

A Structured Educational Intervention for Enhancing Self-Management and Readiness of Diabetic Adolescent for the Health-Care Transition

¹Gawhara Gad SolimanEbrahim²Wafaa Gameel Mohammed Ali ³Amany
Kamal El- Hawary

¹Pediatric Nursing Department, ² Medical Surgical Nursing, Faculty of Nursing, Mansoura University

³Pediatric Endocrinology and diabetes unit, Faculty of Medicine, Mansoura university.

Corresponding Author: Gawhara Gad SolimanEbrahim

Abstract: The transition to adult medical care is essential for the development of adolescents and young adults with type 1 diabetes. This shift refers to the discrete point in time, when the adolescent is in the adult health care system. Transition may be a multiyear process, ideally starting early in adolescence, it designed to develop and improve effective knowledge, self-management and promotion to enhance readiness to meet the health care needs of adults.

The aim of this study was to evaluate the effectiveness of a structured educational intervention on enhancing self-management, and readiness of diabetic adolescent for the health-care transition.

Methods: A quasi- experimental design was utilized on a convenient sample of 60 diabetic adolescents in Pediatric and Diabetes and Endocrinology unit inpatient and outpatient clinic at Mansoura University Children's Hospital. Three tools were used to collect data regarding; Diabetic Adolescent's Structure Interview Questionnaire, Observational Checklists and University of North Carolina (UNC) TR(x)ANSITION Scale version 3.

Results: There were statistically significant improvements in all aspects of transmission readiness of the adolescents of the study group throughout the program, compared to before the program implementation.

Conclusion: program results in increased knowledge, practices and improved transition readiness of diabetic adolescents.

Keywords: educational program, self-management, readiness, diabetic adolescent, health-care transition.

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I. Introduction

Type 1 diabetes mellitus (T1DM) is a chronic and complex health condition that necessitates continuous insulin treatment. It characterized by autoimmune destruction of the islets of Langerhans and insulin-secreting β 1 cells. Insulin, diet regimens and exercise programs are customary treatments.^(1, 2, 3) According to the statistical record of Mansoura University Children Hospital, 552 diabetic child and adolescent were admitted to hospital during the year 2017-2018.⁽⁴⁾

The World Health Organization defines youth people as all young people aged 15 to 24 years old, with an adolescent stage that ends at age 19 years old.⁽⁵⁾ Young peoples with diabetes are vulnerable to acute complications of diabetes⁽⁶⁾, so it is essential to follow up them until a reduction in those complications. Adolescents with a longer duration of diabetes have been reported to have suboptimal glycemic control that may deteriorate further after passing care.^(7,8,9) So a smooth transition from pediatric to adult care is necessary because the disease lasts a lifetime as the child passes into adulthood and beyond.⁽¹⁰⁻¹⁴⁾ The transition of young people with T1DM to adult healthcare is a challenge for young people, their families and health workers. Achieving a successful transition can be difficult, because of major changes that occur during adolescent development.⁽⁹⁾ While there is a general consensus that the transition should not be concomitant with a medical crisis.^(15, 16)

Treatment of T1DM during adolescence and early adulthood needs accurate assessment of range of problems of the physiological system, development and health care. This stage is characterized by greater independence and accountability for most of the activity of daily living, including treatment of diseases.⁽¹⁷⁾ In addition to the possible problems of adherence linked to the decrease in the participation of parents in the management of diabetes. The achievement of optimum metabolic management is difficult in presence of adolescent hormonal changes, resulting in temporary increases in insulin resistance and related insulin requirements to maintain normal level of blood sugar.⁽¹⁸⁾

The longitudinal investigations report that the levels of glycohemoglobin start to increase at ten years, simultaneously with puberty and body growth. Its level reach its peak mean (8.9%) between fifteen and eighteen years, before it gradually decreased to 8.2% at the age of twenty-six.⁽¹⁹⁾ According to American Diabetes Association recommendation glycohemoglobin levels should be maintained less than 7.5% for adolescents and less than 7.0% for adults with type 1 diabetes.⁽²⁰⁾

It is important to maintain a regular relationship with the diabetes care giver during adolescence and adulthood to ensure frequent monitoring essential to reduce complications associated with diabetes. The transition to adult medical care is essential for the development of adolescents and young adults with T1DM.⁽²¹⁾ This shift refers to the discrete point in time when the adolescent is in the adult health care system. Transition may be a multiyear process, ideally starting early in adolescence, it designed to develop and improve effective knowledge, self-management and promotion to enhance readiness to meet the health care needs of adults.^(21,22) In adulthood patients, parents, health care providers, and others who provide support contribute to the transition process and to both children and adult health care services.⁽²³⁾

There are many basic differences between child and adult health care system. Childhood diabetes often relies on integrated medical care.⁽²⁴⁾ Conversely, the health care system for adults.⁽²⁵⁾ Training adolescents as they enter the adult care setting can reduce disturbances and promote continued commitment to quality care for diabetics.⁽²⁶⁾ Preparation for adult health care generally requires a frequent and systematic assessment of transitional readiness – or skills and behaviors that are essential for adult health care and therefore the institution and implementation of transition plans to manage the specific disability of these skills, knowledge and behaviors prior to transfer,^(22, 27) several measures are available to assess transitional readiness for adolescents with special needs.^(28,29)

The role of pediatric nurse in the education of children with T1DM in self-management is crucial.⁽³⁰⁾ Diabetic adolescents education on self-care and the improvement of the role of nurses in diabetes care lead to an improvement in adolescents outcomes and the process of care. Nurses' are responsible to help the diabetic adolescents to change their lifestyle.⁽²⁹⁾ However, there is a lack of self-care practices in children with T1DM in Egypt, and most self-care practices, such as insulin therapy, glycemic monitoring and foot care, are performed by mothers.⁽³¹⁾

Significance of the study:

The transition of adolescent to independence may face challenges in maintaining diabetes care plans, experiencing diabetes exhaustion and the stress of having new life experiences at college or in the workplace, while at the same time receiving less direct support from parents. Furthermore, most of the diabetic adolescents may neglect self-care administration.⁽⁹⁾ Delay or difficulties in transferring to adult services can also lead to disconnection of medical care before the transition, which increases the risk of developing short and long term diabetes complications.⁽⁸⁾

Aim of the study:

The aim of this study was to evaluate the effectiveness of a structured educational intervention on enhancing self-management and readiness of diabetic adolescent for the health-care transition.

Research hypothesis:

Diabetic adolescent will have better self-management and readiness for the health-care transition after exposure for the structured educational intervention.

II. Subjects and Methods

Design:

A quasi- experimental design was used in this study.

Setting

The study was conducted in Pediatric Diabetes and Endocrinology unit inpatient and outpatient clinic at the Mansoura University Children Hospital.

Sample:

A convenient sample of 60 diabetic adolescents who met the following criteria comprised the sample: their age between 15 and 18 years, both sexes and without other chronic diseases.

Tools of data collection:

The data were collected through the use of the following tools:

Tool I: Diabetic Adolescent's structure Interview Questionnaire: It was developed by the researchers after examining the recent relevant literature and consists of two parts:

Part I: demographic data of diabetic adolescents and their parents, such as name, age, education level and birth order, resident and family, ie the number of family members, income, etc.

Part II: concerning adolescents' knowledge on diabetes mellitus, as definition, causes, manifestations, treatment and complications.^(32, 33) The scoring system for diabetic adolescents' knowledge was developed; the total score was 33. The correct answer was evaluated with 1, the incomplete answer with 0.5 and the answer not known with zero. These scores were converted into a percentage score, the knowledge were considered "high" if the percentage score was above 70%; "moderate" if the percentage varies between more than 65% - <70% and the unsatisfactory knowledge if the percentage score is <65%.

Tool II. Observational Checklists:

Researchers developed an observational checklist after reviewing recent relevant literature and including three check lists: blood sugar checklist, insulin injection checklist and foot care checklist.^(32, 34) The total practice score was 31. The score for each performance was distributed as follows, "Done correctly" (score 1), "Done incorrectly" or "Not done" (score 0). These scores were converted into a percentage score, the performances were considered "high" if the percentage score was above 70%; "moderate" if the percentage varies between more than 65% - <70% and the unsatisfactory practice if the percentage score is <65%.

Tool III: the University of North Carolina (UNC) TR(x) ANSITION Scale version 3:

The tool was developed by **Maria Ferris, et al., (2012).**⁽³⁵⁾ The scale provides a short, reliable and valid assessment of the transition preparation of medical care for emerging adolescents to adults. It evaluates the adolescent's competence in knowledge and mastery of the skills associated with the transition of medical care regardless of the disease in question. The UNSI TR (x) ANSITION scale consists of 33 item divided into the following 10 domains: disease type, Rx=medications, Adherence, Nutrition, Self-management, Informed-reproduction, Trade/school, Insurance, Ongoing support, and New health providers. It takes about 7-8 minutes to be administered. Only one question related to reproduction was eliminated during the current study because it was culturally inappropriate.

Scoring Scale TRXANSICIÓN UNC follows a simple procedure such that each domain is equal to one point, resulting in a total score of 10 points with higher scores reflecting greater transition preparation medical attention Scores (ie, 0, 0.5, 1) for the elements within a domain are weighted make total score 1 for each domain. Therefore, the scores are calculated for each specific domain, with an interval of 0-1 and the total transition score, with an interval of 0-10

IV: Health Educational intervention:

It was developed in a simple Arabic language, after examining the recent relevant literature, to improve the knowledge and practices of adolescents related to their diabetes, which in turn improves their preparation for self-management and the transition of medical care. The educational intervention consisted of theoretical knowledge about: diabetes as definition, medications, adherence, nutrition, self-management, reproduction, ongoing support... etc.^(20, 32,33,34,36, 37) In addition, practical part regarding procedures of blood sugar test, insulin injection and foot care were included.^(32,34)

Operational Design

1-Preparatory phase:

- An official permission was taken from the director of the Pediatric Diabetic and Endocrinology unit after explaining the aim of the present study.
- A review of the past and current local and international related literature on the various aspect of the problem using, articles, periodicals, magazines and books were done. This review helped the researcher to be acquainted with the actual dimension and magnitude of the problem as a major health problem confronting the pediatric age group in Egypt and worldwide and guide also in developing the study tools.
- Tools were developed and tested for content validity by 5 experts in the field and they were structured interview sheet and observational checklist. Tools reliability was ascertained where it was 94 for tool I; tool II (96 for blood glucose test, 93 for foot care). Correlation of validity was tested by Cronbach's Alpha.
- Tool III: the scale was translated using back-translation method. The translations were carried out by independent translators. The translations were compared with original form (the scale). Final version of translations was revised and modified by a committee which consisted of experts in nursing research. Finally reliability was ascertained where it was 87.

Pilot study:

A pilot study was conducted involving 10 adolescents with type I DM. It was carried out to test the validity of the study tools and detect the time for filling the sheet and to test the content. Results of the pilot study helped in necessary modification of the study tools. They were excluded from the subjects of the study.

Field of work:

The actual field work started from March 2018 and extended to June 2018. This period consumed for data collection was governed by the availability time for both the researchers and the study respondents.

II- Implementation of the educational intervention

- It was started by interviewing the adolescent with diabetes at the above mentioned setting. The researchers started by introducing herself to study subjects and giving them a brief idea about the aim of the study, its components and expected outcomes.
- Oral consent from the adolescent was obtained for their participation in the study after explaining the aim of the study and informed that all the collected data were confidential and will be used only for the purpose of the study. Adolescents were informed that they could refuse to participate in the study, and to withdraw at any time.
- Adolescent was individually interviewed in the endocrinology unit to assess his/her knowledge about diabetes and its care using tool 1 and was observed for his /her blood test, insulin injection and foot care using tool II (before the educational intervention).
- Educational intervention was developed based on the adolescents' learning needs assessment.
- The program was implemented in small groups (5-8 adolescents). At the end of each session, the researcher ensured the adolescents' understanding of the instructions.
- Each adolescent was re-interviewed immediately after the educational intervention in endocrinology unit and after 3 months during his/her follow-up in the out-patient clinic to assess his/ her knowledge, practice, and then each adolescent's practices were reassessed (post assessment)
- The participated adolescents were divided to small groups (5-8 adolescents) and the educational intervention was delivered to each group on 3 sessions. Each session took about one hour, 1st and 2nd session included knowledge about diabetic definition, causes, signs and symptoms, complications, treatment, adherence, nutrition, self-management, reproduction, Insurance, ongoing support, and selection of new health providers, 3rd session included practices regarding blood test, insulin therapy and foot care. At the end of each session the researcher ensured the adolescents' understanding of the instructions.
- Different teaching methods as short lecture, group discussion, role playing, demonstration, and re-demonstration were used. Also different audio visual materials were used as pamphlets; hand out, pictures, and posters to facilitate the teaching of each topic.
- Evaluation of the effectiveness of the educational intervention was based on the improvement of the adolescents' self-management skills and readiness for the health-care transition. This improvement was evaluated after the implementation phase using the same pre- format (Tool I, II & III).

Data analysis:

The data were coded and transferred in formats specifically designed for data entry, so the data were analyzed and calculated using the statistical social science package (SPSS version 20.0) for statistical analysis. The collected data were organized, categorized, and tabulated in tables, average percentage and standard deviation. One-way ANOVA test was used to verify the difference between the groups for quantitative data. Statistical significance was considered with a value of $p < 0.05$.

Results

It was revealed from the table I that the highest percentages of the studied adolescent (46.7%) were in age 16 to less than 17 years old. Slightly more than half of the diabetic adolescents were female and thirty five percent had less than one year duration of the disease.

Table (1): Demographic data of studied group

Characteristics	N n=60	%
15 to less than 16 years old	18	30
16- to less than 17 years old	28	46.7
17 - 18 years old	14	23.3
Mean± SD	15.9± .73	
child sex		
▪ Male	28	46.7
▪ Female	30	53.3
Child education		
▪ Preparatory school	17	28.3
▪ Secondary school	43	71.7
birth order		
▪ First	5	8.3
▪ Second	21	35
▪ Third	27	45
▪ Fourth	5	8.3
▪ Other	2	3.3
disease debut		
▪ Patient complain	31	51.7
▪ Diabetic coma	11	18.3
▪ Patient complain and parent observation	18	30
duration of disease		
▪ < 1 year	21	35
▪ 1 year -	23	38.3
▪ 2 to 3 years	16	26.7
Mean± SD	1.91 ± .78	

Table (2) illustrated characteristics of participated adolescents' families. As clarified from the table, 31.7% of the mothers had completed secondary / diploma education compared to 46.7% for fathers. Regarding number of family member it was found that 60 % of the studied families were composed of 4 to 6 members. One third of the families stated that their income was insufficient. The majority of families were residing in rural area (75%), only 21.7% of the family had positive history of diabetes.

Table (2): Characteristics of the family

Characteristics	N n=60	%
mother level of education		
Illiterate	2	3.3
Read and write	24	40
Finished preparatory school	4	6.7
Secondary / Diploma	19	31.7
University	11	18.3
mother occupation		
House wife	44	73.3
Worker	16	26.7
father level of education		
read and write	15	25
Finished preparatory school	4	6.7
Secondary / Diploma	28	46.7
University	13	21.7
father occupation		
Work	60	100
number of family members		
1 to 3	15	25
4 to 6	37	61.7
7 to 10	8	13.3
Family income		
Sufficient	40	66.7
Insufficient	20	33.3
Resident		
Rural	45	75
Urban	15	25
Family history of diabetes		
Positive history of diabetes	13	21.7
Negative history of diabetes	47	78.3
Affected person in the family	n= 13	

Father	2	3.3
Mother	5	8.3
Grand father	5	8.3
Grand mother	1	1.7

Fig (1) illustrated that mean score of adolescent's total practice was 16 before the educational program and statistical significant increased to 25.4 immediately after the program and then decreased to 24.4 three months later. Also knowledge before the program implementation was 19.3 and improved significantly to 28.4 immediately after the program. Then it decreased to 27.4 three months later.

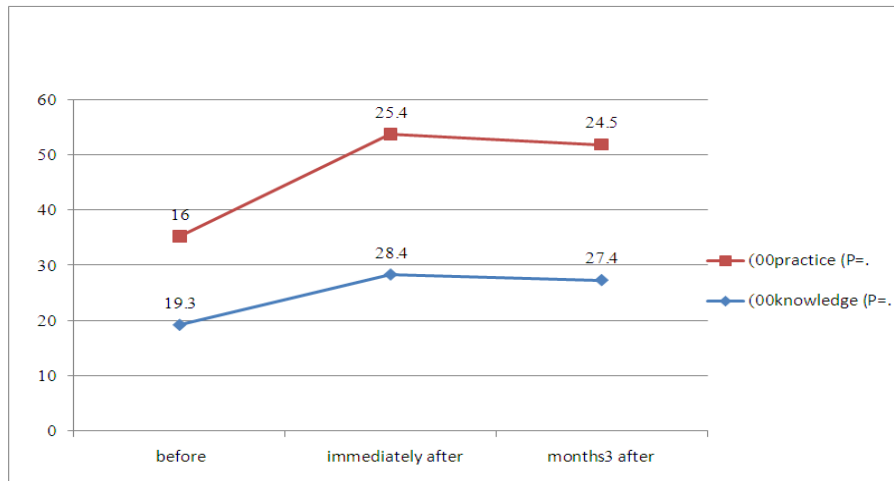


Fig (1) Comparison between mean score of total diabetic adolescents' practices and knowledge before, immediately after and after 3 months

Figure 2 showed that slightly less than half of diabetic adolescent have had "Good" practices score before the program implementation (48%). This percent improved to 83.3% and 80% immediately after the program and after 3 months respectively.

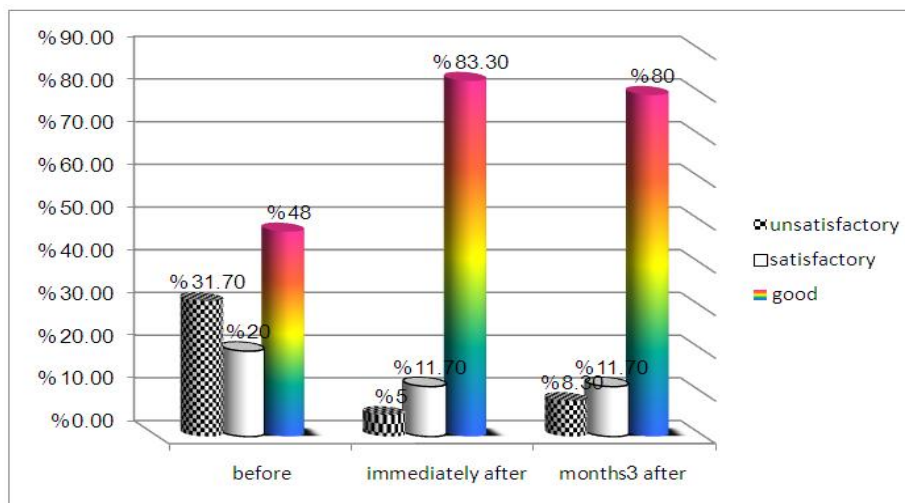


Fig (2) Level of adolescents' practices about diabetes

Level of adolescents' knowledge about diabetic is illustrated in Figure (3). It is revealed from the figure that before the program implementation, 40% of the adolescents had "Good" knowledge score. Immediately after the program the percentage increased to 76.7% and 71% after 3 months.

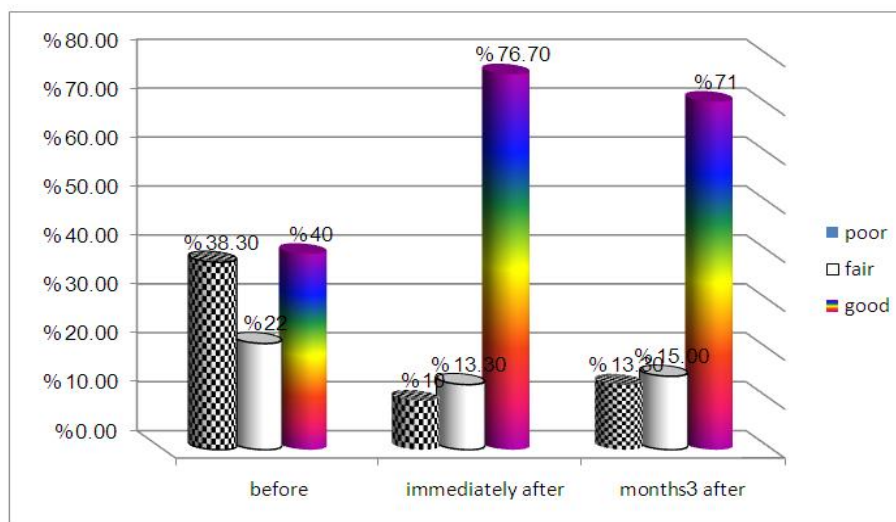


Fig (3) Level of adolescents' knowledge about diabetes

Table (3) portrays diabetic adolescents' readiness for transmission before, immediately after and after 3 months of the educational program. It was found that mean knowledge of adolescents regarding medication was 0.53 before the implementation of the educational program and this score improved to 0.81 and 0.78 immediately after the program and 3 months later respectively with statistically significant difference (P0.001).

In relation to self -management skills the table shows that the mean score of studied adolescent was 0.48 before the program compare to 0.76 immediately after the program and 0.72 after 3 months of the program implementation and the difference was statistically significant (P 0.001). The average score of all items of transition readiness for adolescents showed statistically significant increase, immediately after the educational program and three months later in comparison to before the educational program (p <0.05).

Table (3): diabetic adolescents readiness for transmission before, immediately after and after 3 months of the educational program (n=60).

Variable	Before	Immediate After	After 3 months	Test of significant	
	Mean ±SD	Mean ±SD	Mean ±SD	F	Sig
Type of chronic health condition	0.82±0.23	0.93±0.11	0.91±.012	9.96	0.001
Medications	0.53±0.25	0.81±0.18	0.78±0.19	39.52	0.001
Adherence	0.77±0.17	0.92±0.11	0.91±0.12	29.48	0.001
Nutrition	0.70±0.12	0.91±0.07	0.88±0.10	94.67	0.001
Self-management skills	0.48±0.17	0.76±0.16	0.72±0.15	63.56	0.001
Reproduction issues	0.07±0.15	0.83±0.19	0.80±0.23	404.55	0.001
Trade / School	0.47±0.37	0.75±0.31	0.72±0.32	16.45	0.001
Insurance	0.39±0.23	0.87±0.14	0.86±0.15	194	0.001
Ongoing support	0.05±0.16	0.65±0.41	0.65±0.39	90.86	0.001
New health care providers	0.24±0.17	0.68±0.26	0.65±0.26	86.39	0.001

(*) statistically significant at p <0.05

(**) highly statistical significance at p <0.001

III. Discussion

Diabetes mellitus is a syndrome with impaired metabolism and inadequate hyperglycemia due to a lack of insulin secretion or a combination of insulin resistance and insufficient insulin secretion.⁽³⁸⁾ Ineffective health care transition from adolescent with diabetes to adult health services could lead to suboptimal adherence to medical control, resulting in increased diabetes complications and hospitalization. Despite national

recommendations, few adolescents received the necessary preparation for the transition to adult health services.⁽³⁹⁾

The finding of the current study represents that slightly more than half of the diabetic adolescents were female with the majority of families were residing in rural area. This finding may be attributed to the limited access to health services and poor health literacy of families resident in rural areas beside the higher rates of consanguineous marriage that may increase the risk of developing diabetic in rural areas than urban. In the contrary to **Attia et al., (2017)** who found that more than half of the studied diabetic adolescents were residing in urban area.⁽³¹⁾

In examining the practices and knowledge of the diabetic adolescents it was found that successful effect of the educational program on their practices and knowledge scores. These results may be interpreted by the fact that adolescents acquired better understanding of the importance of diabetes related practices after the program, which encouraged them to avoid negligence and carelessness regarding their diabetes daily self-care. Also this result may be due to the educational program stressed on the practical training to gain information and change practices using adequate sessions and increased motivation, which is needed for achievement of self-care behaviors, in addition every adolescent was given a complete practical opportunity until each skill is mastered. This finding is supported by **Abolwafa et al., (2017)** who found a remarkable improvement of adolescents children knowledge and reported practices after the implementation of the diabetic program.⁽⁴⁰⁾

Diabetic medication is important to maintain child health condition and prevent complication especially insulin is necessary for normal carbohydrate, protein, and fat metabolism.⁽⁴¹⁾ The results of this current study revealed that total knowledge of adolescents about medication improved immediately after the program and 3 months later than before the educational program with statistically significant difference. This result could be explained by the adolescents' belief that insulin is the only treatment available, and due to the availability of insulin injection from the clinic and consequently they are compliant with the treatment regimen in addition to their fear from the complications and frequent hospitalization.

Suboptimal adherence remains a major concern for adolescents with type 1 diabetes, whose treatment regimen is complex and includes numerous behaviors. Accurate assessment of adherence is essential for effective medical assistance and measurement of test results. Without a valid adherence biomarker, assessment strategies should be based on the measurement of management behavior.⁽⁴²⁾ The results of current study showed statistically significant increase immediately after the educational program and three months later in comparison to before the educational program regarding adolescent adherence. This could be explained in the light of adolescents were willing to engage with a structured education program designed to improve diabetes control whilst enabling them to be more like their peers. The current finding come in the same line with **Gandhi et al. (2015)** who cited that intervention trials show that the use of phone interventions, integrative health coaching, case managers, pharmacists, education, and point-of-care testing improve adherence of diabetic patients to prescribed glucose-lowering agents.⁽⁴²⁾

In relation to self-management skills the differences in adolescent's total knowledge before, immediately after and after 3 months were highly statistically significant. This was in the same line with **Attia (2017)** who stated that children's practice scores of self-care activities improved significantly after the intervention, and readiness of children plays an active role in improving these scores.⁽³¹⁾ The results of current study could be attributed to the fact that their curiosity to know was met in this program and they were had fun while learning and gaining more control of their own health. In this respect, **Pelicanet al. (2015)** who emphasized on the importance of satisfying adolescents' need to gain autonomy in the management of their condition.⁽⁴³⁾

The finding of the present study also revealed that there is improvement in adolescents' readiness for transition regarding reproductive issue immediately after the program and after 3 months. This success could be attributed to more than one reason. First, the program content was easy to be assimilated to adolescents. Second, the process of instructions was in a friendly environment, with small groups acting as encouraging teams for each other. Third or last each adolescent was encourage to ask questions and the instruction was repeated as needed. This result incongruent with **Prochownik et al., (2001)** who stated that interventions focusing on changing health beliefs and on increasing awareness may be effective in promoting positive reproductive health behaviors in adolescent with diabetes.⁽⁴⁴⁾ In the contrary with **Fernandes et al (2014)** who found significant gaps in "transitioning education" were identified. These included stated deficiencies in education regarding reproductive issue, and health of future offspring.⁽⁴⁵⁾

The findings of the present study have demonstrated statistically significant improvement in all aspects of transmission readiness of the adolescents of the study group throughout the program (Type of chronic health condition, Medications, Adherence, Nutrition, Self-management skills, Reproduction issues, Trade / School, Insurance, Ongoing support and New health care providers), compared to before the program implementation. These findings may be interpreted by the present training program focus on both diabetes related knowledge and practices which lead to gain information and change practices using adequate sessions and

increased motivation that results in satisfaction, so, continuing education for the diabetic adolescents had positive effect on the transmission readiness of the studied adolescents. This interpretation is supported by Schultz (2017) who reported that transition programs showed greatest consistency in reducing diabetic complication.⁽⁴⁶⁾

IV. Conclusion

It is concluded that program results in increased knowledge, practices and statistical significant differences were found between mean score of total knowledge and practices. The average score of all items of the UNC transition readiness scale for Adolescents showed statistically significant increase, immediately after the educational program and three months later in comparison to before the educational program.

V. Recommendation

It is recommended that: It is important that all health care team members give more emphasis to their roles as health educators.

The developed illustrated booklet should be made available and distributed for each diabetic adolescents admitted to hospitals. More research is needed to investigate the long-term effect of such educational interventions.

Future studies are needed to generate evidenced-based guidelines and to determine which transition elements are most effective during the transition period from pediatric to adult care. Researchers should also consider including mental health providers when designing these interventions to address and/or prevent adverse mental health outcomes.

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