

# Could Parenting Stress and Lack of Support/Confidence Function as Mediating Mechanisms between Certain Environmental Factors and the Development of Autoimmunity in Children?

## A Study within ABIS

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**ABSTRACT:** Despite extensive research, the etiology of type 1 diabetes is still to a large extent unknown. We would like to propose psychoimmunology as one possible pathway. Psychological mechanisms are directly linked to hormonal and nervous signals, which increase the need for insulin and affect the immune system. Disparate factors of social, environmental, and medical character have been associated with the onset of type 1 diabetes or with the autoimmune process leading to the disease—for instance, parental age, maternal infections, delivery mood, need for neonatal intensive care, and low socioeconomic status. Our results, based on the analyses of 4337 nonselected newborn children and their mothers, show that all these risk factors were also associated with psychological mechanisms (defined as lack of social support/confidence and high parenting stress). These results support the hypothesis of psychological mechanisms as mediating variables between a number of disparate risk factors and the development of type 1 diabetes.

**KEYWORDS:** type 1 diabetes, children, psychological factors, etiology

## INTRODUCTION

The etiology of type 1 diabetes is still to a large extent unknown; various hypotheses have been offered as explanations<sup>1</sup>—for example, the hygiene hypothesis and the weight gain hypothesis. We would like to propose psychoimmunology as another possible pathway.

Disparate factors of social, environmental, and medical character have been associated with the onset of type 1 diabetes or with the autoimmune process leading to the disease, such as parental age,<sup>2</sup> maternal infections,<sup>3</sup> delivery mode,<sup>2</sup> need for neonatal intensive care,<sup>4</sup> and low socioeconomic status.<sup>4</sup> These factors might con-

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tribute to diabetes in various ways, either by increasing the need for insulin, reducing insulin secretion, or affecting the immune system.

Psychological stress is directly linked to hormonal and nervous signals, which increase the need for insulin and affect the immune system.<sup>5</sup> One main contributor to psychological stress early in life is dysfunctional family (child-parent) interactions. Psychological stress, especially the experience of serious life events, has been linked to type 1 diabetes in humans,<sup>6</sup> and it has also been shown to cause type 1 diabetes in animals. It is, therefore, plausible to believe that psychoimmunological mechanisms could contribute to the autoimmune process that might lead to type 1 diabetes.

Our question is whether a number of rather disparate associations between the development of type 1 diabetes and various environmental variables could be explained by common psychological mediating mechanisms.

## METHODS

### *Participants*

All parents-to-be during the time period October 1, 1997 and October 1, 1999 in southeast Sweden were informed about and asked to participate in the ABIS project (All Babies in Southeast Sweden). Around 78.6% agreed, yielding a sample of about 17,000 subjects. More than 13,800 of them also completed the one-year follow-up. So far, 10,868 unselected at-birth questionnaires and 4450 unselected one-year follow-up questionnaires have been analyzed. The inclusion criterion in this study was that a minimum of 32 of the 34 questions on the stress index (SPSQ) had been answered. Ninety-seven percent met this criterion, yielding a follow-up sample of 4337 participants.

### *Measures*

Social support/confidence was assessed at birth, using the following two questions: "Do you experience enough support from your social environment for yourself and your newborn baby?" and "Do you feel that you have enough confidence/security so that you can give yourself and your newborn child a good start?"

Reported parenting stress was assessed at one year using The Swedish Parenthood Stress Questionnaire. The SPSQ consists of 34 items and was used with six-point Likert-type response scales. The stress score was first calculated as a mean value of the questions answered and then dichotomized into high parenting stress (scoring above the 90th percentile) and low parenting stress (below the 10th ).

To assess a variety of psychosocial background variables two extensive questionnaires were given to the parents, one at the child's birth and one at the end of its first year.

### *Procedure*

The first questionnaire was given to the mothers when the mother and the child were leaving the hospital after the delivery. The second questionnaire was given at the one-year check-up at the well child clinic. All parents who returned an incomplete second questionnaire were contacted and asked to complete the questionnaire.

**TABLE 1. Correlations between various background variables and lack of social support/confidence and high parenting stress**

Background variables (measured at birth)	Lack of support/confidence		High parenting stress	
	$\chi^2$	<i>df</i>	$\chi^2$	<i>df</i>
Experience of serious life events	24.759 <sup>a</sup>	1	NS	
Increased age (mother >30 years)	NS		33.429 <sup>a</sup>	1
Increased age (father >30 years)	NS		19.772 <sup>a</sup>	1
Maternal infections during pregnancy	17.684 <sup>a</sup>	1	21.480 <sup>a</sup>	1
Cesarean section	10.639 <sup>b</sup>	2	NS	
Need for NICU	9.904 <sup>b</sup>	1	NS	
Born abroad (mother)	30.235 <sup>a</sup>	1	NS	
Born abroad (father)	47.480 <sup>a</sup>	1	NS	
Single parenthood at birth	51.587 <sup>a</sup>	2	6.891 <sup>a</sup>	1
Low education (mother)	16.525 <sup>b</sup>	5	NS	
Low education (father)	NS		NS	
Unemployed (mother)	37.416 <sup>a</sup>	1	12.329 <sup>a</sup>	1
Unemployed (father)	9.493 <sup>b</sup>	1	NS	
Smoking during pregnancy	30.946 <sup>a</sup>	1	NS	

<sup>a</sup>  $P < 0.001$ . <sup>b</sup>  $P < 0.01$ . NS = not significant.

Chi-square analyses were conducted using SPSS 10.0. To avoid mass significance, only  $P < 0.01$  and  $P < 0.001$  were considered statistically significant.

## RESULTS

The overwhelming majority of the mothers reported having enough social support and enough confidence/security for themselves and the newborn child at the time of birth. In total, 115 mothers lacked social support, confidence, or both; and there was a significant overlap between them, chi-square (1) = 1077.5,  $P < 0.001$ .

The mean score for parenting stress (SPSQ) in our sample was 2.59, and the cut-off at the 90th percentile yielded a high-stress group of 448 mothers.

As can be seen in TABLE 1, a number of variables that earlier had been connected to increased risk for type 1 diabetes were found to correlate significantly with psychological mechanisms. Lack of support/confidence was correlated with the experience of serious life events during pregnancy, maternal infections during pregnancy, delivery by cesarean section, the need for neonatal intensive care, smoking habits during pregnancy, and some demographic circumstances—namely, born abroad, single parenthood, low maternal education, and unemployment. High parenting stress (SPSQ) was related to maternal infections during pregnancy, higher parental age, unemployment, and single motherhood.

## DISCUSSION

A number of disparate variables of social, environmental, and medical character have earlier been related to the development of type 1 diabetes. Our results show that all these risk factors were related to psychological mechanisms. Our results are based on the analyses of a large, nonselected normal population as part of the ABIS project.

Therlund *et al.*<sup>6</sup> found the experience of serious life events to be a trigger mechanism for type 1 diabetes, through increased need for insulin due to the psychological stress. A significant relation between the experience of serious life events during pregnancy and reported lack of social support/confidence was found in this study.

Increased parental age has been linked to type 1 diabetes in the child.<sup>2</sup> Bingley *et al.*,<sup>2</sup> for example, reported an increased risk of 25% (95% CI: 17–34%) for each additional five-year increase of maternal age and a 9% (3–16%) increased risk for each additional five years of paternal age. Whether the link to increased age depends on somatic changes or on psychological mechanisms remains to be shown. A significant connection between increased parental age and high parenting stress was found in our data.

Maternal infections, especially enteroviral infections, during pregnancy have been associated with later development of autoimmunity in children.<sup>3</sup> Our results reveal a significant correlation between maternal infections during pregnancy on the one hand and maternal lack of support/confidence and high parenting stress on the other.

In a number of studies cesarean sections have been shown to constitute a risk, although the mechanisms by which this has a biological effect are not known.<sup>2</sup> McKinney and her colleagues also found that transfer to a special baby care unit after delivery increased the odds ratio for diabetes.<sup>4</sup> We found significant correlations between maternal lack of support/confidence and delivery by cesarean section as well as need for neonatal intensive care after the delivery. Zar, Wijma, and Wijma<sup>7</sup> found that anxiety was a risk factor for obstetric complications, including cesarean sections, probably through decreased psychological capacity and impaired interaction with the staff during delivery. Maybe there is a similar effect of maternal lack of support/confidence during pregnancy.

A number of studies have investigated the role of low socioeconomic status in connection to type 1 diabetes.<sup>4</sup> Some have found that low maternal educational level and having a father who is a manual worker increased the risk. We found significant correlations between lack of support/confidence and a number of variables indicating low socioeconomic status, such as parents born abroad, single parenthood, lower maternal education, and parental unemployment. Single parenthood and unemployment were also significantly related to high parenting stress.

It has been proposed that cigarette smoking leads to increased susceptibility to autoimmune diseases.<sup>8</sup> We found a significant connection between smoking during pregnancy and lack of support/confidence.

Our conclusion is that the hypothesis of psychological mechanisms as mediating variables between a number of disparate risk factors and the development of type 1 diabetes cannot be excluded.

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### REFERENCES

1. ÅKERBLOM, H.K. & M. KNIP. 1998. Putative environmental factors in type 1 diabetes. *Diabetes Metab. Rev.* **14**: 31–67.
2. MCKINNEY, P.A., R. PARSLow, K. GURNEY, *et al.* 1997. Antenatal risk factors for childhood diabetes mellitus; a case-control study of medical record data in Yorkshire, UK. *Diabetologia* **40**: 933–939.
3. HYÖTY, H., M. HILTUNEN, M. KNIP, *et al.* AND THE CHILDHOOD DIABETES IN FINLAND (DiMe) STUDY GROUP. 1995. A prospective study of the role of Coxsackie B and other enterovirus infections in the pathogenesis of IDDM. *Diabetes* **44**: 652–657.
4. MCKINNEY, P.A., M. OKASHA, R.C. PARSLow, *et al.* 2000. Early social mixing and childhood type 1 diabetes mellitus: a case-control study in Yorkshire, UK. *Diabetic Med.* **17**: 236–242.
5. SCHELOWSKI, M. & U. TEWES. 1999. *Psychoneuroimmunology: An Interdisciplinary Introduction*. Kluwer Academic/Plenum Publishers. New York.
6. THERNLUND, G.M., G. DAHLQUIST, K. HANSSON, *et al.* 1995. Psychological stress and the onset of IDDM in children. *Diabetes Care* **18**: 1323–1329.
7. ZAR, M., K. WIJMA & B. WIJMA. 2001. Is anxiety a risk factor for obstetric complications? *In* Diagnostic Aspects of Fear of Childbirth. Dissertation no. 78, by M. Zar, Dept. of Behavioural Sciences and Dept. of Health and Environment, Linköping University, Sweden.
8. GEORE, J., Y. LEVY & Y. SHOENFELD. 1997. Smoking and immunity: an additional player in the mosaic of autoimmunity. *Scand. J. Immunol.* **45**(1): 1–6.

