Insulin and plasma magnesium in normal and obese subjects

Dear Sir,

We read with interest the article by Paolisso et al. [1] describing the plasma magnesium lowering effect from infusing insulin and glucose and from ingesting oral glucose. We have studied the effect of a hyperinsulinaemic euglycaemic clamp on plasma magnesium in 11 obese (5 male; body mass index 31.2 ± 2.7 kg/m², mean $\pm$ SD; age 42.3 ± 13.1 years) and 10 normal weight subjects, well matched for age and sex (5 male; body mass index 22.3 ± 2.1 kg/m², mean $\pm$ SD; age 43.2 ± 16.7 years). Our clamp was based on the minimal model of Bergman [2], with insulin infused at a rate of 40 mU/m² surface area per minute, achieving a plateau of plasma insulin of 69.7 ± 8.4 mU/l in normal and 77.9 ± 21.1 mU/l in obese subjects ($p = \text{NS}$). The 20% dextrose used to achieve euglycaemia contained 40 mmol/l potassium chloride. After 2 h the metabolic clearance rate of glucose was higher in the normal weight compared to the obese subjects (9.86 ± 3.27 vs 3.24 ± 1.34 ml·kg⁻¹·min⁻¹, $p < 0.0001$). Blood samples were taken at 0, 1 and 2 h of the clamp for measurement of plasma magnesium, which was done in duplicate with a colorimetric method using calmagite (Sigma Diagnostics). The inter-batch coefficient of variation was 2.1%. This method correlates well with atomic absorption spectrophotometry on a Perkin-Elmer apparatus ($r = 0.91$).

In 10 normal weight subjects, plasma magnesium remained unchanged at 0, 1 and 2 h (0.82 ± 0.08 , 0.83 ± 0.09 and 0.81 ± 0.10 mmol/l, mean $\pm$ SD). Similarly, in the 11 obese subjects there was no change in plasma magnesium during the clamp (0 h, 0.82 ± 0.05 ; 1 h, 0.83 ± 0.05 and 2 h, 0.83 ± 0.06 mmol/l). The plasma concentration of insulin achieved with our lower rate of infusion of the hormone could have accounted for our failure to demonstrate a change in plasma magnesium compared to Paolisso et al. [1], who achieved plateau plasma insulins of about 120 mU/l. We note, too, the in vitro effect of 100 mU/l insulin.

However, this may not be the complete explanation, as during the oral glucose tolerance test they reported a fall in plasma magnesium, with a peak plasma insulin of 60 mU/l. We wonder, therefore, if the effect of insulin on lowering plasma magnesium is a relatively weak one, only evident at high concentrations of plasma insulin, and whether the oral ingestion of glucose leads to secretion of other gut hormones which may potentiate the plasma magnesium lowering effect of insulin.

Yours sincerely,

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References

1. Paolisso G, Sgambato S, Passariello N, Giugliano D, Scheen A, 'Onofrio FD & Lefèbvre PJ (1986) Insulin induces opposite changes in plasma and erythrocyte magnesium concentrations in normal man. *Diabetologia* 29: 644–647
2. Pacini G, Finegood DT & Bergman RN (1982) A minimal-model-based glucose clamp yielding insulin sensitivity independent of glycaemia. *Diabetes* 31: 432–441.

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Erratum

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T. P. Almdal, K. F. Petersen, B. A. Hansen, H. Vilstrup: Increased capacity of urea synthesis in streptozotocin diabetes in rats

p. 814: Please note that the legends to Figures 2 and 3 have been inadvertently interchanged.