QoL in Southtyrol T1D Pediatric Patients Psycho-social Well-being, Quality of Life, Health Status and Family Conflicts in a South-tyrolean Group of Pediatric Patients with Diabetes Mellitus Type I

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Authors' contributions

Authors MT and MAM designed the study. Author MT performed the statistical analysis, managed the literature and wrote the first draft of the manuscript with assistance of author SB. Authors VP and NP collected the medical and psychological data in the hospital. All the authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Background: Psychological well-being and metabolic control in pediatric patients with diabetes mellitus type I (T1D) could be negatively influenced by adolescence current age, age at the diagnosis, lower economic condition and lower education status and by higher family conflict. However, they reported lower or comparable levels of emotional difficulties compared with normative population.
Objective: To understand psycho-social symptoms, quality of life, health status and family conflicts of pediatric patients with T1D in the unique cultural environment of South-Tyrol. The present study has two goals. The first is to understand psychological symptoms and to investigate the possible risk

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factors. The second deals with the subgroup of adolescents, comparing their psychological functioning with a healthy control group.

Methods: Patients (n=59) with a mean age of 13.19 years (SD=3.26; range 8–18) were contacted at the Day Hospital check-ups and self- and proxy-reported questionnaires were administered: CBCL/ YSR, DFCS-R, DQOLY-SF. From this group, 45 patients aged 11–18 were matched by gender and age in months with a control group of healthy peers.

Results: Glycemic control was severely inadequate and a subgroup of patients showed lower indexes of total competencies and activities performed, especially if they were of poor economic condition and had the illness for a longer duration. The adolescent patients self-reported better psychological functioning than their healthy peers, except for conduct problems.

Conclusions: Specific psycho-social interventions should address the dangerous levels of metabolic control indexes and mitigate the patients' conduct problems.

1. INTRODUCTION

1.1 Epidemiology and Incidence of Diabetes Mellitus Type I

Diabetes is one of the most common chronic diseases among children in the world and it is considered a health emergency by the World Health Organization. In Italy in 2012 were identified 15,563 patients with T1D, aged less than 18 years, treated across 68 diabetes centers. Accordingly, the prevalence of T1D was calculated to be about 1.4 patients per 1,000 people with a large geographical variation: highest in Sardinia, intermediate in Central-Southern Italy, and high in Northern Italy [1]. In 2014 in South Tyrol district children 5-14 years old with T1D were 109, with a prevalence of 0.2% of population with diabetes [2].

1.2 Health Status, Psychopathologic Disturbances and Quality of Life in Children and Adolescents with T1D

Glycosylated hemoglobin (HbA1c) is a measure of satisfactory control of glycemic value associated with a good adherence to treatment and with the absence of clinical symptoms. Currently [3], the satisfactory control of glycemic value is indicated by a HbA1c value of <7.5%. When pediatric patients enter the development stage of adolescence, glycemic control typically worsens [4-7]. Teenagers with T1D are trained to acquire greater self-management and to balance their autonomy/dependence on parents with a shared responsibility for management of the illness [8,9], even if close parental monitoring of care completion could contribute to better adherence [10].

Adolescents are more at risk also in their well-being and in developing behavioral and psychopathologic problems [11,12], especially those who show high levels of glycosylated hemoglobin [12,13], which is also associated with poor attention functioning [14]. However, the results of a group of studies [15,17] showed that children and adolescents with T1D reported lower or comparable levels of externalizing and internalizing problems compared with healthy peers.

Another field of studies found that children and adolescents with T1D could show some psychological disturbances, such as more oppositional problems, aggression and rule-breaking behavior than controls [18], with a double risk of psychiatric morbidity [19], elevated depressive or internalizing symptoms [20,21]. Also they reported more externalizing disorders and the presence of family conflicts [22-25] that may lead to non-adherence to treatment and poor glycemic control.

Protective factors for a positive treatment outcome of diabetes and quality of life were parents' higher educational status and higher family income [25,26], strong family cohesion [27], cohesive or balanced family climate [15], and family involvement and support in management of the illness [13,28].

1.3 Aims and Expected Results

Quality of life and psycho-social wellbeing in children and adolescents with T1D in the unique cultural environment of South-Tyrol has never been addressed. This is an autonomous multilingual Italian region with special social demands, values, and attitudes because there was a cultural adaptation between two different cultures: Italian and German. Children and adolescents had necessarily to adapt to their disease according also to the demands of their

local and larger cultural environments [29]. This study aimed to take a step in this direction, replicating some of the findings already existing in the literature.

The present study has two goals. The first is to understand psychological internalizing and externalizing symptoms and to investigate the possible risk factors, such as current age [6,11], age at the diagnosis [7] and economic condition [26]. We expect to confirm the results of previous literature, namely more psychological symptoms and a worse health-related quality of life closely associated with high levels of glycosylated hemoglobin [12,13,22].

The second goal deals with the subgroup of adolescents with diabetes type I, in order to focus on their psychopathological symptoms, family conflicts and related quality of life, comparing their psychological functioning with a healthy control group. We expect that the perception of conflict between adolescent patients and their parents could influence their metabolic control and psychological well-being [15,24], with worse perceptions of quality of life [27,30]. We also expect to find that adolescents from families with higher income and education status report better self-management skills than those from poorer families and adolescents who have the disease for a longer period have poorer glycemic metabolic control [25,26]. We explore the inter-rater agreement between parents and adolescents in reporting psychological symptoms and conflict scores, to better understand the parent–adolescent relationship in the illness management.

Comparing the two groups of adolescents, we do not expect to find significant differences [15,16], except for externalization symptoms [18].

2. METHODS

2.1 Participants

The participants were recruited from patients attending the Pediatric Department of the Hospital of Bolzano during the period 2011–2012. Eligibility criteria were: treatment for diabetes mellitus type I, currently aged 3–18 years, attending at the hospital for the annual Day Hospital follow-ups, at least 6 months from the diagnosis. We excluded patients with learning or sensory problems, genetic syndromes, those who were unable to complete questionnaires.

We identified 122 eligible patients and, of these, 104 were informed of the study and contacted by phone before their visit to the clinic in the study period. The researcher collected completed questionnaires from 59 patients and their parents (response rate=56.73%). From these 59 patients, the 45 adolescents aged 11–18 were matched with a control group. Fig. 1 shows the flow diagram of the participants and Table 1 illustrates their socio-demographic and medical information.

Control group participants met the following eligibility criteria: no history of life-threatening or chronic illness or injury (for example, cancer or severe asthma) and an absence of learning or sensory problems and other pathological aspects. The two groups (diabetes and control) were matched by gender, age and native language (Italian, German). Preliminary statistical analyses showed that there were no significant differences between adolescents with diabetes and their matched healthy peers in terms of the education level of their parents, showing a good comparability of the two groups (Table 2).

2.2 Procedure

The researchers telephoned the patients' parents to explain the study before their checkup visit or contacted them directly when they attended the clinic for appointments. On arrival at the clinic, the researchers gave to the patients and their parents a pack including information about the study, a consent form for the parents and the questionnaires to assess the research variables. Stamped, addressed envelopes were supplied for the return of the questionnaires. The tests were given in the Italian and in the German languages taking into account the primary language of the patient and of the parents. The study was inserted in the health psychology service routine and it was proposed in collaboration with physicians and nurses staff.

In parallel to the data collection at the hospital, healthy pre-adolescent and adolescent peers, matched by gender and age in months, were recruited by the same researchers from secondary schools and youth groups in the same geographic area.

2.3 Measurements

In this study several instruments were used, derived from the international literature on the assessment of pediatric patients and of parents' perceptions of their children.

2.3.1 Psychological Symptoms and Child Behaviour

2.3.1.1 Child Behavior Checklist 6–18 (CBCL) [30] and Youth Self-Report 11-18 (YSR) [31]

The Child Behavior Checklist/6–18 (CBCL) is completed by parents and used to detect emotional and behavioral problems in children and adolescents aged 6–18 using a three-point Likert scale (0=absent, 1= occurs sometimes, 2=occurs often). The Youth Self-Report (YSR) is completed directly by the child or adolescent aged 11–18 years.

The CBCL and YSR are part of the Achenbach System of Empirically Based Assessment (ASEBA). The CBCL/6–18 consists of 113 questions relating to the parent's experiences in the past six months and it is made up of eight syndrome scales that show a good internal coherence in this study: Anxious (α=0.76), depressed (α=0.70), somatic complaints (α=0.84), social problems (α=0.70), thought problems (α=0.74), attention problems (α=0.79), rule-breaking behavior (α=0.70), and aggressive behavior (α=0.80) are grouped into two higher order factors: internalizing and externalizing.
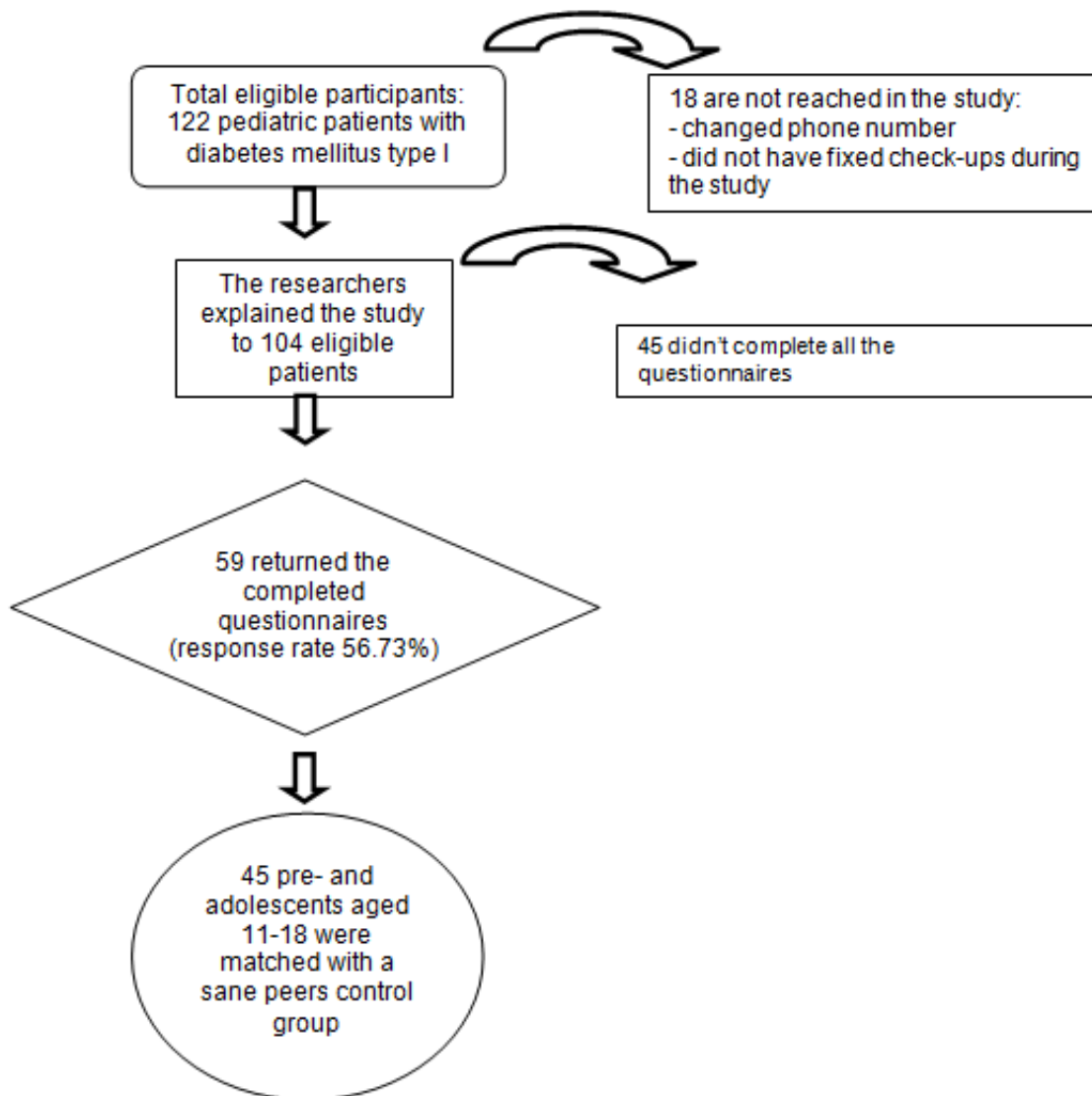

Fig. 1. Flow diagram of the participants

Table 1. Socio-demographic and disease characteristics of patients and their families

Characteristic of patients		Frequency	%
Mean Age, Years (SD)	13.19 (3.26) range 8-18 ys		
Age groups	8-10 ys	16	27.1
	11-18 ys	43	72.9
Gender	Males	26	44.1
	Females	33	55.9
	Total	59	100
Mother's education	5 years of schooling	0	0
	8 years of schooling	14	23.7
	13 years of schooling	35	59.3
	>13 years of schooling	9	15.3
	Not reported	1	1.7
Father's education	5 years of schooling	2	3.4
	8 years of schooling	15	25.4
	13 years of schooling	29	49.2
	>13 years of schooling	10	16.9
	Not reported	3	5.1
Mother's employment status	Housewife/retired/unemployed	15	25.4
	Part-time	23	39
	Full-time	20	33.9
	Not reported	1	1.7
Father's employment status	Househusband/retired/unemployed	3	5.1
	Part-time	1	1.7
	Full-time	53	89.9
	Not reported	2	3.4
Perceived economic situation	Low	9	15.3
	Medium	32	54.2
	High	18	30.5
Home situation	Rent home	9	15.3
	Home ownership with mortgage	26	44.1
	Home ownership without mortgage	19	32.2
	Other	5	8.5
Relationship of the parents' civil status	Married	47	79.7
	Cohabitants	5	8.5
	Separated	6	10.2
	Single	1	1.7
N Siblings	0	11	18.6
	1	37	62.7
	≥2	11	18.7
Age at diagnosis, Mean months (SD)	95.73 (42.58) range 17-176 months		
Disease duration. Mean months (SD)	46 (47.06) range 6-190 months		
Last HbA1c (SD)	8.08 (1.06) range 6.4-10.7		

The eight syndrome scales of the YSR are identical to those of the CBCL and the Cronbach alpha showing a good internal coherence in this study: Anxious ($\alpha=0.82$), depressed ($\alpha=0.60$), somatic complaints ($\alpha=0.60$), social problems ($\alpha=0.72$), thought problems ($\alpha=0.50$), attention problems ($\alpha=0.79$), rule-breaking behavior ($\alpha=0.68$), and aggressive behavior ($\alpha=0.81$). The 2001 revision also added six Diagnostic Symptoms Manual-oriented scales consistent with DSM diagnostic categories: affective problems, anxiety problems, somatic problems, ADHD, oppositional defiance problems, and conduct problems. The CBCL (and the YSR) are also scored on competence scales for competence in activities, social relations, school and total competence.

2.3.2 Quality of life (QoL)

2.3.2.1 Diabetes quality of life for youth short form DQOLY-SF [32]

This shorter form (18 items) is a more precise version with improved construct validity and with

items known to be associated with metabolic control. Each item has five possible scores with a value from 0 to 4, with 0 representing 'never' and 4 'all the time'. Higher scores indicate a more negative impact of diabetes and poorer QoL, and lower scores indicate better QoL. The two

subscales, which also showed a good internal coherence in this study, are: impact of diabetes on daily life (α=0.67; N item=11), and worries about diabetes (α=0.75; N item=7). This questionnaire was administered directly to patients aged 10 years or over.

Table 2. Socio-demographic characteristics of adolescent patients and the matched peers (11-18 years old (N=45)

Patients				Healthy control group		X^2	p
Characteristic		Frequency	%	Frequency	%		
Mean Age, Months (SD)	176.29 months (27.58)			176.18 months (27.62)			
Gender	Males	23	46.9	23	46.9		
	Females	26	53.1	26	53.1		
	Total	49		49			
Mother's education	5 years of schooling	0	0	1	2		
	8 years of schooling	11	22.4	3	6.1	7.01	0.53
	13 years of schooling	31	63.3	22	44.9		
	>13 years of schooling	6	12.2	18	36.8		
	Not reported	1	2	5	10.2		
Father's education	5 years of schooling	2	4.1	0	0		
	8 years of schooling	16	32.7	10	20.4		
	13 years of schooling	22	44.9	11	22.4	9.75	0.37
	>13 years of schooling	5	10.2	21	42.9		
	Not reported	4	8.2	7	14.3		
Mother's employment status	Housewife/pensioner/unemployed	13	26.5	10	20.4		
	Part-time	20	40.8	13	26,5	9.09	0.06
	Full-time	15	30.6	23	46.9		
	Not reported	1	2	3	6.1		
Father's employment status	Househusband/pensioner/unemployed	3	6.1	2	4.1		
	Part-time	0	0	0	0		
	Full-time	44	89.8	40	81.6	0.11	0.74
	Not reported	2	4.1	7	14.3		
Perceived economic situation	Low	8	16.3	4	8.2	9.93	0.04*
	Medium	23	46.9	19	38.8		
	High	18	36.7	24	49		
	Not reported	0	0	2	4.1		
Home situation	Rent home	7	14.3	5	10.2		
	Home ownership with mortgage	19	38.8	14	28,6		
	Home ownership without mortgage	18	36.7	23	46.9	15.21	0.08
	Other	5	10.2	5	10.2		
	Not reported	0	0	2	4.1		
Relationship of the parents' civil status	Married	41	83.7	38	77.6		
	Cohabitants	3	6.1	3	6.1		
	Separated	4	8.2	3	6.1	16.58	0.34
	Single	1	2	2	4		
N Siblings	0	12	24.5	17	34.7		
	1	28	57.1	21	42.9		
	≥2	9	18.3	9	18.3	17.68	0.12
	not reported	0		2	4		

2.3.4 Family conflicts

2.3.4.1 Revised diabetes family conflict scale DFCS-R [33]

The revised conflict scale includes 19 management tasks, including diabetes management (e.g., logging blood glucose results, carrying food with fast-acting carbohydrates, and being absent from school), and it is available in child (aged 8–18) and parent versions. The response set is on a three-point Likert scale (1=never argue, 2=sometimes argue, and 3=always argue), yielding a scale range of 19 to 57 (19=no conflict to 57=high level of conflict). Internal consistency in this study is good for both child (α=0.91; n items=19) and parent versions (α=0.91; n items=19).

2.3.5 Socio-demographic and medical information

Each parent filled in a socio-demographic questionnaire about patient's level of schooling, mother's and father's education and type of employment, their family perceived economic situation, their family type of home situation.

Medical information was extracted by the researchers from the medical records such as date of diagnosis, last HbA1c glycosylated hemoglobin level and age at diagnosis.

2.4 Statistical Methods

We used the SPSS 20.0 software for the following analyses.

A Chi-Square test in crosstabs was used to estimate the possible socio-demographic differences between the two samples and to understand better the comparability of the samples. The two groups were matched by gender and age in months and a file created with the matched clinic and control pairs. Descriptive measures of central tendency and variability were computed for all relevant variables and comparisons made between the two groups. Inferential comparisons were made between participants with diabetes and control peers using a paired-sample t-test with a Bonferroni correction and controlling the effect size d. Inter-rater agreement between child's and parent's reports by the statistic K Cohen was assessed for CBCL and YSR items and for child and parent versions of DFCS-R items.

We ran preliminary Pearson bivariate correlations to find the possible significant associations between the examined variables.

An ANCOVA analysis was run to identify predictive factors of glycemic control (HbA1c) (dependent variable). The independent fixed variables were: perceived economic situation (low, medium, high), patient's gender and age groups (children vs pre-adolescents/ adolescents). The covariates inserted in the model were: duration of illness, age at diagnosis and family conflict score (only for the subgroup of adolescents).

A series of ANCOVAs were then run to identify predictors of CBCL outcomes in children with diabetes I. The independent fixed variables inserted in the model were: perceived economic situation (low, medium, high), fathers' education status (5 years of schooling, 8 years, 13 years of schooling, >13 years) and age at the assessment (8-10 years old vs 11-18 years old). The covariates inserted in the model were: duration of illness, age at diagnosis, glycosylated hemoglobin value, and parent's reported conflict mean score. The dependent variables were the eight CBCL symptomatology scales, the two higher order factors – internalizing and externalizing and the six DSM-oriented scales.

Other series of hierarchical regression analyses were run to identify predictors of YSR outcomes in children aged 11-18 with diabetes type I. In the first step the independent fixed variables inserted were: gender, duration of illness, age at diagnosis, age at the assessment, glycosylated hemoglobin value. In the second step the modifiable variables inserted were: impact of illness on daily life and worries about the illness (DQOLY scales). The dependent variables were the eight YSR symptomatology scales, the two higher order factors – internalizing and externalizing, and the six DSM-oriented scales.

Other ANCOVAs were run to identify possible predictors of QoL perceived by pre-adolescents and adolescents, specifically with the dependent variables alternatively the two scales of impact of illness on life and worries about the illness. The independent variables inserted in the model were: father's education status and economic situation and the covariates were: HbA1c, age at assessment and duration of the illness.

Statistical significance was evaluated at the nominal level of p=0.05, with adjustments for

multiple comparisons, after controlling the normal distribution of the test scores and the homogeneity of variances.

3. RESULTS

3.1 Glycemic Control and Predictive Factors

Glycemic control was adequate (6–7.5%) in just 33.9% of pediatric patients, and inadequate (>7.5%) in the majority of the patients (66.1%).

An ANCOVA analysis with the last value of HbA1c as dependent variable and socio-demographic and illness factors as fixed independent variables or covariates showed significant differences in the glycemic control depending on economic situation (F_2=4.96; *P*=0.011; η_p2=0.18; B=0.78) and duration of illness (F_1=6.46; *P*=0.014; η_p2=0.12; B=0.70). HbA1c value was higher if the children had a poor economic situation and if the diabetes was of longer duration. Actual age at the assessment did not emerge as a predictive factor as expected.

3.2 Psychological Symptoms and Behaviors Reported by Parents

Descriptive analyses of CBCL scoring in the several subscales showed that parents declared a few symptoms in their children aged 8-18 years old, while some problems were reported in the activities and competencies scales (Figs. 2 and 3).

3.3 Stable and Modifiable Predictors of Psychological Well-being in Children with Diabetes According to Parental Perceptions

ANCOVA analyses showed these results (Table 3):

- longer duration of the illness influenced the withdrawn/depressed symptoms;
- father's low education level, low economic condition and lower age at diagnosis impacted on somatic complaints;
- father's low education level and low economic condition influenced anxiety symptoms DSM oriented scale;
- attention symptoms were predicted by a family's low economic condition and by a high parental conflict mean score (DFCS questionnaire);
- father's low education level impacted on internalizing symptoms;
- parental conflict mean score was identified as a modifiable factor significantly influencing externalizing symptoms and thought problems.
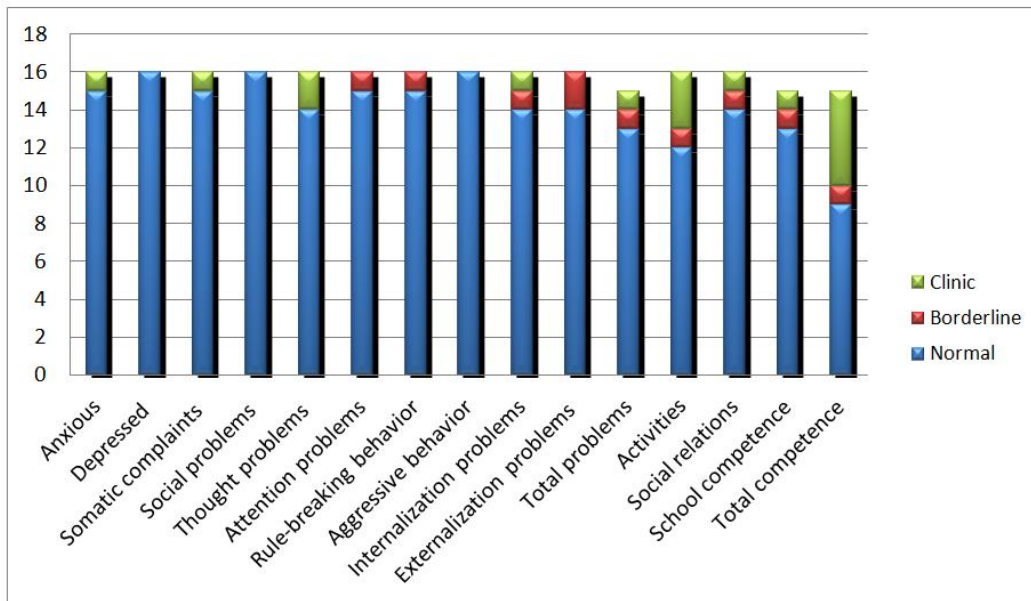

Fig. 2. Psychological symptoms and competencies reported by parents in children with diabetes aged 8-10 (N=16)
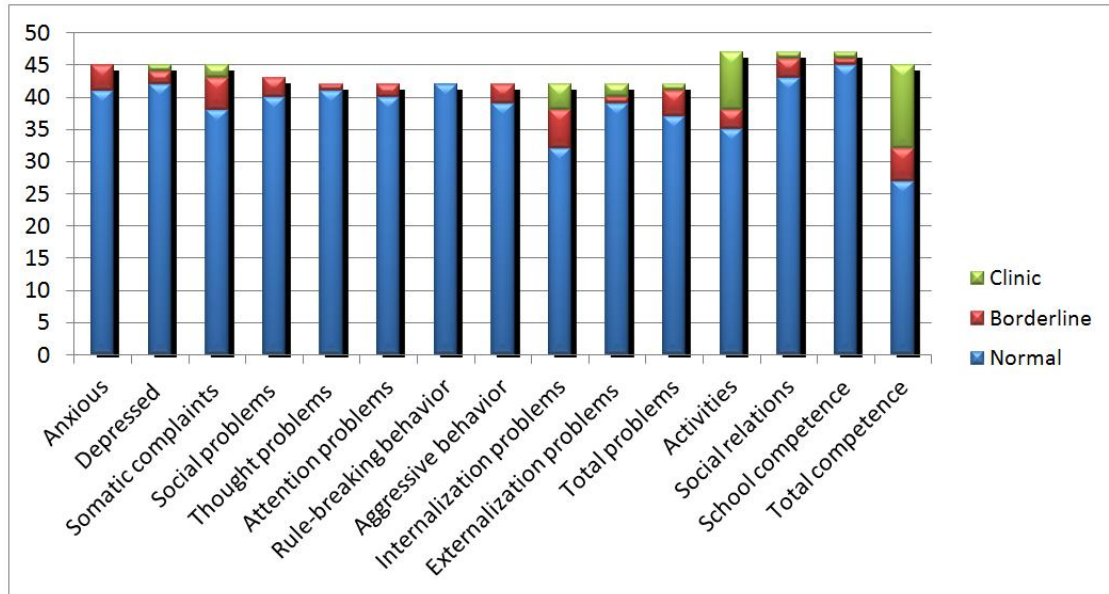
Fig. 3. Psychological symptoms and competencies reported by pre- and adolescents with diabetes aged 11-18 (N=43)

3.4 Stable and Modifiable Predictors of Psychological Well-being in the Subgroup of Preadolescents/ Adolescents with Diabetes According to Their Own Perceptions

Hierarchical regression analyses identified the modifiable factor of worries about the illness (DQOLY subscale) impacting on social problems and on internalizing symptoms, specifically on anxious/depression symptoms reported by pre-adolescents and adolescents with T1D (Fig. 4). Somatic complaints were predicted by the minor age at the assessment and by a worse impact of diabetes on life which influence also the thought and attentional problems (Fig. 5). Both the global scale and two specific subscales of externalizing symptoms (rule breaking and aggressive behaviors) were predicted by impact of illness on life scale (Fig. 6).

3.5 Predictors of Quality of Life Perceptions in the Subgroup of Pre-Adolescents and Adolescents with Diabetes

ANCOVA analyses identified a unique stable predictor in the Worries about the illness scale reported by pre-adolescents and adolescents: HbA1c value (F_1=6.06; *P*=0.02; ηp2=0.18; B=0.66). Higher values of this health status parameter were associated with more worries reported by young people towards their illness.

3.6 Inter-Rater Agreement between Parents' and Pre-Adolescents/ Adolescents' Reports on Psychological Symptoms and on Conflict Scores

Inter-rater agreement between parents' and adolescents' reports was present only for two scales and it was modest: retired and depression (K=0.21; *P* =0.003); and DSM-oriented scale oppositional defiant problems (K=0.22; *P*=0.0001). The other scales did not produce a significant inter-rater agreement score or had a low kappa value.

Inter-rater agreement between parents' and adolescents' reports on the conflict items of DFCS-R were high in almost all of the 19 items using K Cohen statistic and the Pearson correlation between each mean score was high (r=0.79; *P*=0.0001). The concordant items were the following: no.4 (k=0.46; *P*=0.0001), no.6 (K=0.53; *P*=0.0001), no.7 (K=0.36; *P*=0.01), no.8 (K=0.26; *P*=0.05), no.10 (K=0.4; *P*=0.0001), no. 11(K=0.37; *P*=0.002), no.12 (K=0.28; *P*=0.02), no.13 (k=0.39; *P*=0.006), no.14 (K=0.32; *P*=0.002), no.15 (K=0.52; *P*=0.0001) and no.17 (K=0.36; *P*=0.006). The other items did not reach a significant agreement.

Table 3. ANCOVAS to identify predictors of psychological symptoms in children with diabetes along parental perceptions

DV: Outcome CBCL	N	Source	df	F	P value	η_p2	B	Estimated marginal means (Confidence interval 95%)
Withdrawn/depressed	59	Duration of illness	1	3.84	0.05	0.10	0.48	Mean of covariate Duration of illness=62.67
Somatic complaints	59	Father's education level	3	5.21	0.005	0.31	0.89	*5 ys schooling* 5.35 (3.16-7.54) / *8 ys schooling* 1.5 (0.37-2.61) / *13 ys schooling* 1.4 (0.61-2.18) / *>13 ys schooling* 2.74 (1.62-3.86)
		Economic situation	2	3.38	0.04	0.16	0.6	*Low* 4.1 (2.42-5.77) / *Medium* 2 (1.20-2.78) / *High* 1.21 (0.21-2.22)
		Age at diagnosis	1	4.23	0.04	0.16	0.6	Mean of covariate Age at diagnosis=97.43
Attention problems	59	Parental conflict mean	1	4.34	0.04	0.11	0.52	Mean of covariate Conflict score=1.39
		Economic situation	2	5.09	0.01	0.23	0.78	*Low* 6.79 (4.85-9.73) / *Medium* 4.19 (2.80-5.57) / *High* 2.34 (0.58-4.1)
Internalizing symptoms	59	Father's education level	3	3.24	0.03	0.22	0.69	*5 ys schooling* 16.9 (9.7-74.1) / *8 ys schooling* 4.8 (1.13-8.5) / *13 ys schooling* 5.89 (3.31-8.46) / *>13 ys schooling* 6.75 (3.07-10.42)
Externalizing symptoms	59	Parental conflict mean	1	3.71	0.05	0.10	0.46	Mean of covariate Conflict score=1.39
DSM-oriented scale II Anxiety	59	Father's education level	3	4.73	0.007	0.29	0.86	*5 ys schooling* 4.5 (2.68-6.33) / *8 ys schooling* 1.3 (0.37-2.23) / *13 ys schooling* 1.5 (0.86-2.16) / *>13 ys schooling* 1.46 (0.54-2.4)
		Economic situation	2	4.13	0.02	0.19	0.69	*Low* 2.55 (1.16-3.95) / *Medium* 2.11 (1.45-2.77) / *High* 0.57 (0.26-1.41)
DSM-oriented Scale III Somatic		Father's education level	3	11.36	0.0001	0.5	1	*5 ys schooling* 4.6 (3.25-5.96) / *8 ys schooling* 1.08 (0.39-1.77) / *13 ys schooling* 0.76 (0.27-1.24) / *>13 ys schooling* 2.04 (1.35-2.73)
	59	Age at diagnosis	1	3.82	0.005	0.10	0.47	Mean of covariate Age at diagnosis=97.43
DSM-oriented Scale IV Thought	59	Parental conflict mean	1	4.71	0.03	0.12	0.56	Mean of covariate Conflict score=1.39

IV = Father's education level (5 years of schooling, 8 years of schooling, 13 years of schooling, Graduation), Economic condition (Low, Medium, High); Age at assessment (8-10 years old; 11-18 years old) COV = age at diagnosis, Parental conflict mean, duration of illness. DV=Outcome CBCL
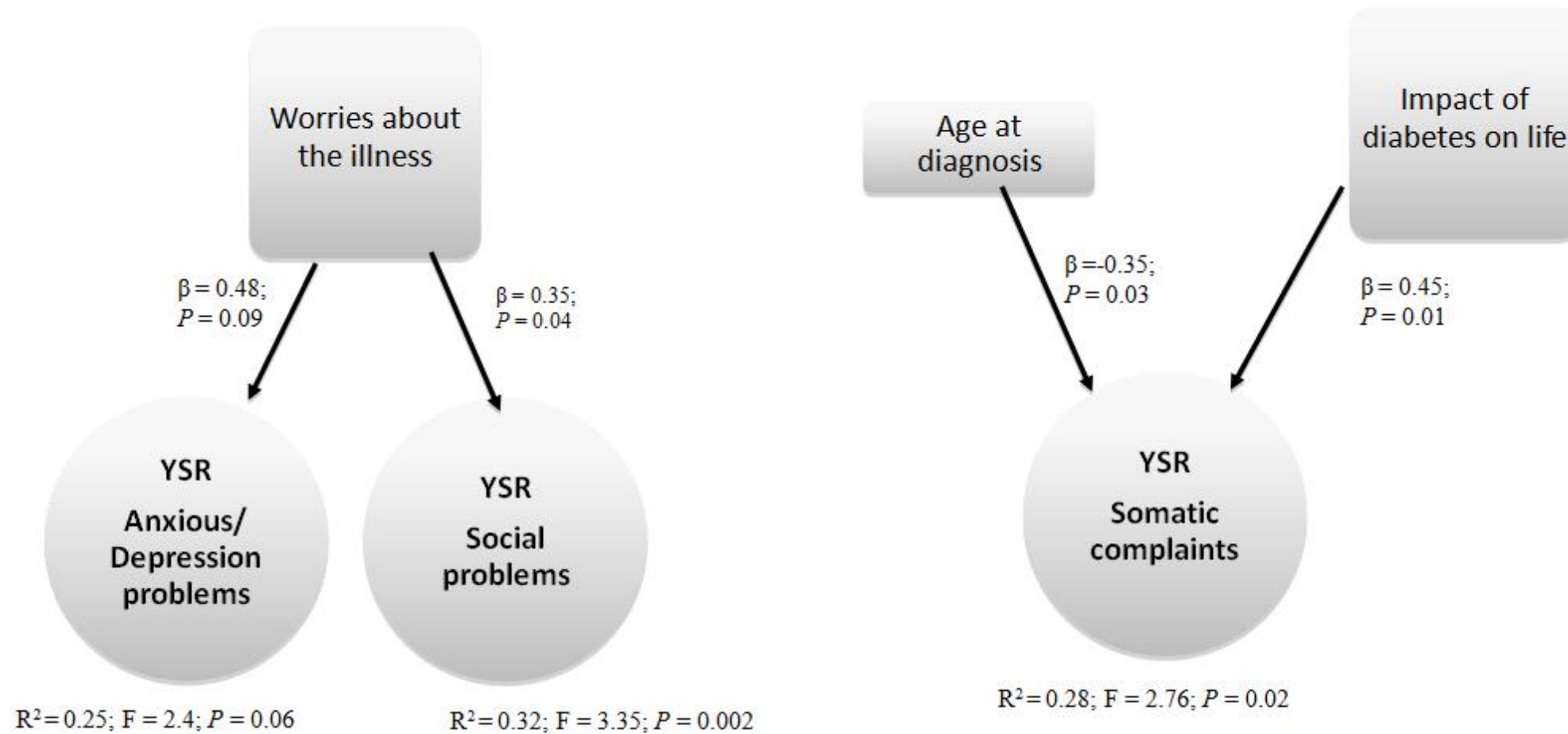*ANCOVA: analysis of covariance*

Fig. 4. Predictive factors of YSR scale I, III, IV
Legend, Rectangle: Independent variables; Square: modifiable Independent variables; Circle: Dependent variables
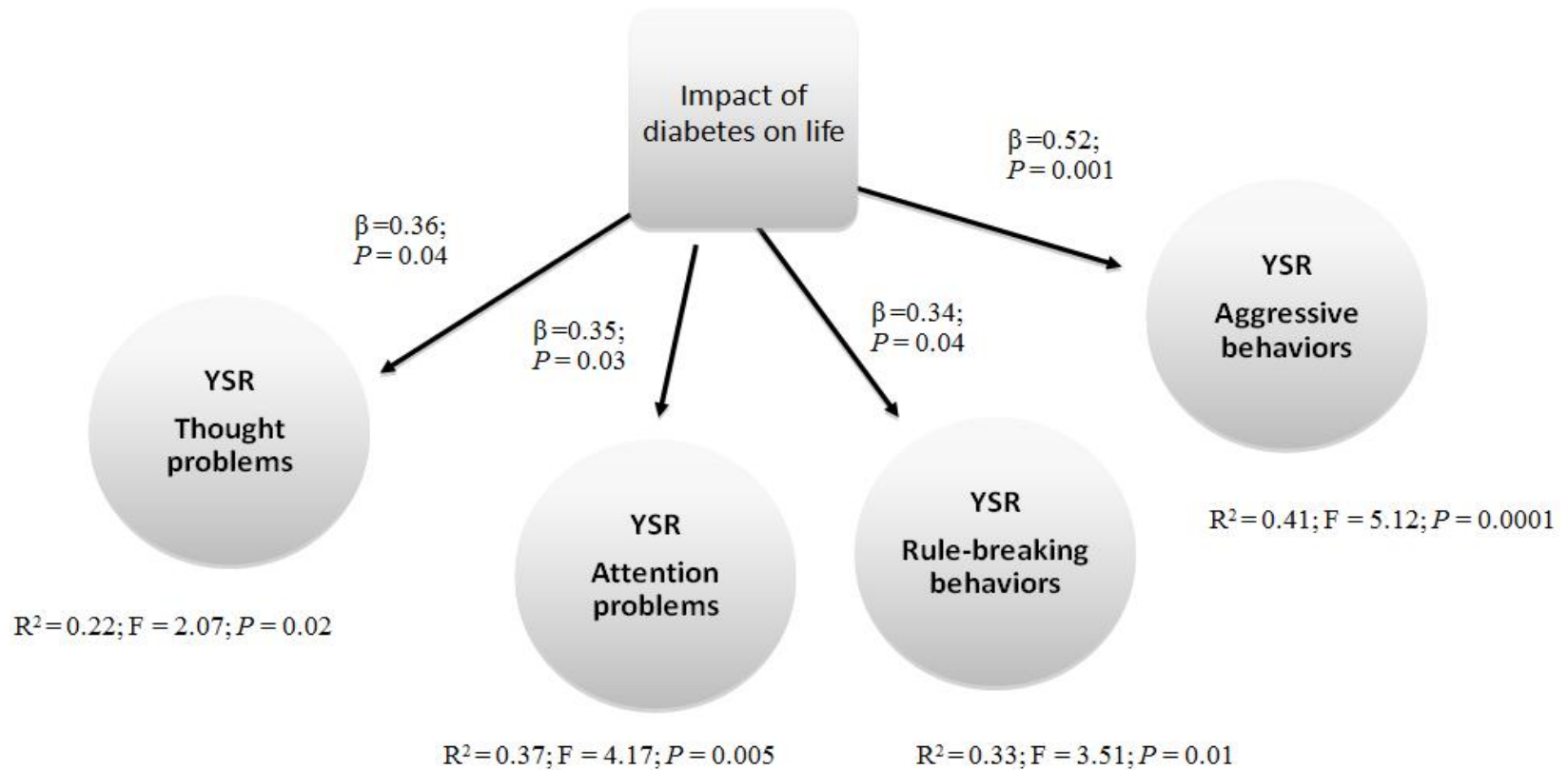
Fig. 5. Predictive factors of ysr scales V, VI, VII, VIII
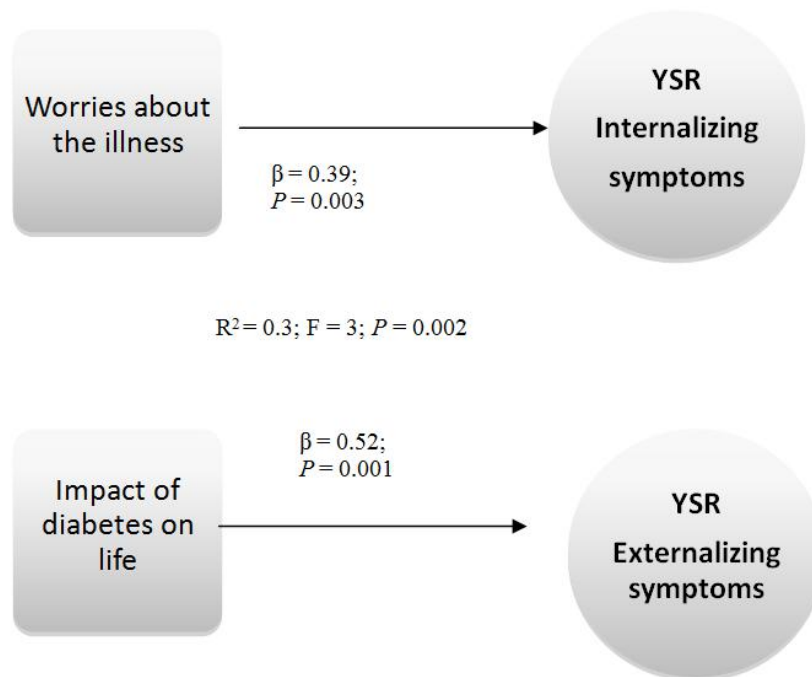*Legend, Rectangle: Independent variables; Circle: Dependent variables*

Fig. 6. Predictive factors of YSR internalizing and externalizing symptoms

3.7 Comparison between Pre-adolescents and Adolescents with Diabetes and Controls' Psychological Symptoms

Pre-adolescents and adolescents with diabetes showed significantly fewer psychological symptoms than matched healthy peers. In the following scales patients reported fewer problems: depression (t_{44}=-3.86; P=0.0001; d=1.15), somatic complaints (t_{44}=-3.86; P=0.0001; d=0.85), social problems (t_{44}=-2.84; P=0.007; d=0.69), thought problems (t_{44}=-5.13; P=0.0001; d=1.53), attention problems (t_{44}=-3.21; P=0.002; d=0.96), internalizing symptoms (t_{44}=-3.06; P=0.004; d=0.91), except for DSM-oriented scale conduct problems (t_{44}=3.87; P=0.0001; d=1.15) where they showed more problems.

For competencies, the diabetes group reported more social relationships (t_{45}=2.83; P=0.007; d=0.84), and a better global competence (t_{43}=2.11; P=0.04; d=0.63) than the controls (Fig. 7).

4. DISCUSSION

Health status, psychological symptoms, quality of life and family conflicts are important research and clinical issues in pediatric diabetes care,

which this study addressed for the first time in the South Tyrol district, in the north of Italy.

The inadequate glycemic control reported by these patients is alarming for the possible short- and long-term negative effects on their health, so that it is fundamental to understand the risk factors of this poor treatment adherence. This study confirmed [25,26] as risk factors poor economic situation and longer duration of illness, while older age did not emerge as significant predictive factor of risk for glycemic control, as suggested by other studies [9], neither did family conflict [15,24].

Consistent with some of the studies on psychological adjustment in pediatric patients with T1D [15,16], the pediatric patients showed few psychological symptoms and a generally good quality of life in parental reports. The comparison of adolescents with diabetes I with matched healthy peers showed in the diabetes group better psychological functioning than their peers, except for conduct problems, which were more frequently reported. The only domains where the patients could be categorized clinic or borderline along psychopathology indexes, according to parental and self-reports, were the quantity of total competencies and activities performed, which could be associated with the
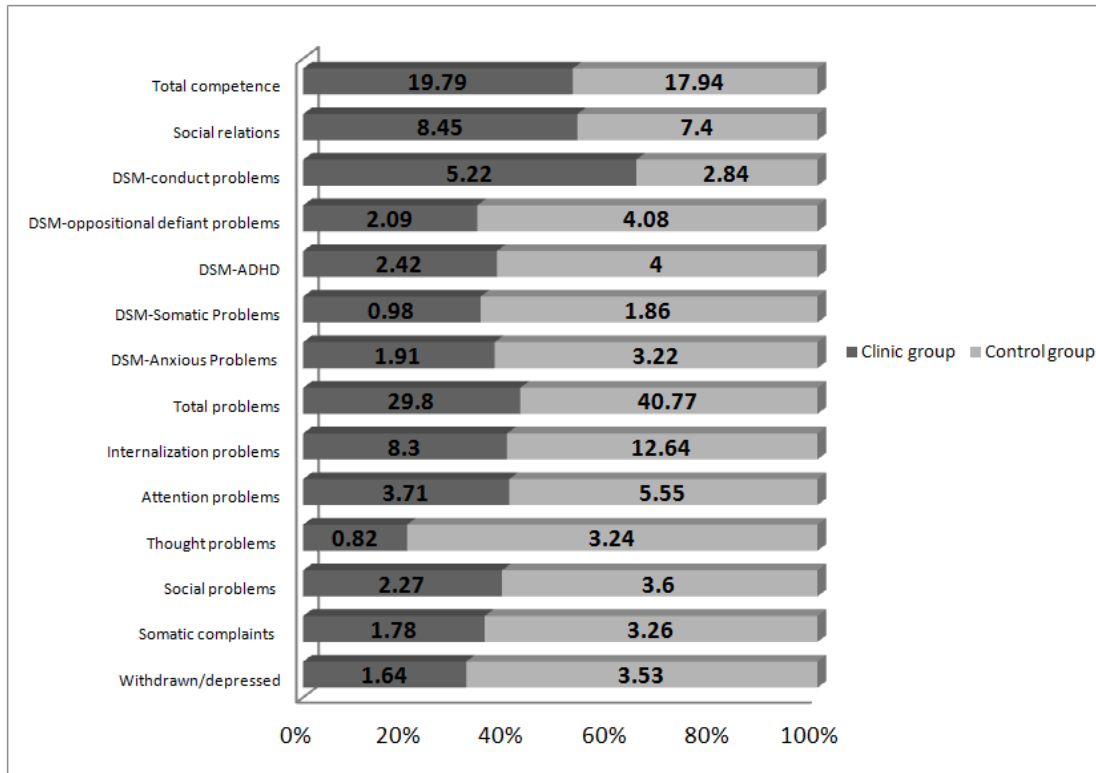
Fig. 7. Self-reported psychological symptoms by the adolescents with diabetes (N= 45) and controls (N= 45)

high prevalence of inadequate glycosylated hemoglobin found by the physicians at the medical follow-up.

Another aim of this study was to identify stable and modifiable risk factors on psychological functioning of pediatric patients with T1D. Our results did not confirm high glycosylated hemoglobin as a key factor, as the literature suggested [9,12,13,22] nor older age at the assessment [9,10]. Only the somatic complaints reported by adolescents were higher, but with lower patient's age at the assessment and a perceived self-report higher impact of disease on their life. The glycosylated hemoglobin seemed to be associated negatively only with quality of life perceptions in pre-adolescents and adolescents, specifically in the dimension of worries about the illness [12].

The other significant risk factors for psychological problems reported by parents (somatic, internalizing symptoms, anxiety DSM-oriented scale) were principally stable factors related to family conditions such as father's low education status, a factor that emerged as associated only with treatment adherence in the precedent

studies [26], and a low economic situation. Father's educational status emerged as new predictive factors from parents' reports on their children's psychological well-being. Probably the parents with lower educational status and a lower economic condition show more difficulties in care-giving, especially in supporting their children in their emotive regulation. Future studies with larger samples could better explain this result.

Parental conflict score was identified as a key element to impact on externalizing symptoms (confirming the results obtained by Luyckx et al. [22]), on thought DSM- oriented scale and also on attention symptoms. Attention functioning was also influenced by the lower age at the diagnosis, confirming the studies that found more problems in attention/executive function skills in children with early-onset diabetes than late-onset diabetes [14]. An innovative finding was that the conflict declared by parents with their children in the daily management of the illness influenced thought and attention functioning in their pre-adolescents and adolescents. Family involvement and support in management of the illness emerged as protective factors [13,29], in

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this study also in the development of possible attentional or thought deficit.

Adolescents' reports on symptomatology (especially related to anxiety/depression, internalizing and social problems) were predicted by greater worries about the illness. A high and negative impact of diabetes on daily life self-reported by the young patients negatively influenced their psychological functioning, especially somatic and attention problems the global scale of externalizing symptoms (specifically, rule-breaking and aggressive behaviors).

Parents were highly influenced by their conflicts with children over treatment adherence in reporting externalizing symptoms, while children and adolescents were more influenced by their worries about the illness and its influence on their daily life in reporting their emotional status.

It is important at this point to understand if the declared symptomatology changed depending upon the informant, whether the parent or the young patient. The inter-rater agreement in reporting psychological symptoms was very low and only occurred in a few specific psychological functions, such as withdrawal/depression and DSM-oppositional defiant problems. This indicates that it is important to have information about patients' psychological well-being both according to their own opinions and their parents' opinions. There was instead good agreement in their reports of family conflicts, even if we have seen how this factor could be predictive only for parents and not for children's and adolescents' points of view. Parents' reports could be informative to understand their own psychological well-being, especially in their care-giving role and cultural differences in parenting.

Some of the limits of this study are that only the Italian clinic population of South Tyrol was involved, so the study lacks generalizability to all the Italian population. It would be useful to involve other Italian centers both in the south (i.e. Sardinia) and in the center. The number of patients involved are reduced and mainly concentrated into the pre-adolescent and adolescent age. It is necessary to make the sample more homogenous by current age and age at the diagnosis, seeing the important factor of age at the diagnosis that influenced the somatic complaints.

It would be interesting also to have a longitudinal design for the study, not just a one-time-point design. In addition, the self-reported questionnaires are not a strictly objective measure as respondents may answer questions in order to be viewed favorably by others. This bias can interfere with the interpretation of average tendencies as well as individual differences. Future studies should take into consideration other measures such as focus groups, especially for adolescents, where they could more freely express their specific needs and their worries. Another possible limit is that some of the statistical differences found between clinic group and control one could be statistically significant but perhaps these results didn't give a meaningful clinical suggestion for these patients.

The strengths of this study are the inclusion of only one type of diabetes, and the matched control group that completed the same questionnaires which allowed for the comparison between patients and their peers. The multi-method approach and double-informant perceptions (parent and child) is also an added value to this study. The cultural differences should be taken into consideration for psychological interventions both for patients and their parents.

5. CONCLUSION

With this study, new in the Italian context, it will be possible to set up a useful psycho-social screening to identify pediatric patients with diabetes who are more at risk of psychological symptoms, poor glycemic control and maladaptive adaptation to the illness. The health professionals who take care of these patients could work together to dampen the dangerous metabolic control indexes and to improve the quality of life of these children/adolescents and their families, so they can have as much of a normal life as possible. Examining the family conflicts and the parenting practices, it will be possible to set up specific psycho-social interventions to increase adolescents' treatment adherence and to mitigate the family conflicts that may arise in the context of the daily management of the illness.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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