ORİJİNAL ARAŞTIRMA ORIGINAL RESEARCH

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The Effects of Locus of Control and Parental Attitudes on the Management of Diabetes in Adolescents with Type 1 Diabetes Mellitus

Tip 1 Diyabetli Adölesanların Denetim Odağı Düzeylerinin ve Anne-Baba Tutumlarının Diyabetin Yönetimine Etkisi

Hamide COŞKUN ERÇELİK[a], Bengü ÇETİNKAYA[b]

[a]Süleyman Demirel University Health Research and Application Center, Isparta, TURKEY
[b]Department of Pediatric Nursing, Pamukkale University Faculty of Health Sciences, Denizli, TURKEY

ABSTRACT Objective: This study sought to evaluate the effects of locus of control and parental attitudes on the management of Type 1 diabetes mellitus in adolescents with Type 1 diabetes mellitus. **Material and Methods:** The study was designed as a descriptive and cross-sectional study and was conducted with 74 adolescents between the ages of 13 and 16 years with Type 1 diabetes mellitus. The study data were collected using the Adolescents with Diabetes Information Form, Internal-external Locus of Control Scale, Parental Attitudes Scale and Metabolic Control Results Form in face-to-face interviews at Süleyman Demirel University Research and Application Hospital and Pamukkale University Hospital located in the Aegean and Mediterranean regions of Turkey. The study data were analyzed using Predictive Analytics Software 18. The study variables were analyzed using parametric statistical techniques, independent samples t-test and the Pearson correlation test. Furthermore, the Kolmogorov-Smirnov test was used to determine whether the variables show normal distribution or not; $p<0.05$ value was accepted as the level of statistical significance. Finally, descriptive statistics were also used in the study. **Results:** A significant difference between locus of control and fasting plasma glucose and HbA1c levels in adolescents with Type 1 diabetes mellitus ($p<0.05$). The study results also suggested a significant relationship between democratic parental attitudes and HbA1c levels, between protective-demanding parental attitudes and fasting plasma glucose variables, and between authoritarian parental attitudes and fasting plasma glucose variables ($p<0.05$). **Conclusion:** The study results indicated that locus of control and parental attitudes in adolescents with Type 1 diabetes mellitus had a far-reaching impact on diabetes management.

Keywords: Adolescent; diabetes mellitus; internal-external control; attitude; parents

ÖZET Amaç: Bu çalışma, Tip 1 diabetes mellituslu adölesanların denetim odağı düzeyinin ve anne-baba tutumlarının Tip 1 diabetes mellitusun yönetimine etkisini değerlendirmek amacıyla yapılmıştır. **Gereç ve Yöntemler:** Tanımlayıcı ve kesitsel tipte olan araştırmanın verileri, Türkiye'nin Ege ve Akdeniz bölgelerinde bulunan Süleyman Demirel Üniversitesi Araştırma ve Uygulama Hastanesi ile Pamukkale Üniversitesi Hastanesi'nde yürütülmüştür. Araştırmaya 13-16 yaş grubunda, Tip 1 diyabet tanılı, diyabet yönetimi konusunda eğitim almış 74 adölesan alınmıştır. Veriler, Diyabetli Adölesanı Tanıtıcı Bilgi Formu, İç-Dış Denetim Odağı Ölçeği, Anne-Baba Tutumları Ölçeği ve Metabolik Kontrol Sonuçları Formu ile yüz yüze görüşme tekniğiyle toplanmıştır. Verilerin analizi, "Predictive Analytics Software 18" programı ile yapılmıştır. Değişkenler, parametrik istatistiksel tekniklerden bağımsız örneklem t-testi, Pearson korelasyon testi ile analiz edilmiştir. Değişkenlerin normal dağılım gösterip göstermediklerini belirlemek amacıyla tek örneklem Kolmogorov-Smirnov testi uygulanmıştır. Çalışmada, $p<0,05$ değeri istatistiksel olarak anlamlı kabul edilmiştir. Tanımlayıcı istatistikler de çalışmada kullanılmıştır. **Bulgular:** Tip 1 diabetes mellituslu adölesanların denetim odağı durumu ile açlık kan şekeri ve HbA1c arasında anlamlı bir fark saptanmıştır ($p<0,05$). Denetim odağı durumu ile tokluk kan şekeri arasında anlamlı bir ilişki saptanmamıştır ($p>0,05$). Demokratik anne-baba tutumları ile HbA1c değişkeni arasında anlamlı bir ilişkinin olduğu belirlenmiştir ($r=0,236$, $p<0,05$). Koruyucu-istekçi anne-baba tutumları ile açlık kan şekeri değişkeni arasında anlamlı bir ilişki saptanmıştır ($r=0,285$, $p<0,05$). Otoriter anne-baba tutumları ile açlık kan şekeri değişkeni arasında anlamlı bir ilişkinin olduğu saptanmıştır ($r=0,391$, $p<0,05$). **Sonuç:** Bu çalışma, Tip 1 diabetes mellituslu adölesanların diyabet yönetiminin, onların denetim odağı düzeylerinden ve anne-baba tutumlarından etkilendiğini göstermektedir.

Anahtar Kelimeler: Adölesan; diabetes mellitus; iç-dış kontrol; tutum; ebeveynler

Correspondence: Bengü ÇETİNKAYA
Department of Pediatric Nursing, Pamukkale University Faculty of Health Sciences, Denizli, TURKEY/TÜRKİYE
E-mail: bcetinkaya@pau.edu.tr

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Type 1 diabetes mellitus (T1DM) which results from the autoimmune destruction of insulin-producing pancreatic beta cells, is the most common type of diabetes in children and adolescents.[1,2] Data collected by the International Diabetes Federation (2017) show that 1,106,500 children and adolescents between 0 and 19 years of age have T1DM, and every year, 132,600 new T1DM patients are diagnosed worldwide. The prevalence of T1DM in children under 18 years old was 0.75/1,000, and the total incidence was 10/100,000 in Turkey.[3]

Chronic diseases in childhood and adolescence may adversely affect the development of certain personality traits, and among these, locus of control (LC) plays a significant role.[4] The concept of LC was first developed by Rotter, who designed a scale and defined one end of the spectrum as the internal locus of control (ILC) and the other end as the external locus of control (ELC).[5] Whether children have an ILC or ELC determines their recognition and perception of the disease.[4]

Health locus of control (HLC) is frequently used to define one's control over one's own health outcomes.[6] Recent studies have shown that individuals with internal supervision assign more value to their health and undertake greater responsibility regarding preventive health practices. It was also noted that individuals with ILC tend to display a more positive attitude towards health than those with ELC.[7-10]

The study results further confirmed the correlation between diabetes management and LC.[11,12] Nabors et al. found that HbA1c levels were much lower (better) in children with high ILC scores. It was also reported that HbA1c levels were higher in patients with negative health attitudes and low ILC scores.[12] Morowatisharifabad et al. similarly noted a positive correlation between compliance with diabetes regimens and ILC; they also pointed out a negative correlation between the former and a fatalistic LC.[11]

It has been widely reported that parents whose children have T1DM are frequently challenged by the management of the disease and express concerns about poor metabolic control.[13]

Carroll and Marrero stated that parents with children who have diabetes reported that compliance with treatment becomes even more difficult during adolescence.[14] It is critically important for parents to establish positive and supportive relationships with their adolescent children in order to maintain metabolic control of the disease.[15,16] Establishing open, clear, supportive, and respectful communication with adolescents also enables their better adjustment to the disease. However, when parents demonstrate extremely protective, restrictive, prohibitive attitudes towards their adolescent children, these attitudes may negatively affect glycemic control and complicate their adolescents' adjustment to treatment.[17]

Geffken et al. focused on adolescents diagnosed with T1DM with or without the experience of diabetic ketoacidosis and found a lower incidence of ketoacidosis in children whose parents strive to establish warm, positive and acknowledging communication with their children.[18]

By contrast, in their study, Baykara et al. reported that over-interventionist and protective mothers whose children were diagnosed with T1DM had deliberately higher scores. The study results also indicated that non-democratic, over-interventionist, and protective parental attitudes can lead to parent-adolescent conflicts. These can eventually cause adolescents with T1DM to fail to undertake sufficient responsibility for their diabetes management, resulting in problems related tothe administration of injections, blood sugar monitoring, and dietary compliance.[19]

Adolescence is often considered a critical and vital period in the formation of healthy behaviors, and thisis confirmed by the increasing numbers of studies on adolescence and health globally. Nurses can help improve the health of adolescents by using current study results in the care of adolescents with T1DM. This research, therefore, aims to investigate the correlation between LC and attitudes of parents with adolescent children with T1DM and to assess the effects of LC and parental attitudes on the management of T1DM.

MATERIAL AND METHODS

STUDY DESIGN AND SETTING

This study was designed as a descriptive and cross-sectional study and conducted in pediatric endocrinology units and pediatric units in Süleyman Demirel University Research and Application Hospital and Pamukkale University Hospital located in the Aegean and Mediterranean regions of Turkey.

STUDY PARTICIPANTS

The study participants included adolescents between the ages of 13 and 16 years with diabetes mellitus who had been diagnosed with T1DM. In this particular study, the power analysis indicated that the number of participants in the sample was 58, given that the significance level was $\alpha=0.05$ ($p<0.05$), $\beta=0.20$ and 1-β=power; and 1-0.20=0.80.[20] Accordingly, taking possible losses into account, 74 adolescents (25% more than the sample size) who met the inclusion criteria were included in the study.

DATA COLLECTION

The study data were collected using the Adolescents with Diabetes Information Form, Internal-external Locus of Control Scale (ILCS-ELCS), Parental Attitudes Scale (PAS), and metabolic control results form in face-to-face interviews.

The adolescents with diabetes information form basically inquires about the sociodemographic characteristics of adolescents and parents.

The ILCS-ELCS was developed by Nowicki-Strickland in 1973 and adapted for Turkish use by Öngen in 2003. The scale can be used in studies to be conducted with adolescents.

It consists of 29 items and 5 sub-dimensions. The scale is scored from strongly agree (1 point) to strongly disagree (4 points), and higher scores indicate ILC, while lower scores suggest external locus of control. The cronbach alpha value of the scale was found to be 0.72.[21]

The PAS was developed by Kuzgun and Eldeleklioğlu. The scale is used to measure how children/adolescents perceive the attitudes of their parents when raising children by children/adolescents. It comprises 40 questions and 3 sub-dimensions. The sub-dimensions were democratic parental attitude (DPA), authoritarian parental attitudes (APA) and protective-demanding parental attitudes (PDPA). The scale is scored from inappropriate (1 point) to completely appropriate (5 points). Higher scores in the sub-dimensions indicate that individuals perceive their parents as more DPA, more PDPA or more APA, while lower scores show that it is less likely for individuals to perceive their parents as DPA, PDPA, or APA. The highest score in the DPA and PDPA sub-dimensions was 75, and the lowest score was 15, where as the highest score in the sub-dimension APA was 50, and the lowest was 10. Cronbach alpha value was 0.90 for DPA sub-dimension, 0.79 for APA sub-dimension and 0.82 for PDPA sub-dimension.[22]

The metabolic control results form was designed by the researchers to evaluate adolescents'success in regard to their diabetes management; it includes questions about fasting plasma glucose (FPG), postprandial plasma glucose (PPG), and the most recent HbA1c values.

ETHICAL APPROVAL

Permission in writing was obtained from the Pamukkale University Non-interventional Clinical Research Board of Medical Ethics (Appraoval number: 60116787-020/7752, 6.2.2014) as well as from the author to use the internal-external locus of control scale to implement the study. All adolescent participants and their parents involved in the study were informed about the purpose of the study in advance, and their oral consent was obtained.This study was conducted according to the principles of the Declaration of Helsinki.

DATA ANALYSIS

The study data were analyzed using "Predictive Analytics Software" 18. The study variables were analyzed using parametric statistical techniques, independent samples t-test and the Pearson correlation test. Furthermore, the Kolmogorov-Smirnov test was used to determine whether the variables show normal distribution or not; $p<0.05$ value was accepted as the level of statistical significance. Finally, descriptive statistics were also used in the study.

The study participants were divided into two main groups, ILC or ELC groups, depending on their LC scores. Accordingly, those with lower scores (below the median) for each LC dimension were identified as the ELC group, and those with higher scores (above the median) were included in the ILC group. The participants with median scores between these two groups were included in the ILC group.[21]

RESULTS

Descriptive characteristics of adolescents with T1DM are shown in Table 1. It was found that a majority of the participants attended school, and more than half were diagnosed with T1DM between 6 months and 5 years ago. Age and sex-specific body mass index percentiles were also analyzed, and it was found that 12.2% of the participants had a low weight, 81.1% hada healthy weight and 6.7% were overweight. Determination of the underweight, normal, overweight or obesity of adolescents Centers for Disease Control and Prevention parameters were used.

TABLE 1: Descriptive characteristics of the adolescents with Type 1 diabetes mellitus (n=74).

Characteristics	n (%)	M±SD, range
Age (year)		
13	21 (28.4)	
14	15 (20.3)	
15	16 (21.6)	
16	22 (29.7)	
Sex		
Female	41 (55.4)	
Male	33 (44.6)	
Educational status		
Primary school	34 (45.9)	
High school	38 (51.4)	
Not attending	2 (2.7)	
Type 1 diabetes diagnosis		
6 months-5 years ago	46 (62.1)	
6-9 years ago	18 (24.3)	
10-16 years ago	10 (13.6)	
BMI percentile values		
Low weight (under 5. percentile)	9 (12.2)	
Healthy weight (between 5-85 percentile)	60 (81.1)	
Overweight (85-95 percentile)	5 (6.7)	
Maternal age		39.60±4.89, 32-55
Paternal age		43.86±6.27, 34-77
Maternal employment status		
Employed	10 (13.5)	
Unemployed	64 (86.5)	
Paternal employment status		
Employed	74 (100.0)	
Unemployed	-	

BMI: Body mass index; M: Mean; SD: Standard deviation.

TABLE 2: Characteristics of adolescents with Type 1 diabetes mellitus and their metabolic control results (n=74).

Characteristics	M±SD, range
Laboratory results	
FPG (mg/dL)/last 24 hrs	134.76±57.00, 49-300
PPG (mg/dL)/last 24 hrs	213.65±80.51, 106-490
HbA1c (%)	9.70±2.10, 5.56-14.19

FPG: Fasting plasma glucose; PPG: Postprandial plasma glucose; M: Mean; SD: Standard deviation.

The metabolic control results of the participants were additionally analyzed, and it was noted that the mean FPG for the previous 24 hours (mg/dL) was 134.76±57.00; PPG (mg/dL)/last 24 hrs was 213.65±80.51, and mean level of HbA1c (%) was 9.70±2.10 (Table 2).

It was further reported that the percentage of adolescents with ILC was 56.8%, and the rate of those with ELC was 43.2%. The effects of LC on metabolic control results were investigated.The results suggested a significant difference between LC and FPG and HbA1c levels ($p<0.05$). The metabolic control results of the ILC group were found to be better. Finally, it was noted that there was no significant relationship between LC and PPG levels ($p>0.05$) (Table 3).

Table 4 indicates the correlation between PAS and metabolic control results. It was reported that there was a statistically significant positive, direct proportion but quite low correlation between PDPA and the FPG variable at a significance level of 0.05 ($r=0.29$, $p<0.05$). Likewise, a statistically positive, directly proportional but rather low correlation was found between APA and the FPG variable ($r=0.39$, $p<0.05$).

It was suggested that there was a statistically positive, directly proportional yet considerably low correlation between DPA and HbA1c variable ($r=0.24$, $p<0.05$) (Figure 1).

DISCUSSION

This study aimed to investigate the effects of LC and parental attitudes on the management of diabetes in adolescents with T1DM. The results showed that ILC

TABLE 3: The effects of LC status on metabolic control results of adolescents with Type 1 diabetes mellitus (n=74).

Variables	LC	n	M±SD	t value	p value
FPG	ELC	32	149.88±65.89		
ILC		42	123.24±46.79	2.03	0.046
PPG	ELC	32	229.34±86.93		
ILC		42	201.69±74.08	1.48	0.144
HbA1c (%)	ELC	32	10.28±1.90		
ILC		42	9.25±2.16	2.13	0.037

FPG: Fasting plasma glucose; ILC: Internal locus of control; PPG: Postprandial plasma glucose; LC: Locus of control; ELC: External locus of control; M: Mean; SD: Standard deviation.

TABLE 4: Correlation between parental attitudes scale and metabolic control results (n=74).

	Parental Attitude		
Variable	DPA	PDPA	APA
Metabolic control results			
FPG	r=-0.12	r=0.29	r=0.39
	p=0.292	p=0.014*	p=0.001*
PPG	r=-0.09	r=0-.09	r=-0.02
	p=0.419	p=0.436	p=0.852
HbA1c (%)	r=0.24	r=0.13	r=0.02
	p=0.043*	p=0.269	p=0.901

*p<0.05.
DPA: Democratic parental attitude; PDPA: Protective-demanding parental attitudes; APA: Authoritarian parental attitudes; FPG: Fasting plasma glucose; PPG: Postprandial plasma glucose.

or ELC in adolescents with T1DM influenced the metabolic control results (Table 3).

The study findings were also confirmed by relevant studies on the correlation between positive attitudes towards health and LC. Steptoe and Wardle conducted a study with university students in 18 European countries and analyzed the correlation between LC and 10 different health-related behaviors (physical exercise, smoking, alcohol use, breakfast habits, tooth-brushing habits, seatbelt use, fruit consumption, fat consumption, fiber consumption, and use of salt). They also reported that positive attitudes towards health increased with increasing ILC, which was consistent with the findings of a similar study conducted by Tabak and Akköse.[8] Tabak and Akköse suggested that adolescents with a higher ILC perception tended to undertake responsibility for their health and were more active in promoting healthy behaviorssuch as engaging in physical exercise, not smoking, brushing their teeth and getting medical examinations.[9] Kneckt et al. further reported that people with high levels of ILC place particular emphasis on their oral health. They also pointed out that the correlation between tooth-brushing habits and LC indicated a remarkable shift towards the ILC.[7]

The findings of our study were also confirmed by another study conducted by Hekimoğlu and Şensoy, which suggested that individuals with higher levels of ILC deliberately undertake greater responsibility for sustaining their LC and engaging in preventive health practices.[10] Hong et al's study further demonstrated that patients with hypertension who have an ILC take their medications more regularly, which also confirmed our findings.[23]

The study results further suggested that the adolescents with an ILC had lower (better) HbA1c and FPG levels compared to those with an ELC. A review of the literature on LC and positive attitudes towards health suggests that metabolic control indicators of patients with an ILC should be expected to be better.

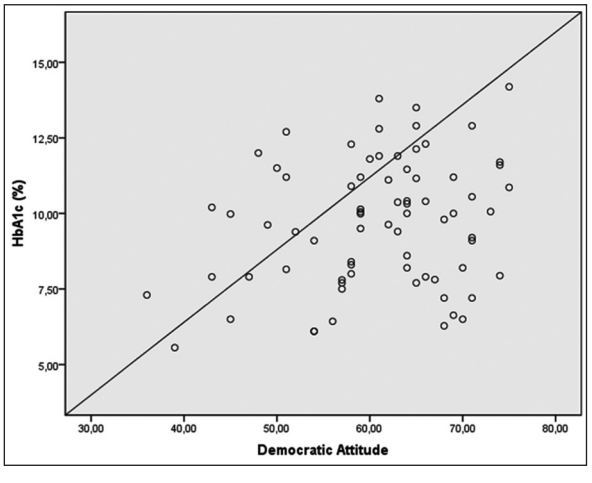

FIGURE 1: Correlation between democratic attitude and HbA1c.

Nevertheless, a similar literature review on LC and diabetes management may imply contradictory results.

Morowatisharifabad et al. reported a positive correlation between compliance with diabetes regimens and ILC.[11] Nabors et al. noted that HbA1c levels were lower (better) in children with higher scores for ILC. It was further concluded that HbA1c values were higher in patients with negative health attitudes and with low scores for ILC.[12] In our study, it was concluded that adolescents with an ILC had better management of their diabetes than those with an ELC, which aligned with the results of the studies mentioned above. In contrast to the findings of our study, Kneckt et al. indicated no correlation between diabetes, LC, HbA1c levels.[7] Mansour-Ghanaei reported no significant correlation between diabetes information, health beliefs, LC, and HbA1c levels in diabetic patients with T1DM in Iran.[24] That the study results differ considerably may result from the fact that attitudes towards health might be shaped by a variety of factors other than LC, that social characteristics of the study sample may be potentially different, and that the sample size may affect the results.

The results of our study emphasized a significant correlation between parental attitudes and metabolic control results of adolescents with T1DM (Table 4). Recent studies have also indicated that conflicts between children and adolescents with T1DM and their parents affected HbA1c levels. Leonard et al. reported that adolescents with higher (poor) HbA1c levels experienced more problems with their parents in regard to managing their diabetes than those with low (better) HbA1c levels.[25] Similarly, Williams et al. found that children and adolescents between the ages of 10 and 17.9 years with higher (poor) HbA1c levels reported problems with their parents more frequently with regard to the management of the disease.[26] The study results further demonstrated that HbA1c levels of adolescents whose parents had DPA were found to be higher. Recent research studies have already shown that DPA has a more positive impact on the treatment of adolescents with T1DM.[27] Helgeson et al. noted that metabolic control in adolescents with T1DM was poor during adolescence and that the supportive attitudes of parents greatly influenced metabolic control, which, indeed, contradicted the results of our study.[16]

The present study results additionally suggested that adolescents with PDPA had higher FPG levels and that children with T1DM who had authoritarian parents similarly had higher FPG levels. Anderson concluded that APA and family conflicts were associated with poor glycemic control and inefficiency in maintaining treatment.[28] Our results were further confirmed by Tsiouli, whose study identified that APA and dysfunctional intrafamily relationships were affiliated with poor glycemic control.[27] In contrast to the results of our study, Evans and Hughes controversially reported a common perception that APA was required to achieve better diabetic control.[29]

Carroll and Marrero investigated parental attitudes in adolescents with T1DM and found that mothers of adolescents with T1DM were concerned about their ability to manage diabetes, which consequently led to overprotective and accusatory attitudes.[14]

A majority of adolescents with T1DM are, seemingly, unable to adjust to diabetes management due to a variety of reasons such as the desire to be independent, individual characteristics or imperatives, and the complexity of diabetes management.[30] It can be concluded that ensuring metabolic control and undertaking the responsibility for an adolescent's disease management is possible only through positive parental attitudes.

CONCLUSION

The findings of the present study indicate that LC and parental attitudes have a certain impact on diabetes management in adolescents with T1DM. It was also reported that adolescents with an ILC had better metabolic control results than those with an ELC. It should be kept in mind that HLC is a crucial personal trait that enables individuals with an ILC to supervise their own health conditions and that it promotes desirable health attitudes. It was further found that parental attitudes have a far-reaching influence on maintaining metabolic control. For successful diabetes management, programs for adolescents should include their parents, who should be encouraged to participate in the education, care, and supervision of

diabetes. It is also suggested that parents refrain from over-interventionist and restrictive attitudes and that they are provided with training and counseling to encourage them to undertake responsibilities in diabetes management.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

All authors contributed equally while this study preparing.

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