

Long-term blood glucose control and its relationship with cognitive function in older adults with type 1 diabetes: Preliminary Analysis



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1. Background:

• High blood glucose over the long-term is related to the onset of microvascular complications for individuals with type 1 diabetes including retinopathy (retina), neuropathy (peripheral nerves), and nephropathy (kidney).

• These complications have been linked to decline in specific areas of cognitive function.¹

• Because of this relationship chronically high blood glucose may affect cognitive function before physical complications manifest.^{2,3}

2. Aim

To investigate the relationship between long-term blood glucose and other diabetes health indicators, with cognitive function in an older adult population with type 1 diabetes. This is the preliminary analysis for the initial participants in the cognitive study.



3. Participants

- n = 40
- age 45 + (mean = 57)
- type 1 diabetes 10 years+

4. Materials & Procedure

Participants completed emotional questionnaires and cognitive measures including:

- NART/Ravens SPM standardized residual difference (Estimate of Lifetime Cognitive Change)⁴
- AMIPB Story Recall - Episodic Memory
- Digit Span - Short-term Memory
- Symbol Digit Modalities - Processing Speed
- Trail Making Test (TMT A- Processing Speed, TMT B- Executive Function)

Medical information collected through record on clinical management system (SCI-DC)

- Long-term blood glucose level was estimated using the mean of available values for glycated haemoglobin (HbA1c).

1. Brands, et al. (2004). Cerebral dysfunction in type 1 diabetes: Effects of insulin, vascular risk factors and blood-glucose levels. *European Journal of Pharmacology*, 490, 159-168.

2. Jacobson, et al. (2007). Long-term effect of diabetes and its treatment on cognitive function. *The New England Journal of Medicine*, 356, 1842-1852.

3. Wessels, et al. (2008). Hyperglycaemia as a determinant of cognitive function in patients with type 1 diabetes. *European Journal of Pharmacology*, 585, 88-96.

4. Deary, Whalley, & Crawford. (2004). An 'instantaneous' estimate of a lifetime's cognitive change. *Intelligence*, 32, 113-119.

Harriet's Lay Summary

• Could a history of high blood sugar have a negative effect on thinking and reasoning as it does on the physical health of those with type 1 diabetes?

• Older adults who have had type 1 diabetes for a long time were asked to complete puzzle-like tasks.

• Results show an emerging pattern of greater decline in reasoning skills and slower thinking speed for those with a history of high blood sugar.

• In contrast, high blood sugar was a significant advantage for performance on a simple number memory task.

• Brain imaging will be used in a follow-up study to examine differences in brain structure and function for those with a history of extreme high vs. low blood sugar.

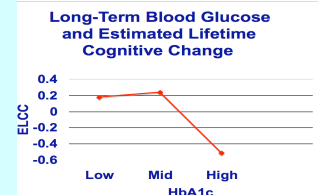


5. Statistical Analysis

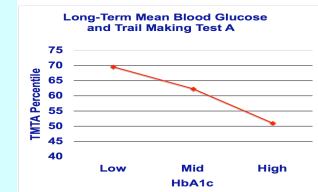
Univariate analysis using ANOVA. Participants were split into 3 similar size groups according to long-term mean blood sugar.
* high (HbA1c > 9%) * mid (HbA1c 8.2-8.9%) * low (HbA1c ≤ 8.1%).
• In this sample, the high HbA1c group was significantly older than the low HbA1c group. The results reported take age into account.

6. Results

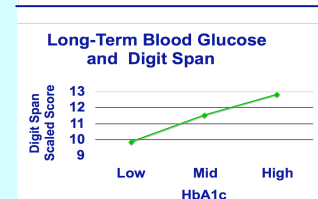
a. The high HbA1c group showed a trend towards greater negative lifetime cognitive change (ELCC) than the low HbA1c group $t(1,38) = -.70, p = .086$



b. Scores on measure of processing speed (TMT A) showed a trend towards lower scores for the high vs. low HbA1c groups $t(1,38) = -18.54, p = .071$



c. In contrast scores on a measure of short term memory (digit span) were higher for the high vs. low HbA1c groups $t(1,38) = 2.858, p = .02$



7. Discussion and Future Plans:

Results indicate a non-significant trend towards lower scores for those with history of high blood glucose in cognitive change and thinking speed. A benefit of high blood glucose was found in short term memory which was unexpected. There was no clear trend in for episodic memory or executive function. Because the groups are close in HbA1c value in comparison to other studies², more participants are needed to allow for greater differentiation between groups and multivariate statistics to compare the relative impact of diabetes complications and well-being on cognitive function. Structural and functional MRI will be used to follow-up participants who are at the extremes of long-term blood glucose.