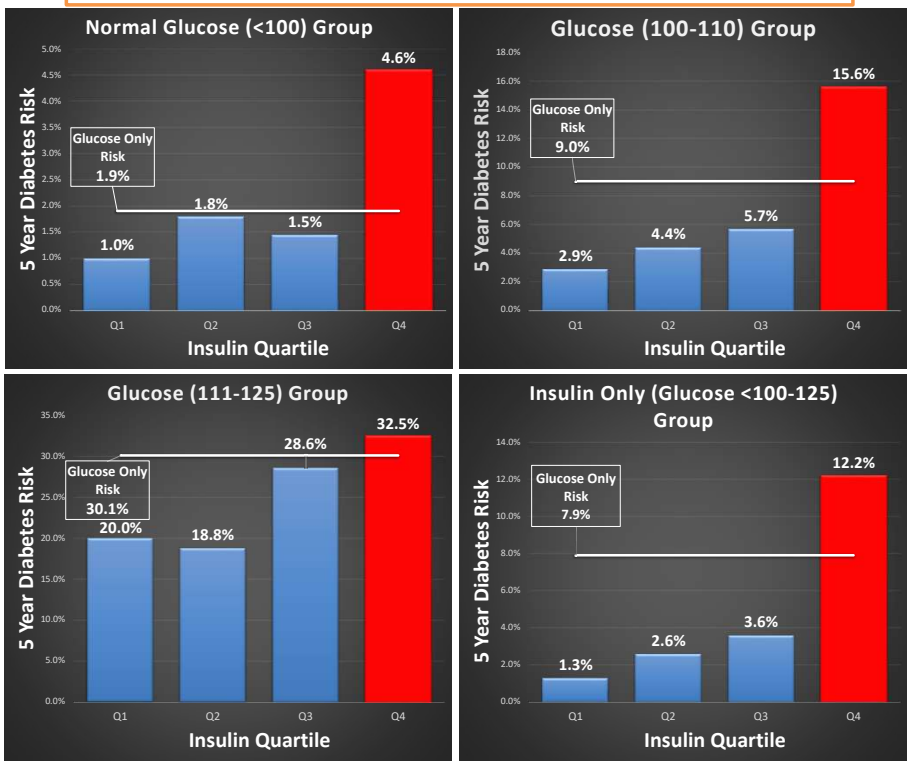
- Using SPSS, data were extracted at each stage consistent with the project algorithm. Percentage of each group that progressed to T2D at year 30 was obtained as a crude measure of risk.

Table 2: Demographics of participants who met inclusion criteria.

Original Cohort	Inclusion Criteria No T2D or BG<126	Gender	Ethnicity
n=5114	n=3023	1706 (56.4%) Female	1677 (55.5%) White, non-Hispanic
		1317 (43.6%) Male	1340 (44.3%) Black, non-Hispanic
			6 (0.2%) Hispanic

Results

5-Year Risk Of Type 2 Diabetes By Glucose Group And Insulin Quartile



Figures 1 – 4: % T2D after 5 years separated by glucose groups and stratified by insulin quartiles.

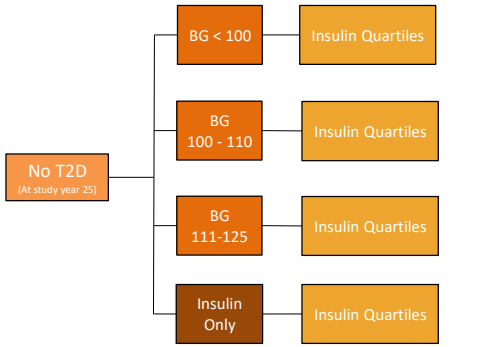


Figure 5: Algorithm separating CARDIA cohort into year 25 glucose groups & insulin quartiles. Outcomes in Figures 1-4.

Table 3: Unadjusted relative risk comparing insulin Q4 to Q1 of each glucose group.

Groups	Relative Risk Ratio Q4:Q1
Normal Glucose <100	4.6
Glucose 100-110	5.4
Glucose 111-125	1.6
Insulin Only	9.4

Table 4: P-values showing overall significance of each glucose group.

Groups	Significance (P-value)
Normal Glucose <100	P <0.01
Glucose 100-110	P <0.05
Glucose 111-125	P >0.05
Insulin Only	P <0.05

Discussion

- Participants with fasting insulin levels in Q4 (>14.2 mIU/mL) had greater 5-year T2D outcomes in Glucose <100, Glucose 100-110, and the insulin only groups **(see Table 4)**.
- In all groups, Q4 insulin level showed higher risk of 5-year T2D development compared to the risk predicted by glucose alone.
- No statistically significant 5-year T2D risk was found in the Glucose 111-125 group **(see Table 4)**. This is perhaps due to the extent of dysglycemia already within the group.
- In the Glucose <100 and Glucose 100-110 groups, participants in Q4 insulin quartile were respectively at a 4.6 & 5.4x greater risk of developing T2D compared to those in Q1 insulin quartile **(see Table 3)**.
- This study is limited by lack of ethnic diversity (predominantly Blacks and Whites) and limited sample sizes at the subgroup level. A larger, more diverse group would help generalize this information to the US population.

Conclusion

- Fasting insulin shows potential as a clinically relevant predictor of 5-year risk of progression to T2D in normoglycemic and prediabetic patients.
- This study adds evidence to the growing field of metabolic-focused assessment of T2D. Using both glucose and fasting insulin, a 5-year risk of progressing to T2D can be better assessed.
- Future studies should broaden their scope to include a larger, more diverse group when assessing the predictive value of fasting insulin and glucose on progression to T2D.

References