Associations between vitamin D status and measures of glycaemia in participants with normoglycaemia, impaired fasting glucose and type 2 diabetes

[1] F Curtis*, [2] S Rice, [1] R Thatcher, [1] G Davison

[1] Department of Sport and Exercise Science, Aberystwyth University, Aberystwyth, UK; [2] Diabetes Centre, Prince Phillip Hospital, Llanelli, UK

Introduction

There is emerging evidence linking vitamin D deficiency to impaired β-cell function, insulin resistance, and glucose intolerance, all of which are central to the pathogenesis of type 2 diabetes[1].

Aims:

- To identify if baseline vitamin D status is associated with future glycaemic control.
- To assess whether vitamin D status differs between two groups when classified by glucose control (above or below 6.1 mmol/l: cut off point for impaired fasting glucose[2]).

Methods:

Following ethical approval 104 participants (female 53; male 51) were recruited from the local community (Mid-Wales). Participants with varying levels of glucose control attended the laboratory in a fasted state on three occasions, each separated by 6 months. During each visit blood was drawn from an antecubital vein and stored for later analyses.

Vitamin D status was determined (25 hydroxyvitamin D_3) by HPLC-MS/MS. Remaining samples were analysed for fasting plasma glucose (FPG), fasting plasma insulin (FPI), and HbA1c at the Diabetes Research Network Wales Laboratory.

Results:

Significant negative correlations were observed between 25(OH)D_3 at 0 months and HbA1c at 12 months ($r = -0.241$, $n = 75$, $p = 0.04$) and FPI at 12 months ($r = -.225$, $n = 81$, $p = 0.04$), but not FPG at 12 months ($r = -.105$, $n = 80$, $p = 0.35$).

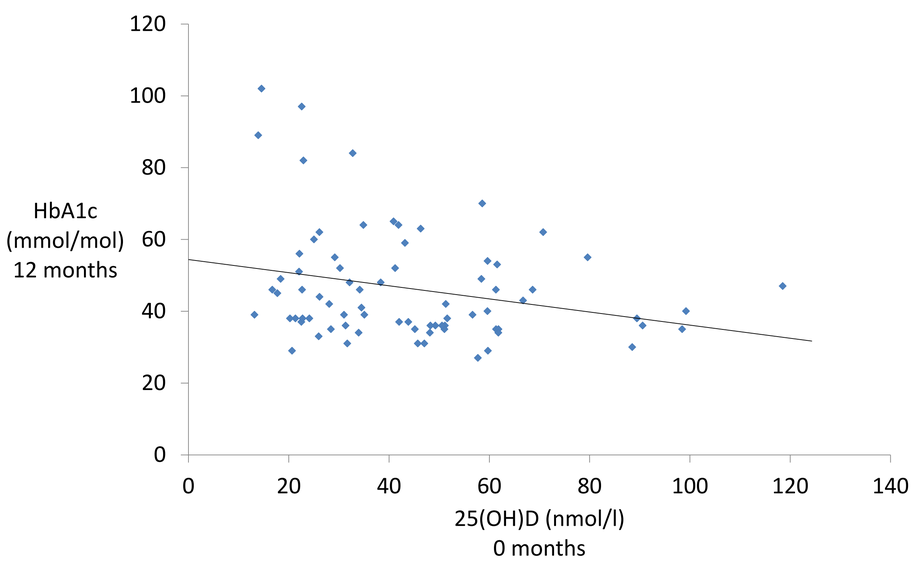

Figure 1: The relationship between 25(OH)D at 0 months (winter) and HbA1c at 12 months (winter).

When participants were separated based on FPG (group one ≤ 6 mmol/l (n = 49) vs group 2 ≥ 6.1 mmol/l (n = 14)) a 2-way mixed ANOVA revealed a significant main effect of group on 25(OH)D concentration ($F(1,59) = 4.860$, $p < 0.05$, partial n2 = 0.076) and a main effect of time point ($F(2,118) = 75.751$, $p < 0.05$, partial n2 = 0.562). There was no statistically significant group × time interaction ($F(2,118) = 0.680$, $p = 0.51$, partial n2 = 0.011)

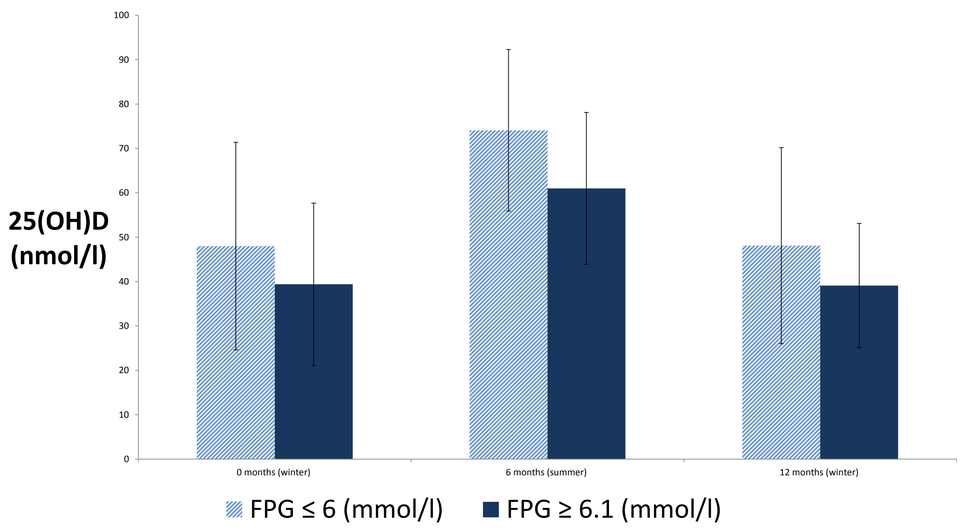

Figure 2: 25(OH)D concentration at the different time points in normal and high FPG groups (FPG ≤ 6 mmol/l vs ≥ 6.1 mmol/l).

Conclusions:

Vitamin D status only accounted for a small proportion of the variance (~5%) in the measures of glycaemia at 12 months, however, the development of type 2 diabetes is multifactorial and any easily modifiable risk factors are noteworthy. A seasonal variation in vitamin D status was observed for both FPG groups, and participants in the low FPG group had higher vitamin D concentrations than those in the high FPG group across the seasons.

These findings may provide additional evidence of a protective effect of vitamin D in relation to glycaemic control and the development of type 2 diabetes, although, further studies are required to determine cause and effect.

References

1.Song, Y. & Manson, J. E. (2010) Vitamin D, Insulin Resistance, and Type 2 Diabetes. Current Cardiovascular Risk Reports, 4, 40–47.
2.World Health Organisation (WHO) (2006). Definition and Diagnosis of Diabetes Mellitus and Intermediate Hyperglycaemia: Report of a WHO/IDF Consultation.

Contact

Dr Ffion Curtis, email: fcurtis@lincoln.ac.uk tel: 01522 835732

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