Association between Socioeconomic Status and Glycemic Control in Children with Type 1 Diabetes Mellitus

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Abstract

Background: Considering the higher rate of suboptimal glycemic control in type 1 diabetic(T1DM) children and the increasing trend of T1DM in our community and worldwide and the role of glycemic control in preventing complications of the patients along with the lack of studies regarding the role of family socioeconomic status (SES) and its indicators in our community, we aimed to investigate the association between family SES and glycemic control in children and adolescents with T1DM in Isfahan, Iran.

Methods: In this cross sectional study, T1DM patients aged 1-18 years were enrolled. The patients were classified into two groups, with and without appropriate glycemic control, based on the mean of the last three HbA1c mean levels. The characteristics of the patients in different categories of family SES were compared and the associations were evaluated.

Results: In this study 312 children with T1DM (156 with and without optimal glycemic control) and their families were evaluated. Low, moderate and high family SES was presented in 20.4%, 71.6% and 8% of the total population. Frequency of low SES was significantly higher in patients with poor glycemic control (P<0.001).There was significant positive association between family SES and appropriate glycemic control (P<001, OR=6.63, CI95%; 2.2-19.3).

Conclusion: Our findings indicated that in accordance with previous studies, the SES of Iranian families, assessed by multiple factors of parents' and families' characteristics, is associated with glycemic control of children with T1DM. These findings would be helpful for health care professionals to design more comprehensive programs based on the SES of the patients' families as well as healthcare policymakers to properly allocate resources in order to obtain more appropriate glycemic control for all patients with T1DM.

Key Words: Glycemic control, Socioeconomic status, Type 1 diabetes mellitus.

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1- INTRODUCTION

Type 1 diabetes mellitus (T1DM) is one of the most common endocrine disorders in children (1). Epidemiologic data has indicated that the incidence of T1DM has an increasing trend worldwide(2) and the trend is significantly higher in developing countries and those with low to intermediate incidence rate of the disease(3).

T1DM is related to higher rates of mortality and morbidity. Research evidence has demonstrated an association between good glycemic control and low rates of T1DM related complications (4-6). In addition, in spite of recent advances in the management of the disease in order to improve the process of diabetes self-management and glycemic control in this group of patients, there are many challenges including health and social inequalities in this field and it is estimated that 56% of children with T1DM have poor glycemic control(7). The rate seems to be higher in developing countries and in families with low socioeconomic conditions. Results of a recent study from our study population indicated that about 85.5% of the diabetic patients had suboptimal glycemic control (8).

Different factors are responsible for the high reported rate of poor glycemic control, one of the factors which is also evaluated by other studies and could influence other related factors is the socioeconomic status of the patients' families. Some studies have found higher levels of HbA1c are associated with low socioeconomic status (SES) (9-11). A recent review indicated that the young population with T1DM and lower SES has higher HbA1c than those with higher SES (12).

The American Diabetes Association (ADA) has introduced some health inequalities due to the different social factors such as family SES in T1DM outcomes (13). Accordingly, they have recommended that for improving diabetes management and outcomes, it is necessary to determine the patients' social needs related to such inequalities (13). Considering the impact of race/ethnicity in the mentioned inequalities, appropriate approaches should be developed for each community and the evaluations should be accessed in each community (13, 14).

Considering the high rate of suboptimal glycemic control in our population (8), the increasing trend of T1DM in our community and worldwide, and the role of glycemic control in preventing both short and long term complication of the patients, along with the lack of studies regarding the impact of family SES and its indicators in our community, we aimed to investigate the association between family SES and glycemic control in children and adolescents with T1DM in Isfahan, Iran.

2- MATERIALS and Methods

In this cross sectional study, T1DM patients, aged 1-18 years old referred to diabetes clinics of Imam Hossein children's hospital and pediatric endocrinologists of Isfahan city, were enrolled. The patients were selected by simple randomization method. T1DM patients, who had at least three HbA1c measurements during the previous year with diabetes' duration of more than 1 year, were included. Patients with other diseases or conditions which influence their glycemic control were excluded.

The patients were classified in two groups, with and without appropriate glycemic control, based on the mean of the last three HbA1c evaluations. According to the ADA guideline, those with HbA1c<7% were considered as patients with optimal glycemic control and those with HbA1c>7% as those with poor glycemic control.

Using a checklist, the patients' demographic information and T1DM

diagnosis results along with the treatment and anthropometrics characteristics were recorded. SES of the patients' family was determined based on the protocol of the Progress in International Reading Literacy Study (PIRLS) (15).

Parents of the patients complete a standardized questionnaire for evaluation of the family SES. Using the Principle Component Analysis (PCA) method and family related variables such as parents' occupation and education, family possessions of private car(s), type of home (rental/private), personal computer, type of children's school (public/private), the weighted average of the variables were determined as the family SES score. The scores were categorized in tertiles (low, moderate and high SES).

The characteristics of the patients in different categories of family SES were compared and the associations were evaluated.

2-1. Data analysis

Data was analyzed by SPSS version 23. Continuous and categorical variables were presented as mean (SD) and frequency (%), respectively. Characteristics of the patients in the two groups of with and without optimal glycemic control were compared using t student and chi- square tests. The association between family SES and glycemic control were evaluated using logistic regression analysis.

3- RESULTS

In this study, 312 children with T1DM (156 with and 156 without optimal glycemic control) and their families were evaluated. 56.9% of the participants were female. Mean age of the participants was 7.91(4.2) years. Low, moderate and high SES was presented in 20.4%, 71.6% and 8% of the total population. 42-48% of the parents had diplomas and 85% of the mothers were housewives.

The characteristics of the studied population in the two groups are presented in **Table1**.

The frequencies of different categories of SES in the two studied groups are presented in **Fig. 1**. Frequency of low SES was significantly higher in patients with poor glycemic control (P<0.001).

Logistic Regression analysis indicated significant positive association between SES and appropriate glycemic control (P<001, OR=6.63, CI95%; 2.2-19.3).

4- DISCUSSION

In this study we investigated the association between SES and its determinants with glycemic control of children and adolescents with T1DM in Isfahan. Our findings provide evidence that SES determined by parents' related variables and family assets are negatively associated with the HbA1c level of T1DM patients. Previous studies have also documented an independent association between SES indicators and glycemic control among patients with T1DM (16-18). Some studies have evaluated the role of SES as a combination of different related social or familial indicators. However, the indicators of SES in the mentioned studies were not similar in different studies and communities. It is suggested that the selected variables were based on the characteristics of each community. Most of the studies have shown significant associations between SES and glycemic control (9-12).

In a recent study in the USA, Fegan-Bohm et al. investigated the association between SES, diabetes distress, and glycemic control. Diabetes distress was evaluated by age-appropriate Problem Areas in Diabetes (PAID) questionnaires in T1DM patients aged 9-13 years. Based on their findings, children with low SES had higher PAID scores and the PAID score was the best predictive factor for elevated HbA1c (19).

Table-1: Demographic characteristics of the T1DM patients with optimal and non-optimal glycemic control

Variables		T1DM patient With optimal glycemic control	T1DM patient With Poor glycemic control	Total population	P value
Age (years)*		7.83(4.7)	8.01(3.9)	7.91(4.2)	0.34
Gender (female/male)		83(55.3%)/67(44.7%)	87(58.4%)/62(41.6%)	170(56.9%)/129(43.1%)	0.59
Region Urban/Rural		140(93.3%)/10(6.7%)	129(86.6%)/20(13.4%)	269(89.9%)/30(10.1%)	0.05
HbA1c (%)*		6.78(1.79)	8.91(2.54)	7.44(2.17)	0.04
Duration of diabetes (years)*		6.72(2.81)	6.95(2.43)	6.79(2.64)	0.41
Age at diagnosis (years old)*		7.2(2.91)	7.74(3.25)	7.46(3.07)	0.38
Type of home	Private	98(65.3%)	102(68.5%)	200(66%)	0.71
	Rent	52(34.7%)	47(31.5%)	99(34%)	
Type of school	Public	101(67.3%)	100(67.1%)	201(72%)	0.04
	Private	44(29.3%)	34(22.8%)	78(28%)	
Personal computer		100(66.7%)	101(67.8%)	201(67%)	0.83
Personal car		112(74.7%)	112(75.2%	224(75%)	0.92
Father education	Illiterate	1(0.7%)	2(1.3%)	3(1/01%)	0.007
	Elementary	38(25.3%)	47(31.6%)	85(28.8%)	
	High school	56(37.3%)	69(46.3%)	125(42.4%)	
	Academic	52(34.7%)	30(20.2%)	82(27.7%)	
Mother's education	Illiterate	2(1.3%)	3(2.0%)	5(1.7%)	0.01
	Elementary	27(18%)	46(20.2%)	73(24.5%)	
	High school	75(50%)	67(45%)	142(47.6%)	
	Academic	46(30.7%)	32(21.4%)	78(26.2%)	
Father's occupation	Unemployed	3(2%)	3(2%)	6(2%)	0.04
	Worker	36(24%)	48(32.2%)	84(28.1%)	
	Employee	54(36%)	42(28.2%)	96(32.1%)	
	Farmer	1(0.7%)	3(2%)	4(1.3%)	
	Self-employed	52(34.7%)	51(34.2%)	103(34.5%)	
	not alive	4(2.7%)	2(1.3%)	6(2%)	
Mother's occupation	Housewife	124(82.7%)	132(88.6%)	256(85.9%)	0.02
	Worker	0(0%)	1(0.7%)	1(3%)	
	Employee	16(10.7%)	9(6%)	25(8.4%)	
	Farmer	0(0%)	1(0.7%)	1(3%)	
	Other	10(6.7%)	5(3.4%)	15(5%)	

In another recent study by Sutherland et al., the association between socioeconomic position (SEP) and glycemic control was studied among young adults with T1DM. They used more extensive determinants for SEP evaluation including family income, parental education, health insurance, household food insecurity, and participation in food assistance programs. They demonstrated that young patients with lower SEP are more likely (2.24 times higher) to have high levels of HbA1c (>9%) than those with lower SEP (20).

In a study in Brazil, Andrade et al. evaluated the association between SES and T1DM in 68 children. They reported that 73.5% of the patients had lower SES and poor glycemic control among them was 1.4 times higher than those with higher SES (21).
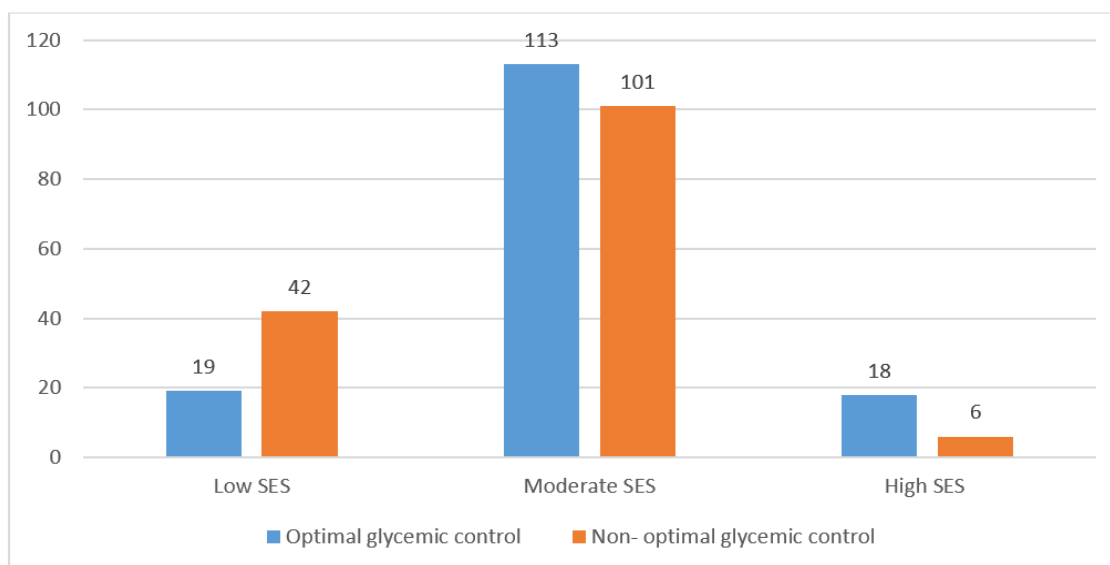
Fig. 1: Frequency of different categories of SES in T1DM patients with optimal and non-optimal glycemic control

Based on the results of this study, parents of those with good glycemic control had higher levels of education. And the frequency of employed parents was significantly higher among the patients with appropriate glycemic control.

In a study in Saudi Arabia, the fathers' and mothers' occupations and educational levels were associated with T1DM children's glycemic control. It was revealed that the association was more prominent for fathers than mothers (22).

Findings of a nationwide longitudinal study from Denmark, demonstrated that maternal education level (high school vs. master's degree) could explain 41% of the differences in HbA1c level of diabetic children (23).

Similarly, in another study from a developing country, Alassaf et al. indicated that SES and maternal level of education were associated with glycemic control of T1DM children (24).

Gesuita et al. in Italy, indicated that in addition to personal and clinical characteristics of T1DM patients, their family characteristics including SES and parental education are associated with

level of HbA1c (25). According to the findings of the current research and previous studies in this field, parents' education and occupation can be considered as the most important determinants of family SES; so, it can be suggested that increasing the information of the parents of families with low SES about diabetes and its complications along with providing facilities for consulting and educating them will minimize the effect of other determinants of low SES.

It is also recommended that the education which is provided for T1DM patients and their families be based on their SES. Physicians, health care staff and nutritionists who are involved in the management of this group of patients and families should be trained in this field in order to provide the best fitted management programs for families with different SES. In addition, health care policy makers should allocate resources based on the families' SES. Researchers can also plan interventional studies on equitable management programs to decline the impact of SES on the outcomes of T1DM.

4-1. Limitations of the study

The main limitations of the current study included its small sample size and the cross sectional design of the study. However, its analytical simplicity and high descriptive potential made the findings useful baseline information for health care programming.

In this study we used the validated questionnaire for Iranian families with a consideration to family related factors such as parents' occupation and education, family possessions of private car, type of home (rental/private), personal computer, and type of the children's school (public/private). Some recent studies have reported that other variables such as health insurance, housing stability and food security also have important roles in diabetes outcome. In this study, however, we did not evaluate the mentioned factors.

Recently Liese et al. indicated that the inequalities in glycemic control of T1DM are, mainly, the consequences of intersection between race/ethnicity, SEP and clinical characteristics (26).

Thus, evaluation of other determining factors as mentioned above and their interaction with current evaluated SES, in further studies, would be helpful for healthcare systems.

The strength of the current study was that it was the first study in our region which investigated the association between SES and its components and glycemic control in children with T1DM.

5- CONCLUSION

Our findings indicated that in accordance with previous studies, the SES of Iranian families, assessed by multiple factors including parents' and families' characteristics, is associated with glycemic control of children with T1DM. These findings would be helpful for health care professionals to design more comprehensive programs based on the SES of the patients' families and for healthcare policymakers to properly allocate resources in order to obtain more appropriate glycemic control in this group of high-risk children and consequently reduce T1DM-related complications.

6- ETHICAL CONSIDERATIONS

The protocol of the study was approved by the pediatrics research board and ethics committee of Isfahan University of Medical Sciences with a research code of 397408 and ethics code of IR.MUI.MED.REC.1397.180. Oral assent and written informed consent were also obtained from the children or their parents.

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