

# Blood glucose levels as an indicator for the early detection of infections in type-1 diabetics

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## OBJECTIVE

The aim of the study is to assess the correlation between blood glucose levels and infection and to propose the development of a model for the early detection of infections in diabetics.

## BACKGROUND

It is well known that diabetic patients are particularly sensitive to infections however no robust diagnostic test for the early detection of infection has been developed to date. Glucose levels would be an ideal indicator, since diabetics measure their blood glucose (BG) on a daily basis along with insulin intake. At the same time some computerized systems have been developed that collect BG values using sensors and transmit them to a central data repository, such as the Electronic Healthcare Record [1]. Acute infection often results in hyperglycemia, due to release of regulatory hormones and pro-inflammatory cytokines as evidenced by studies on hospitalized patients [2, 3]. Nevertheless the underlying mechanisms of infection-related stress hyperglycemia are not fully understood [4].

## METHODS

We considered evaluating the fluctuation of levels of glucose related blood proteins and molecules, such as glycosylated hemoglobin (HBA<sub>1c</sub>) and fructose amine (FRA) with respect to infections. The Diabetes Control and Complications Trial (DCCT) archives were used as the data source: DCCT was a full-scale multi-center clinical trial which recruited 1441 type-1 diabetic patients and was conducted by the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) from 1983 to 1993. During this trial detailed data on a variety of parameters, including infections and HBA<sub>1c</sub> levels, were collected for each patient. Based on the assumption that a patient was considered ill if he/she reported disease duration of more than five days, we selected patients older than 18 years of age that were similarly treated. We assessed average HBA<sub>1c</sub> values for specific time intervals: infection, 6-month period before and after

infection documentation. Males (n=150, age = 29.0 ± 5.6 years) and females (n=130, age = 28.0 ± 5.9 years) were studied separately. All statistical analyses were performed with SPSS software (version 14.0 for Windows, SPSS Inc., Chicago, IL). Sample distribution was considered normal and the null hypothesis that HBA<sub>1c</sub> values during infection are higher was tested with paired t-test for both sexes. All *p* values were based on two-sided testing, and differences were considered significant at *p*<0.05.

## RESULTS

HBA<sub>1c</sub> male and female values during infection are significantly higher compared to the corresponding values of the 6-month periods before (males: mean=0,267±0,721, 95% CI [0,151, 0,384], *p*<0.001, females: mean=0,288±0,719, 95% CI [0,163, 0,412], *p*<0.001) and after infection (males: mean=0,225±0,681, 95% CI [0,115, 0,335], *p*<0.001, females: mean=0,273±0,851, 95% CI [0,126, 0,421], *p*<0.001).

## CONCLUSIONS

Blood glucose levels and infection occurrence seem to be highly correlated. However, the exact mechanism and timing require further investigation. A more accurate study design and the development of a precise mathematical model for patient processing would lead to early detection of infections in a highly sensitive and difficult-to-manage population.

## REFERENCES

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