SUMMARY - The aim of the study was to determine whether IDDM affects the course of psychological adjustment in youths. The study sample included 164 children with IDDM (mean age = 10.2) and their parents compared to 164 healthy controls matched for age, sex and socioeconomic status. Adjustment was measured with the Child Behavior Checklist, a parental rating scale, validated and adapted for the French population. Two-way ANOVAs on CBCL scale scores showed that scores for both internalizing and externalizing problem behaviors and the total CBCL score were significantly raised in diabetic children (p < 0.001). Further comparisons on the 8 narrow-band scale scores of the CBCL indicated increased scores for diabetic children on 6 dimensions. A significant Gender x Status (IDDM versus Controls) interaction was found, supportive of higher rates of aggressive behaviors amongst male diabetic children (p < 0.01). Controlling for age, no correlation was found between CBCL total, internalizing and externalizing scores and duration of IDDM or HbA1c levels within the diabetic group. Psychological adjustment to chronic illness needs to be considered with respect to both normal developmental demands as well as in the context of the specific challenges posed by the disease.

Key-words: IDDM, children, psychological adjustment, CBCL (Achenbach), behaviors, gender.

RÉSUMÉ - Adaptation psychologique chez les enfants diabétiques de type 1, étude d’une cohorte française.

Dans le but d’analyser l’impact du diabète insulinodépendant (DID) sur l’adaptation psychologique des enfants qui en sont atteint, une étude multicentrique française a été menée auprès de 164 enfants âgés de 7 à 13 ans (âge moyen = 10.2 ans) et de leurs parents. L’adaptation psychologique a été mesurée par l’échelle d’Achenbach (Child Behavior Checkist, CBCL), préalablement validée en France, remplie par les parents. Les résultats obtenus dans cette population d’enfants DID ont été comparés à ceux de 164 enfants sains appariés pour l’âge, le sexe et le niveau socio-économique.

L’analyse de variance à 2 facteurs montre que les scores à l’échelle CBCL sont significativement plus élevés (p < 0,001) chez les enfants DID que chez les contrôles, aussi bien pour le score global que pour les sous-échelles explorant les dimensions d’internalisation (I) et d’externalisation (E). Parmi les 8 problèmes émotionnels et de comportements explorés par cette échelle, six sont significativement plus élevés chez les enfants DID que chez les contrôles. L’effet du sexe a été montré aussi bien chez les diabétiques que chez les contrôles : les garçons ont des scores plus élevés pour les problèmes d’agressivité et d’attention. L’analyse de l’interaction Sexe x Diabète montre un accroissement significatif plus important des scores relatifs aux comportements agressifs chez les garçons diabétiques (p < 0,01). La durée du diabète et le taux d’HbA1c ne sont pas corrélés aux scores et sous-scores (I et E) de l’échelle.

L’adaptation psychologique à la maladie chronique devrait être considérée à la fois dans la perspective des solicitations développementales et des défis imposés par la maladie.

Mots-clés : diabète insulinodépendant, enfant, parents, adaptation psychologique, échelle CBCL (Achenbach), comportements, sexe.

Insulin-dependent diabetes mellitus (IDDM) is one of the four most prevalent chronic illnesses of childhood and the most common endocrine disorder of childhood [1]. IDDM is considered to be a severe psychosocial stressor. For a child, living with diabetes may require considerable readjustment, both at a psychological level (i.e., accept the idea of being indeed vulnerable, or having little control) and at a behavioral one (i.e., changing life-styles). A chronic illness brings significant challenges to health, development and social adaptation of these children and their families.

The early literature on the psychological adjustment of chronically ill, emphasized the increased risks of psychological maladjustment or even psychopathology in children [2-4].

In the eighties, Dunn et al. debunked the "myth of the diabetic personality" [5]. These authors concluded that "the clinical heterogeneity of diabetes is matched by the psychological heterogeneity of its sufferers".

Conceptualized as the balance between cognitive, emotional and behavioral factors, the phenomenon of adjustment gained increased interest in the study of chronic conditions, mainly because of its implications in the understanding of the patient’s process of adherence to treatment [6] and of its contribution to the implementation of educational or psychological treatment programs. With the accumulation of evidence that psychosocial factors do influence child and family adjustment, a number of models have been proposed that attempt to explain how risk and resilience factors might operate [7-10].

Nowadays, several instruments with well-developed norms and allowing for meaningful statistical comparisons are available to measure the behavior of a given child or group of children [11]. From the different available sources of information for measuring child adjustment, parents are generally considered as knowledgeable observers of their children’s behavior across time and settings. In 1983 Achenbach & Edelbrock [11] constructed the Child Behavior Check List (CBCL), a screening tool for behavioral and emotional problems, This instrument, of frequent use in studies of child adjustment to chronic disease, has dominated the field in the late eighties. Twelve out of 20 studies in America published between 1987 & 1989 relied upon this measure [12].

In France, the CBCL has been used in epidemiological studies with non clinical populations [13-15] and clinical samples as well [16]. Comparisons of French and American CBCL data have shown considerable cross-cultural similarity [17].

However to date in France, in the field of Pediatric Psychology, there are no available studies investigating psychological adjustment to IDDM in children with reliable measures. Consequently, the aim of the present study is to measure the psychological adjustment, as reported by their parents, of an IDDM French juvenile sample, using psychometrically reliable and valid instruments such as the CBCL.

Three specific questions were addressed in this investigation:

1) What is the average psychological adjustment of IDDM children, as reported by their parents?
2) Does the adjustment of insulin-dependent diabetic children differ from that of children in general?
3) Is the psychological adjustment of diabetic children related to duration of diabetes and to the level of glycemic control?

**METHODS**

Procedure and instruments – The procedure of the present study was imbedded in different data collections, each focusing on different aspects of the illness: glycemic control [18], family functioning [19], adherence to diabetes regimen [20], adjustment to illness. Of relevance to the current study is only the analysis of adjustment as measured by the Child Behavior Check List [11].

The Child Behavior Check List (CBCL) provides a standardized description of behavior problems and competencies in children as reported by the parents. It is a self-administered 120 items list of behavior problems rated by the child’s parents. Each item is scored on a 3-point scale as 0, 1, or 2 according to its presence or its frequency over the past 12 months. The instrument generates a total problem score, which is an index of psychopathological severity. Additional scores of maladjustment can also be estimated from the existing syndrome subscales, and are computed on the Internalizing, Externalizing and other syndrome scales. Externalizing symptoms include impulsive behavior, conduct problems, and aggressive behavior. Internalizing symptoms include behaviors such as withdrawal, somatic complaints, anxiety and depressive problems. The other syndrome subscales include social, attention, and thought problems.

The subscales have been developed through prior, large scale factor analyses. Normative data are available for American children between ages of 4 to 16 [11]. The instrument demonstrates high test-retest and inter-parent reliability and is a valid discriminator of maladjustment and poorly achieving children [11].

The French version of the CBCL was developed in France in 1985. Several studies have shown the reliability and validity for the French version of the CBCL [16, 21-22]. Normative data for French children, 4-16, both sexes are now available [14-15].

Only the behavior scale of the Child Behavior Check List (120 items) was used in this study. An assistant explained the procedure and answered any question. The research assistant subsequently checked that it was filled out appropriately.

Glycemic control level was assessed in all diabetic children by HbA1c measurement, performed in a single laboratory by HPLC (reference value = 5.1 ± 0.6%, mean ± 2sd).

Subjects – IDDM children and their families were recruited from 6 university-based pediatric departments in France. Families with diabetic children aged 7 to 13, insulin dependent for more than 6 months, able to speak and read French, were included in the survey. The project was approved by the Paris VII University Ethics Committee. Participating families gave their written consent.
The sample’s socioeconomic status, educational level, employment and family status as filled in by the parents were recorded according to the French census scale, INSEE [23]. Results are given in detail elsewhere [18].

Diabetic subjects included in the study were compared to a control group of healthy children matched for child’s age, sex and parental economic status. The controls were issued from the most recent French CBCL normative sample of 2582 children and adolescents aged 4 to 16 [14-15].

Statistical analysis – The questionnaire data were analyzed with the SPSS (Statistical Package for Social Science). Statistical comparisons (Diabetic Vs Control groups) were performed using Student’s t tests. A two-by-two analysis of variance was performed using as the first factor the diagnostic group (diabetic or control) and as the second factor the gender. Then, the effects of diabetic status, gender and gender by diabetic status (interaction) term variables were analyzed. Correlation coefficients between CBCL total scale and subscales scores and diabetes duration and level of HbA1c within the diabetic group were also computed with the Pearson’s correlation coefficients. In order to protect against type I error, the significance level was set at p < 0.01.

## RESULTS

### Sample characteristics

Among 173 eligible families, 164 agreed to participate in the study. Data from 164 families were suitable for analysis. 94 mothers, 54 parental couples and 16 others caregivers of insulin dependent diabetic children completed the CBCL.

The mean age for the diabetic children was 10.2 years (SD = 1.9; range 7-13) and the mean duration of diabetes was 3.1 years (SD = 2.7; range 0.5 to 11 years). Most of the children were receiving two daily injections of insulin (86%), others were treated by 3 injections per day. They attended the pediatric clinic with an average of one visit every two months. Mean HbA1c level was 8.3 ± 1.6% (normal value = 4.5-5.7%). The male/female sex ratio was: 0.88. (72 boys; 92 girls).

### Comparison of CBCL scores in diabetic children and controls

– The means for the total CBCL, the externalizing and internalizing scores were significantly higher amongst diabetic children than amongst the control children (Fig. 1 and Table I).

Two-way ANOVAs on these CBCL scores indicated a significant effect of diagnostic group for the total score (F = 18.5; p < 0.001), the internalizing score (F = 33.9; p < 0.001) and the externalizing score (F = 44.6; p < 0.001). Two-way ANOVAs on the 8 narrow-band CBCL scale scores yielded a significant effect of diagnostic status on 6 of the 8 scales scores (Table I). In all comparisons, the scores of diabetic children were higher than those of the controls.

A gender effect on the CBCL scores was found for the externalizing score (F = 14.6; p < 0.001), and for the 2 narrow-band CBCL factors labeled Aggressive (F = 16.1; p < 0.001) and Attention problems (F = 15.3; p < 0.001). In keeping with known psychopathological sex differences, boys had consistently higher scores than girls on these dimensions, irrespective of diagnostic group.

An assessment of Gender × Status (IDDM versus Control) interactions yielded non-significant results, with the exception of the Aggressive Factor (F = 7.8; p < 0.01) for which the increase in aggressive score was steeper amongst diabetic boys than diabetic girls. It is worth noting, however, that a similar trend was found in the Externalizing score and the Attention Factor, although, due to our choice of a conservative p value of 0.01, these results fell just short of statistical significance.

CBCL scores, diabetes duration and HbA1c levels in the diabetic group – When controlling for age, no significant correlation was found between the total, internalizing and externalizing CBCL scores and either the duration of IDDM or the HbA1c levels. Patterns of correlations were comparable in each gender and showed no association between CBCL scores and sub-scores and HbA1c or duration of IDDM.

### DISCUSSION

Our study has shown in a large French sample, that diabetic children are significantly different in psychological adjustment than matched controls.

Children with diabetes appeared to be psychologically more fragile than healthy peers as they were reported to experience more internalizing (anxiety, unhappiness, loneliness, somatic complaints) and externalizing problems (aggressive behaviors). These findings support previous studies which have reported a greater incidence of internalizing, anxious behaviors in chronic illness [10, 24]. Some authors consider that fear, anxiety and unexpressed anger are feelings engendered by the chronic illness [1, 25, 26].

When controlling for possible bias contained in the Somatic Complaints scale (some behavioral items,
nausea, headache, etc. can have a physiologic etiology and may skew reports of behavioral disturbance). Holmes et al. [27] found that children with diabetes still have significantly higher scores than controls on all of the CBCL scales except two, the Social problems and Attention problems scales. This pattern of general global scale elevation suggests that diabetes is primarily associated with general mild, non specific behavioral symptomatology not confounded by medical symptomatology.

Our study showed that the level of aggression was higher in diabetic children than in controls, a finding which was more pronounced for boys with IDDM. These results could be regarded as statistical artifacts due to multiple testing. But insofar as the same trends were found for 2 other CBCL scores tapping disruptive problems, and whereas none was detected for any of the emotional scores, they argue for a genuine heightened vulnerability to behavioral disturbances in diabetic boys. Further research should aim at replicating these results and exploring the mechanisms involved. It is of importance that glycemic control and duration of diabetes, usually considered as associated factors, were not found to be associated with any behavioral or emotional score in general, and in particular, no association was detected for boys between externalizing problems and biological variables. It suggests in turn that the mechanism of the specific male vulnerability to aggressive behaviors in diabetic children might be linked to a psychosocial mechanism which could play an essential role.

The hypothesis of an association between IDDM and psychiatric disorders is still controversial as no consensus exists on the prevalence or specificity of psychiatric disorders amongst diabetic youth [28, 29].

One limitation to this study needs to be acknowledged prior to draw implications from these findings. The findings we have reported relied only upon paper and pencil measures. Behavior symptomatology was measured through mother’s and parents’ ratings. Reliance on mothers as sole reporters of these children’s adjustment is a limitation to the data which are available. Maternal perceptions of child behavior are probably a function of both child and maternal characteristics. Parents might project personal feelings and cognitions when evaluating their child’s behavior. Parents may express more problems because they perceive their child to be especially vulnerable. Cameron et al. [30] have suggested that parents under stress tend to overestimate inappropriate child behavior. Al-

<table>
<thead>
<tr>
<th></th>
<th>BOYS</th>
<th>GIRLS</th>
<th>Diagnostic effect</th>
<th>Sex effect</th>
<th>Interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Diabetic children n=72</td>
<td>Controls n=72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>mean</td>
<td>sd</td>
<td>mean</td>
<td>sd</td>
<td>mean</td>
</tr>
<tr>
<td>Total score</td>
<td>36.4</td>
<td>20.5</td>
<td>24.1</td>
<td>17.1</td>
<td>30.3</td>
</tr>
<tr>
<td>Internalizing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>withdrawn</td>
<td>10.2</td>
<td>9.9</td>
<td>5.5</td>
<td>4.4</td>
<td>10.4</td>
</tr>
<tr>
<td>anxious/depressed</td>
<td>2.9</td>
<td>2.5</td>
<td>1.6</td>
<td>1.6</td>
<td>2.8</td>
</tr>
<tr>
<td>somatic complaints</td>
<td>5.3</td>
<td>4.1</td>
<td>3.5</td>
<td>3.1</td>
<td>5.3</td>
</tr>
<tr>
<td>Externalizing</td>
<td>13.9</td>
<td>8.8</td>
<td>8.8</td>
<td>6.6</td>
<td>9.1</td>
</tr>
<tr>
<td>delinquent behavior</td>
<td>2.5</td>
<td>2.1</td>
<td>2.4</td>
<td>2.0</td>
<td>1.8</td>
</tr>
<tr>
<td>aggressive behavior</td>
<td>11.4</td>
<td>7.2</td>
<td>6.5</td>
<td>5.1</td>
<td>7.3</td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>attention problems</td>
<td>6.2</td>
<td>3.7</td>
<td>2.0</td>
<td>1.7</td>
<td>4.2</td>
</tr>
<tr>
<td>thought problems</td>
<td>0.6</td>
<td>0.9</td>
<td>0.5</td>
<td>0.8</td>
<td>0.5</td>
</tr>
<tr>
<td>social problems</td>
<td>2.3</td>
<td>2.1</td>
<td>2.3</td>
<td>1.8</td>
<td>2.1</td>
</tr>
</tbody>
</table>

*p < 0.01

**p < 0.001

TABLE I. Comparison of diabetic children and controls on CBCL scores (2 × 2 ANOVA).
though there exists a good deal of validity data for using maternal report on the CBCL [11], this limitation must be kept in mind in interpreting the current findings.

On the other hand, a major advantage of this study lays in the measurement of psychological and behavioral adjustment using an instrument with well-established acceptable psychometric properties. Such a study did not exist in France to date.

An important finding of this study is that children with IDDM display more adjustment difficulties than healthy controls. Anxiety, loneliness, sadness, aggressivity are personal feelings and behavioral reactions that might be greatly generated by the disease and its treatment characteristics.

Psychological research on juvenile Diabetes Mellitus should focus on the identification and specification of modifiable risk factors which differentiate between well and poorly adjusted diabetic children.

Specific suggestions can be made to this end. Psychological screening assessments should be made at regular medical contacts, with an instrument such as the Child Behavior Check List and under supervision of the pediatric psychologist in order to guide psychological intervention and enhance prevention efforts. Monitoring the psychological status of young patients may contribute to identify diabetic children with psychological maladjustment or those at risk for psychiatric disorders and facilitate therapeutic interventions. Although the scale is long to fill in, our study has shown the good acceptance of this instrument by parents.

The model of Health Psychology appears to point towards fruitful directions that can be pursued for further exploration of the links between chronic illness, individual functioning and adjustment. Other productive areas direct attention on the empirical research on selection of psychosocial treatment targets in order to improve psychological adjustment to diabetes [31].

For children with IDDM, obtaining optimal and stable psychological adjustment through life time is difficult if not impossible. Therefore, psychological adjustment might be considered as a continuous, permanent, dynamic coping process that waxes and wanes through life periods, from childhood to adulthood.

The impact of such studies might be enhanced if placed in a context of longitudinal analysis [32]. Such an approach is basic to any full understanding of the child’s coping strategies and psychological development. Longitudinal studies might also provide tremendous insight on the evolution and modification of the complex processes of adjustment. And such knowledge can provide empirically grounded guidance for those who work with those children and their families.

Acknowledgments — This study was supported by funds of Commission de la Recherche Clinique, Assistance Publique-Hôpitaux de Paris, and from the Direction Générale de la Santé, Ministère des Affaires Sociales et de la Santé, Paris, France; the control group derived from an epidemiological study carried out by E. Fombonne with a grant from INSERM among the subjects of the GAZEL cohort (Opération 20 000 volontaires EDF-GDF pour la recherche médicale). The help of S. Vermeersch is acknowledged.

REFERENCES