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Effect of Mood on Blood Glucose Level among Adolescents with Type 1 Diabetes

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Abstract:- Background: Good mood control has an important effect on adolescents' control of their blood glucose level. Adolescents with diabetes face major stressors during the course of their disease which can lead to poor adherence to treatment plan and hormonal changes affecting proper glycemic control. Aim: The aim of this study was to examine the effect of mood as a predictor of blood glucose level in adolescents with type 1 diabetes. Materials &Methods: Research design: A descriptive cross- sectional design was utilized to conduct the study. Settings: Pediatrics clinic at Zagazig University Hospitals and the health insurance clinic for diabetes located at director street in Zagazig city. Tools of data collection: The following tools were used by the researcher for data collection, namely a Self-Administered Questionnaire including the following parts: socio-demographic data sheet, Profile of Mood States-Adolescents (POMS-A). Results: The results revealed that there was there was a statistically significant positive correlation between confusion and Random Blood Sugar (RBS) and between depression and HbA1c. Duration of T1D and depressive mood were the statistically significant independent positive predictors of a score of HbA1c. Conclusion: The current study concluded that depressed and confused mood have a significant effect on blood glucose level among diabetic adolescents. Recommendations: The adolescents with type 1 diabetes should be given health education programs about proper coping with mood disorders throughout their daily activities through teaching relaxation techniques, meditation and proper time management.

Keywords:- *Type 1 Diabetes , Blood Glucose Level; Adolescents; Mood.*

I. INTRODUCTION

Type 1 diabetes mellitus (T1DM) is a disorder of glucose homeostasis characterized by auto immune destruction of the insulin-producing pancreatic b-cell that progressively leads to insulin deficiency and resultant hyperglycemia. Type1 diabetes, once known as juvenile diabetes or insulin-dependent diabetes, is a chronic condition in which the pancreas produces little or no insulin, a hormone needed to allow sugar (glucose) to enter cells to produce energy (1).

Prevalence Rate of Type 1 diabetes in Egypt is about 95,164 cases, where as the incidence rate was about 8.0 per 100.000 population (2). Type 1 diabetes (T1DM) incidence and prevalence showed a progressive increase over a period of 18 years among children aged from 0 to 18 years living in the Nile Delta region. Higher T1DM occurrence was observed in rural areas and female predominance was evident. Seasonality in T1DM diagnosis was documented with a peak occurring in winter (3).

Mood disorders can affect blood sugar. Anxiety, fear, even that happy feeling can be stressful sometimes. When individuals are stressed – whether it's physical stress or mental stress –bodies produce hormones such as cortisol that can raise blood glucose even if individuals haven't eaten. These hormones are known as the "fight or flight" hormones which affect proper glucose metabolism (4).

The co-occurrence of mood disorders and diabetes is well documented, and both conditions frequently present together in the primary care setting. There is strong association between depressed mood and changes in fasting blood sugar levels in type 1 diabetes clients. depressed mood can lead to hyperglycemic episodes in some patients (5). Confused mood and tension can prevent the patient from adherence to treatment plan which can lead to hypoglycemic episodes (blood sugar is below 70 mg/ dl). Community health nurses have an important role and clear responsibilities during the management plan for adolescents with diabetes. It is essential to involve adolescents in all stages of management program development and implementation (6). Health education sessions provided by community health nurses should focus on diabetes as a chronic illness that requires careful medical attention and adaptation of personal lifestyles. Coping with mood disorders should include education about stress management and referral to required community resources (7).

II. SUBJECTS & METHODS

A. Study design and settings:

A descriptive cross-sectional design was utilized by the research team. Settings for the study were the outpatient

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clinics in Zagazig University Hospitals at the paediatrics unit and the health insurance clinic for diabetes located in Director street in Zagazig city.

B. Study population :

Adolescents aged from 12-18 years with type 1diabetes in Zagazig City. All the adolescents with type 1diabetes were eligible to participate in our current study.

C. Sample size:

The study comprised of a convenient sample of 80 adolescents diagnosed with type 1 diabetes who fulfilled the following criteria:

D. Inclusion criteria:

1- Age: 12-18years

2- Agree to participate in the study

E. Exclusion criteria:

1- Adolescents receiving drugs which affect blood glucose levels such as steroids and antipsychotic drugs

2- Adolescents suffering from short- or long-term pain.

F. Study Tools:

The following tool was used by the researcher for data collection, namely a Self- Administered Questionnaire including the following parts: socio-demographic data sheet, Profile of Mood States-Adolescents (POMS-A).

G. Reliability of the proposed tools was done by Cronbach's Alpha Test as the following:

	N of Items	Cronbach's Alpha
Mood scale	24	0.751

H. Ethical consideration:

Firstly, the Committee of Ethics at Faculty Of Nursing, Zagazig University approved the research protocol. At the time of data collection, each adolescent filled an informed verbal consent after full conversation about the aim and benefits of the study.

I. Statistical analysis:

SPSS 20.0 statistical program was used. We presented our data using descriptive frequencies and percentages for qualitative variables as descriptive statistics, and quantitative variables were calculated using means, standard deviations and median. chronbach's alpha test was used to calculate the reliability.

III. RESULTS

Table 1: Socio-demographic characteristics of adolescents in the study sample (n=80)

Socio-demographic characteristics	Frequency	Percent
Age:		
10-16	57	71.25
16-18	23	28.75
Range	10.0-18.0	
Mean±SD	14.3(2.0)	
Median	14.0	
Father education:		
None	6	7.5
Basic/intermediate	33	41.25
University	41	51.25
Father job:		
Employee	41	51.25
Worker	39	48.75
Mother education:		
None	10	12.5
Basic/intermediate	42	52.5
University	28	35.0
Mother job:		
Housewife	58	72.5
Working	22	27.5
Crowding index:		
<2	61	76.2
2+	19	23.8

Table 1. Reveals that the study sample involved 80 adolescents whose age ranged

10 to 18 years. Moreover, more than half of fathers of adolescents (51.3%) had university education and of mothers (52.5%) had basic/ intermediate education.

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Characteristics of T1D among adolescents	Frequency	Percent
Duration of T1D (years):		
<5	51	63.8
5+	29	36.3
Range	0.0-15.0	
Family history:		
No	37	46.3
Yes	43	53.8
Relation:		
1st degree	15	34.9
2nd degree	28	65.1
T1D complications:		
No	30	37.5
Yes	50	62.5
Complications (n=50):@		
Hypertension	4	5.0
Eye problems	30	37.5
Neurological	9	11.3
Delayed wound healing	2	2.5
Renal	3	3.8
Hepatic	3	3.8
Cardiovascular	1	1.3
Recurrent infections	6	7.5
Ketoacidosis	4	5.0

(@) Not mutually exclusive

Table 2. Characteristics of T1D among adolescents in the study sample (n=80)

As Table (2) shows that about one-third of the study sample (36.3 %) had type1diabetes for duration of more than 5 years, and more than one half of adolescents in the study sample (53.8%) had family history of type 1 diabetes. Concerning T1D complications, the table revealed that about three -fifths of adolescents' included in the study sample (62.5%) suffer from complications of T1D.

Characteristics	Spearman's rank correlation coefficient					
	Mood domains					
	Anger	Confusion	Depression	Fatigue	Tension	Vigor
Age	-.054	.053	-.122	-.189	-.164	.084
Education	-.031	.093	-.028	-.170	-.052	.068
Father education	-.167	.101	-.072	-.265*	-.185	.224*
Mother education	-.159	.020	-.072	-.257*	-.158	.232*
Crowding index	-.053	.143	.144	.083	.110	-.319**
Income	.024	-.090	-.073	-.138	-.088	.372**
Duration of diabetes	.020	-.006	-.008	-.091	-.083	.029
No. of complications	-.094	.013	-.119	.048	-.037	-.185

(*) Statistically significant at p<0.05
(**) Statistically significant at p<0.01

Table 3. Correlation between adolescents' mood scores and their characteristics

As table 3 demonstrates, there was statistically significant positive correlation between vigor and adolescents' mother and father education (r = .224, r = .332) respectively. Additionally, there was statistically significant positive correlation between income and vigor (r = 372). Meanwhile, there was statistically significant negative correlation between crowding index and vigor (r = - .319).

Mood states and coping strategies among adolescents in the study sample (n=80)	Frequency	Percent
High (60%+) moods:		
Anger	53	66.3
Confusion	41	51.3
Depression	53	66.3
Fatigue	55	68.8
Tension	54	67.5
Vigor	48	60.0

Table 4. Mood states among adolescents in the study sample (n=80)

Table 4 indicates that mood states are ordered in descending order as the following the frequency of fatigue and

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tension were more than two-thirds in the study sample (68.8%, 67.5%) respectively. The frequency of anger and depression were about two- third (66.3%) of the study sample. The frequency of vigor was three-fifths (60.0%) of the study sample, while the frequency of confusion was more than half (51.3%) of the study sample.

	Spearman's rank correlation coefficient	
	HbA1c	RBS
Mood:		
Anger	.031	.109
Confusion	.037	.221*
Depression	.260*	.133
Fatigue	.107	.210
Tension	.107	.160
Vigor	-.063	.161

(*) Statistically significant at p<0.0
(**) Statistically significant at p<0.01

Table 5. Correlation between glycatedHb (HbA1c) and Random Blood Sugar (RBS) levels and adolescents mood and coping scores

As displayed in the Table 5, there was statistically significant positive correlation between confusion and Random Blood Sugar (RBS) (r= 0.221) and between depression and HbA1c (r = 0.260).

	Unstandardized Coefficients		Standardized Coefficients	t-test	p-value	95% Confidence Interval for B	
	B	Std. Error				Lower	Upper
Constant	9.32	0.69		13.488	<0.001	7.94	10.69
Duration of T1D	0.14	0.04	0.32	3.408	0.001	0.06	0.22
Depressive mood	0.08	0.04	0.21	2.212	0.030	0.01	0.15

Table 6. Best fitting multiple linear regression model for the HbA1c

r-square =0.32
Model ANOVA: F=10.22, p<0.001

Table 6 illustrates that duration of T1D and depressive mood were the statistically significant independent positive predictors of score of HbA1c.

Relations between adolescents' control of HbA1c and their mood scores	HbA1c<7.0		HbA1c 7.0+		Mann-Witney test	p-value
	Mean± SD	Median	Mean± SD	Median		
Mood:						
Anger	11.0±3.6	12.50	10.8±3.0	11.00	0.14	0.71
Confusion	0.7±0.5	1.00	0.6±0.5	1.00	0.05	0.83
Depression	7.5±3.2	8.00	11.0±3.5	12.00	5.05	0.02*
Fatigue	10.2±2.3	10.00	10.3±3.1	10.00	0.15	0.70
Tension	9.2±1.9	9.50	10.7±3.1	11.00	2.29	0.13
Vigor	12.2±3.9	13.00	9.8±3.3	10.00	2.16	0.14

(*) Statistically significant at p<0.05

Table 7. Relations between adolescents' control of HbA1c and their mood scores

Relations between adolescents' control of HbA1c and their mood scores

Concerning to relations between adolescents' control of HbA1c and their mood, table 7 illustrates statistically significant relation between depressed mood and HbA1c control (p = 0.02).

IV. DISCUSSION

The present study aimed at examining the effect of mood and coping styles on blood glucose level among adolescents with type 1 diabetes. The targeted population in the current study was adolescents between 12 – 18 years. This age group was selected because type 1 diabetes adolescents are at a greater risk of emotional problems which in turn affect quality of life, proper glucose metabolism and hormonal balance inside the body. As regards the frequency of mood states among the study sample, the findings indicated that there was high percentage of different mood disorders.

According to the researcher's point of view, presence of chronic disease (type 1diabetes) is strongly associated with psychological disturbances, physiological changes and social problems among adolescents in the study sample. On the same line, a study conducted in Pakistan indicated that a substantial number of adolescents in sample (42.3%) reported clinically significant level of mood disorders. The study results illustrated that there was positive correlation between family education, income and mood scores among the study sample (8). On the same vein, a study in Greece found that poor

family education was associated with more distress which affected type 1 patients mood and glycemic control(9). On the contrary; a astudy found that socioeconomic status and other family variables including parents education was associated with mood disorder, distress and poor glycemic control only in less than one half of the study population (10).

Moreover, there was statistically significant positive correlation between vigor and adolescents' mother and father education respectively. Additionally, there was statistically significant positive correlation between income and vigor. Meanwhile, there was statistically significant negative correlation between crowding index and vigor. According to researcher's point of view, increased family education help to increase the adolescent awareness of the disease and its treatment and help to increase the family which result in increased vigor and decreased tension. These results were in congruence with the findings of a study conducted in The United States who found strong relation between vigor and family characteristics such as education, income and crowding index (11). On the contrary, a study found that family characteristics had no relation to the mood state among the study sample (12).

The results of the current study revealed that about two-thirds of adolescents in the study sample complaint of depression and fatigue. This could be due to increased level of emotional burden as a result of the presence of diabetes alongside with its complications. Mood problems associated with diabetes can affect the productivity of adolescents (13). The prevalence of depression is much more higher in diabetic adolescents. Similary, a study done in Pakistan indicated that among diabetic patients aged 7-15 years observed depressed mood in 33.7% patients (14). In a similar study done in The United States found that the majority of the participants did show depressive symptoms (15). On the other hand, in a large-scale study done in the United States on 2672 youth with Type-I diabetes and conducted found that minority of the sample complaint from depressed mood. The percent of Anger and tension were also about two thirds in the study sample (16). That could be as a result of stress caused by presence of diabetes and its treatment plan. In a study conducted in The United States clarified that insulin disturbances can lead to neuronal changes affecting brain and leading to nervousness (17). On the same line, a study in Canada found high percentage of angry mood, stigma and poor self-esteem among clients with type1 diabetes (18). On contrary, a study in America found that the majority of diabetic adolescents showed low level of anger and anxiety. The results of the current study indicated that there was statistically significant negative correlation between tension, detached and rational coping (19). That reflect the importance of management of stress through teaching coping styles that result from different situation which could increase tension, anxiety and poor adherence to treatment. The results of the current study were in congruence with a study in Pakistan which found that poor coping styles were strongly related with increased frequency of tension, anger and anxiety among the study sample (20).

Regarding confusion, The current study mentioned that about one half of the study sample reported confused mood. It is well-known that high blood glucose level over prolonged period of time among type 1 diabetes patients can affect the function of the brain leading to confusion, delirium and disorientation.

Concerning relations between adolescents' control of HbA1c and their mood, the results of the current study demonstrated that there was statistically significant positive relation between depressed mood and HbA1c control. These results might be due to negative emotions such as depressed mood can cause physical effects and prevent adolescent from taking care of himself. A higher rate of depressed mood is found among diabetic people than the general population as found in Spain (21). On the same vein, in a study conducted in Ethiopia (22) found that depressed mood among diabetic patients with type 1 lead to poor blood glucose readings among the sample. Additionally, a study conducted in India (23) found that high prevalence of depression among type 1 diabetes patient lead to poorer HbA1c control (above 7.5). Additionally, a study conducted in Egypt found that prolonged periods of depressed mood lead poor outcomes in diabetes control especially blood glucose readings (24). On the same line, a study In The United States reported that higher levels of depressed mood and HbA1c were positively correlated (25).

On the other hand, a study in The United States and found no statistically significant relation between depressed mood and HbA1c control among the study sample. Additionally, a study conducted in South India found that Multilevel analyses. That would be the result of other covariates such as education, type and duration of diabetes which would affect diabetes control regardless of mood changes (26).

The results have demonstrated that there was statistically significant relation between fatigue and Random Blood Sugar (RBS). On contrary, a study conducted in Sweden by found that fatigue had no effect on blood glucose control among type 1 clients. That might be the result of proper treatment plan and good lifestyle as a result of proper health education about diabetes management (27). The study findings also indicated that there was positive correlation between confusion and Random Blood Sugar (RBS). This reflect the effect of confused mood on adolescent adherence to treatment plan which lead to poorer glycemic control. On the same line, a study conducted in India found a statistically significant relation between confusion and blood glucose control among diabetic patients (28). On contrary, a study found in the United states that there was no relation found between diabetes and other psychotic disorders as confusion (29). Additionally, The study findings also indicated that vigor and Random Blood Sugar were related statistically. Vigor refers to being active bodily or mental strength or force. The adolescents are characterized by being physically active which is considered as a normal characteristic of that transitional period and requires additional attention to make sure that their treatment plan is suitable to their lifestyle. According to the researcher

point of view , being physically and mentally active can help the adolescent to deal better with different situations related to disease management, leading to better resilience and better adherence to his treatment plan which in turn lead to better glycemic control. In congruence with these results a study in The UK found that adolescents being physically active had better will to adhere to insulin therapy which lead to better glycemic control (30).

V. CONCLUSION

The study results indicate that depressed mood has significant effect on blood glucose level among diabetic adolescents. The scores of confusion, depression and random Blood Sugar (RBS) are positively correlated.

VI. RECOMMENDATIONS

In the light of the main study findings, the following recommendations were proposed: The adolescents with type 1 diabetes should be given health education program about proper management of mood disorders throughout their daily activities through teaching relaxation techniques, meditation and proper time management.

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