



Genetic and environmental contribution of different glycaemic values in Dutch twinfamilies

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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 glucoses (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.

Genetic relationship	MONOZYGOTE	DIZYGOTE	SIBS
Number	100	45	40
Sex (male/female)	43/57	18/27	21/19
Age	30.8 (4.2)	29.2 (4.7)	*34.7 (8.1)
Weight (kg)	72.38 (10.4)	71.3 (12.6)	*79.0 (13.6)
Height (m)	1.744 (0.084)	1.770 (0.090)	1.770 (0.084)
BMI (kg/m²)	23.81 (3.25)	22.65 (2.87)	*25.24 (3.84)
Waist Hip Ratio	0.84 (0.07)	0.82 (0.07)	*0.87 (0.07)
OGTT fasting bg (mmol/l)	4.68 (0.47)	4.50 (0.42)	4.60 (0.48)
OGTT 2hours bg (mmol/l)	5.59(1.20)	*5.03 (0.97)	5.30 (1.12)
Meal fasting bg (mmol/l)	4.40 (0.42)	4.30 (0.39)	4.42 (0.41)
Meal 2 hours bg (mmol/l)	5.45 (0.71)	*5.18 (0.53)	5.44 (0.52)
HbA1c (%)	5.27 (0.27)	5.21 (0.24)	5.25 (0.26)

Table 1 Characteristics

Data as means (SD); bg = blood glucose; BMI = body mass index; * = $p < 0.05$

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).

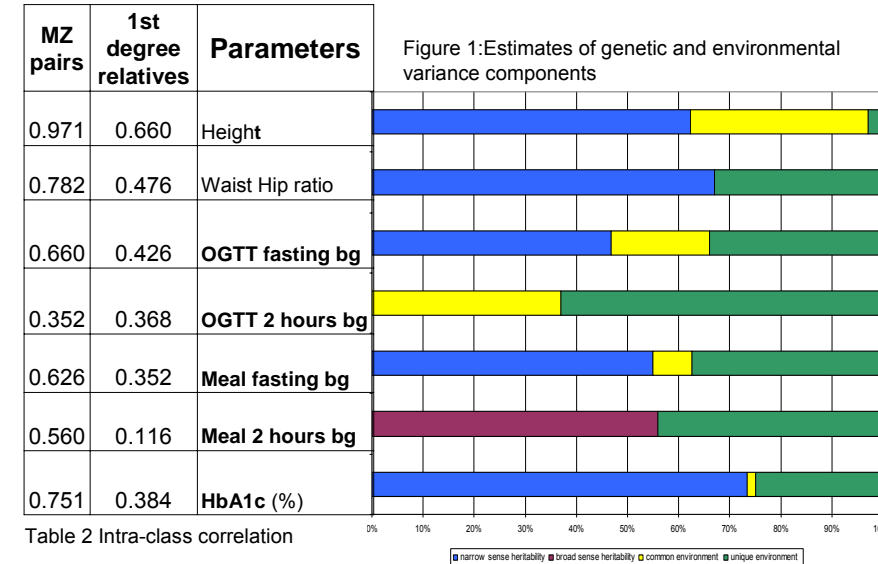


Table 2 Intra-class correlation

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.

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