Genetic and environmental contribution of different glycaemic values in Dutch twin families


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Background and aims
In type 2 diabetes mellitus two pathogenic factors play a crucial role in the development of hyperglycaemia: impaired insulin secretion and insulin resistance. The aim of this twin-sib study is to determine the genetic and environmental contributions to the variance of β-cell function. In this report we present the first results regarding the heritability estimates of fasting and 2 hours blood glucose (OGTT, meal test) and of HbA1c levels.

Material and methods
75 healthy same sex twin pairs, all Caucasian and aged 20 to 45 years, with additional same sex siblings were selected from the Netherlands Twin Register.

Protocol
Three tests were done all after a 12-hour overnight fast. 1) OGTT at home with 75 grams glucose to exclude diabetes. 2) Meal test at the clinic, after a screening with physical examination and blood sampling for haematological and biochemical investigations. Before and after a standardized mixed meal frequent blood sampling was done for blood glucose (by Yellow Spring) and hormonal levels. 3) Clamp test at the clinic, combined euglycaemic/hyperglycaemic.

Analyses
ANOVA was used to obtain estimates of the within and between pair / families variances. ANOVAs for all traits were carried out for MZ twin pairs and for first degree relatives and were used to obtain intra-class correlations.

Results
Mean values were comparable between MZ twins and DZ twins (Table 1). Siblings were slightly older and had a higher BMI. In all groups, the fasting blood glucose before the OGTT was higher than the fasting blood glucose before the meal.

Table 2 shows the intra-class correlation for different traits in monozygotic twin pairs and 1st degree relatives. Estimates of genetic, common environment shared by family members and unique environmental contribution have been derived from these intra-class correlations (see figure 1).

Discussion and conclusion
The first results of our study in 75 twin families show that HbA1c has a strong genetic component, while fasting glucose measurements indicate more environmental influence. We found a substantial influence of broad sense heritability on the 2 hours meal blood glucose. Further results of the study (regarding hormonal levels) will reveal more information about the genetic and environmental contribution to inter-individual differences in β-cell function.