

Management of type 1 diabetes

Good diabetes control is important for academic achievement in children with type 1 diabetes



Daniel Flanagan,
Consultant
Physician,
Derriford Hospital,
Plymouth

It is clear that blood glucose levels above the non-diabetic range are bad. High blood glucose is linked to an increased risk of developing diabetes complications, including nerve damage, and there is no reason to suppose that the brain is spared this damage. Thus a high blood sugar is bad for the brain.

This is a particular worry for children with type 1 diabetes – will high blood glucose affect school performance? If so, then the answer would simply be intensive glucose control for all school children. Unfortunately, we also know that tighter blood glucose control is linked to an increased frequency of hypoglycaemia, which can be extremely disruptive to school attendance. Is recurrent hypoglycaemia itself bad for brain function? Studies suggest that it probably is.

In an ideal world there would be no hyperglycaemia, hypoglycaemia or disruption of normal life, but the majority of people with diabetes are a long way from that position. For most families a decision has to be made about what frequency of hypoglycaemia is acceptable in trying to avoid high blood glucose levels. It is not clear which is most damaging to school performance: high blood sugar, low blood sugar or disruption of normal life.

McCarthy and associates have tried to identify predictors of achievement in children with diabetes. Poor metabolic control was associated with lower academic achievement, although this is not necessarily causal. A more difficult home situation, for example, may result in worse glycaemic control and academic performance. Longer duration of diabetes showed a trend towards worse academic performance but this was not significant. The results do suggest that severe hypoglycaemia may be linked to worse academic performance. Children with good diabetes control ($HbA_{1c} < 8\%$) but who had been hospitalised for hypoglycaemia performed significantly less well. However, this group was small.

What message can be taken from this paper? Good diabetes control is important and the life changes that need to be made do not impact on academic performance. However, it is important to avoid severe hypoglycaemia. Hypoglycaemia is damaging to the brain, but when severe it may be so disruptive to normal life that schooling suffers.

If hypoglycaemia damages the developing brain in children, is it not more dangerous for the fetus? We are willing to accept high rates of hypoglycaemia to achieve a low HbA_{1c} in diabetic pregnancy. It is clear that this reduces the complication rate during pregnancy, but is there a price to pay with academic achievement later in life for the baby?

DIABETES CARE



Factors affecting academic achievement in children with type 1 diabetes

Readability	✓✓
Applicability to practice	✓✓✓✓
WOW! factor	✓✓✓✓

- The impact of diabetes on cognitive skills and academic achievement has been unclear.
- This study aimed to examine academic achievement in children with diabetes and to identify predictors of achievement.
- A total of 44 children with type 1 diabetes aged 8–18 years were examined for school-administered standardised achievement tests (Iowa Tests of Basic Skills and Iowa Tests of Educational Development [ITBS/ITED]), grade point averages (GPAs), school absences, behavioural assessment, age at disease onset, hospitalisations and HbA_{1c} .

4 Reading scores and GPAs were lower for children with poor metabolic control than for those with average control.

5 Children with hospitalisations for hyperglycaemia had lower achievement scores than those with better metabolic control and fewer hospitalisations.

6 Children with tight metabolic control and hospitalisations for hypoglycaemia had low ITBS/ITED scores.

7 Socioeconomic status and parent ratings of behavioural problems were significantly correlated with academic achievement.

8 For most children, socioeconomic status and behavioural factors are more important than medical variables for academic achievement.

McCarthy AM, Lindgren S, Mengeling MA et al (2003) Factors associated with academic achievement in children with type 1 diabetes. *Diabetes Care* 26: 112–7

JOURNAL OF PEDIATRICS



Insulin pump therapy is effective in young children

Readability	✓✓✓
Applicability to practice	✓✓✓✓
WOW! factor	✓✓✓

1 Children younger than 5 with type 1 diabetes have more erratic glycaemic control than older children and are predisposed to severe hypoglycaemia.

2 It might be possible to achieve better glycaemic control with continuous insulin infusions administered by insulin pumps.

3 The effects of pump therapy were analysed in nine young children

who had developed type 1 diabetes between the ages of 10 and 40 months. They were treated with insulin pumps for 7–19 months.

4 At study onset, average HbA_{1c} levels were $9.5 \pm 0.4\%$; patients had a mean 0.52 episodes of severe hypoglycaemia per month.

5 After initiating pump therapy, HbA_{1c} levels decreased to $7.9 \pm 0.3\%$, and severe hypoglycaemic episodes reduced to 0.09 per month.

6 The frequency of parental contacts with health staff reduced by more than 80%.

7 Significant improvements in quality of life and high levels of satisfaction were found with pump therapy for preschool children.

Litton J, Rice A, Friedman N et al (2002) Insulin pump therapy in toddlers and preschool children with type 1 diabetes mellitus. *Journal of Pediatrics* 141: 490–5

‘Islet transplantation can be as good as pancreatic transplantation in restoring good metabolic control and reducing blood glucose variability.’

‘The incidence of type 1 diabetes in children is increasing in Denmark. The increased risk for those born after 1985 may indicate a change in environmental risk factors, e.g. birth weight and maternal age.’

DIABETIC MEDICINE



No increased risk from insulin lispro during pregnancy

Readability	✓✓✓✓
Applicability to practice	✓✓✓✓✓
WOW! factor	✓✓✓

- 1 Diabetes in pregnancy is a risk factor for increased incidence of serious adverse outcomes for the mother (retinopathy, nephropathy and pre-eclampsia) and baby (congenital abnormalities and perinatal mortality).
- 2 The use of lispro insulin in pregnancy has not previously been systematically investigated.
- 3 This study pooled data from seven centres in the UK with experience in the use of lispro insulin in the management of pregnancy in women with type 1 diabetes.
- 4 Out of 76 pregnancies, there were 71 liveborn babies (one twin) and six early miscarriages. Mean gestational age was 37.2 weeks and median birthweight was 3230 g. Seven babies weighed >4 kg. There were four congenital abnormalities.
- 5 There was a 72% increase in the mean insulin dose (0.75–1.29 units/kg/day). Maternal glycaemic control improved throughout pregnancy. None of the mothers developed retinopathy during pregnancy but six mothers with established retinopathy required laser therapy during pregnancy.
- 6 The outcomes found in this study using lispro insulin are comparable to the results of other studies into diabetic pregnancy – there is no evidence of an increased risk of teratogenesis in the baby or retinopathy in the mother.

Masson EA, Patmore JE, Brash PD et al (2003) Pregnancy outcome in type 1 diabetes mellitus treated with insulin lispro (Humalog). *Diabetic Medicine* **20**: 46–50

DIABETES CARE



Islet transplants prove as good as pancreas transplants

Readability	✓✓✓
Applicability to practice	✓✓
WOW! factor	✓✓✓✓

- 1 There are currently two main alternatives to intensive insulin therapy: intraperitoneal insulin infusion with implantable pumps (IPII), which improve metabolic control, and simultaneous pancreas–kidney transplantation (SPK), which leads to insulin independence. Pancreatic islet transplantation has so far had insufficient results in terms of insulin independence.
- 2 This study compared the glycaemic profiles of 26 patients with type 1 diabetes who were treated with an IPII or pancreas or islet transplantation using the continuous glucose monitoring system (CGMS).
- 3 Over 3 days patients were connected to a CGMS. Ten patients received an IPII, 9 received SPK and 7 received islet transplantation after kidney grafting (IAK).
- 4 Mean glucose concentration and glucose variability were lower in patients with SPK and IAK than in those with IPII, and were comparable in SPK and IAK patients.
- 5 No hypoglycaemic events were seen in the SPK patients or insulin-independent IAK patients. There were 4.12 ± 1.66 and 0.66 ± 0.57 hypoglycaemic events in the IPII patients and IAK patients with partial graft function, respectively. These events lasted longer in the IPII patients than in the IAK patients.
- 6 Islet transplantation can be as good as pancreatic transplantation in restoring good metabolic control and reducing blood glucose variability.

Kessler L, Passemard R, Oberholzer J et al (2002) Reduction of blood glucose variability in type 1 diabetic patients treated by pancreatic islet transplantation. *Diabetes Care* **25**: 2256–62

DIABETES CARE



Need for bedtime snack depends on blood glucose level

Readability	✓✓✓✓
Applicability to practice	✓✓✓✓
WOW! factor	✓✓✓✓

- 1 Nocturnal hypoglycaemia is a significant problem for people with type 1 diabetes. It is recommended that patients consume a bedtime snack to prevent it occurring.
- 2 This study investigated the effect of four different bedtime snack compositions on nocturnal glycaemic control, including frequency of hypoglycaemia and morning hyperglycaemia, in adults with type 1 diabetes using lispro insulin.
- 3 A randomised, crossover trial was used to assign four different bedtime snacks to 15 adults. Snacks were placebo or no snack, standard snack, cornstarch-containing snack and protein-rich snack. All were equivalent in kcal, fat and total available glucose. Intravenous blood glucose was sampled hourly through the night.
- 4 Glycaemic level at bedtime (<7, 7–10 or >10 mmol/l) mediated the effects seen.
- 5 Over 50 nights there were 14 hypoglycaemic (60% of patients) and 23 morning hyperglycaemic episodes. Most (71%) hypoglycaemic episodes occurred with no snack compared with any snack, and at glycaemic levels below 7 mmol/l. Standard and protein snacks caused no nocturnal hypoglycaemia. Glycaemic glucose >10 mmol/l was protective of hypoglycaemia even without a snack.

Kalergis M, Schiffrin A, Gougeon R et al (2003) Impact of bedtime snack composition on prevention of nocturnal hypoglycemia in adults with type 1 diabetes undergoing intensive insulin management using lispro insulin before meals. *Diabetes Care* **26**: 9–15