



RESEARCH ARTICLE

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# A STUDY TO ASSESS THE KNOWLEDGE AND PRACTICES ON DIABETIC CARE AMONG THE CAREGIVERS OF CHILDREN WITH TYPE 1 DIABETES MELLITUS

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## ABSTRACT

**Background:** Type 1 Diabetes Mellitus (T1DM) is one of the most common chronic pediatric endocrine illnesses. Diabetes education is an integral part of the ambulatory management of T1DM. **Purpose:** To find out the gaps in knowledge and practices of caregivers related to management of T1DM. **Methods:** In a cross-sectional survey, knowledge and practices of 90 caregivers of children with T1DM were assessed using pre-validated and tested structured knowledge and practice questionnaires and observation checklists. **Results:** There were 48 girls and the mean age of the children was 9.5±2.8 years. Majority of caregivers were mothers (72.2%) with the mean age of 36.7±2.8 years. Majority of children had either sub-optimal or poor glycaemic control (41.6% and 39.3%) with the mean HbA<sub>1c</sub> value of 8.9±1.8. Most of the caregivers had fair knowledge (64.4%) and practices (56.7%) with the mean knowledge and practice scores of 16.1±2.9 and 18.1±2.0 respectively, and demonstrated excellent technique of insulin preparation and administration. There was no significant correlation between knowledge and overall practices ( $r=0.106$ ,  $p=0.321$ ), knowledge and technique of insulin administration (using pen/syringe) ( $r=0.218$ ,  $p=0.141$ ,  $r=0.093$ ,  $p=0.553$ ). A significant relationship of overall practices of caregivers of children with T1DM with glycaemic control ( $p<0.009$ ) and gender of caregivers ( $p<0.04$ ) was observed. **Conclusion:** There exists gap in knowledge and practices of the caregivers related to T1DM attributing to poor or suboptimal glycaemic control in children. **Implication:** Diabetic nurse educator should be placed in indoor and outdoor facilities to draw the maximum output to provide quality care to children.

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## INTRODUCTION

Type 1 Diabetes Mellitus (T1DM) is the most common chronic endocrine disorder in children (*IDF Diabetes Atlas*, n.d.; SEARCH for Diabetes in Youth Study Group et al., 2006). It occurs due to insulin deficiency following the autoimmune destruction of pancreatic beta cells as a result of combination of genetic susceptibility and environmental triggers such as viral infection, toxins or some dietary factors (Verloo et al., 2016). The management of T1DM consists of subcutaneous insulin therapy and appropriate diet.

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Diabetes education regarding diabetes, insulin administration, self-monitoring of blood glucose and daily care, is an integral part of treatment of T1DM. Poor glycemic control of T1DM is associated with various short term and long term complications of diabetes and appropriate management can prevent or delay these complications (Verloo et al., 2016). Unique challenges faced by HCP and the caregivers in caring children with T1DM, are optimal growth maintenance, psychological and social developmental issues, inability of the children to communicate symptoms of hypoglycaemia and diabetic ketoacidosis. The primary management strategy for a child with T1DM aims at metabolic stabilization of child and education of the family related to daily insulin injections, along with regular blood sugar monitoring, healthy diabetic diet and lifestyle modifications that help in delaying or avoiding diabetes associated complications (Association, 2006; *IDF*

*Diabetes Atlas*, n.d.). Unfortunately, in low income group countries like India due to limited resources and lack of health care assistance, children suffer from terrible complications including early mortality (Elamin *et al.*, 1992). Caregivers play key role in managing children with T1DM. Young school going children are not able to maintain their own diabetes management care. Lack of knowledge and poor practices of the caregivers' can adversely affect the outcome in these children. Complications related to suboptimal or poor glycaemic control are seen more frequently in school going and adolescent children with T1DM as compared to young non-schoolers, probably due to growing autonomy in independent management of disease condition and the observed peer group influence (*Clinical presentation of type 1 diabetes. - PubMed—NCBI*, n.d.). Glycaemic control based on the estimation of HbA<sub>1c</sub> level in last blood report was classified as good (HbA<sub>1c</sub> level <7.5%), sub-optimal (7.5-9%) and poor (> 9%) ("ISPAD Clinical Practice Consensus Guidelines 2014 Compendium," 2015). In our facility, there is a multidisciplinary team comprised of endocrinologists, a diabetic nurse educator, a dietician, a psychologist and a social worker to provide diabetic education and self-care training, that permits the child and caregivers to acquire the knowledge and skills needed for diabetic care (Chiang *et al.*, 2014). Despite that, poor glycaemic controls were observed in children attending the speciality clinic of the facility. The present study was planned to find out the gaps in knowledge and practices of caregivers related to management of T1DM.

## METHODS

In a cross-sectional study, using a quantitative approach, total 90 caregivers of children with T1DM were enrolled using consecutive sampling technique in a speciality clinic of outdoor department (OPD) of a selected tertiary care facility. Caregivers were defined as mother or father or any significant family member involved in care of children with T1DM. The inclusion criteria included the caregivers of children with T1DM between the age of 2-12 years diagnosed for minimum of 6 months, involved in diabetic care of the child and regularly accompanying the child in the OPD for minimum of 3 months, willing to participate in study and able to read either Hindi or English. Caregivers suffering from any chronic or mental illness or taking care of any other child with chronic illness in the family were excluded. Sample size was calculated based upon the obtained mean knowledge scores of 16.1±2.9 among 10 caregivers in the pilot study, with relative precision of 5% (95% level of confidence), a sample of 33 was calculated. Due to easy availability of subjects, and time 90 caregivers of children with T1DM meeting the inclusion criteria were included. Ethical clearance was obtained from the Institute Ethical Committee. Written informed consent was taken from the caregivers and assent from the children above 8 years of age. Tools used for the data collection were the pre-validated and tested namely structured socio-demographic-clinical profile (37 items), knowledge (23 items, true false and multiple choice questions (MCQ)) and practice (23 items, modified from injection technique questionnaire (ITQ) developed by Kenneth W. Strauss, 2014 ITQ) and observation checklist for insulin preparation and administration using pen (10 items) and insulin syringe (14 items). A score of '1' for correct response and '0' for incorrect response was given.

Permission to modify the practice questionnaire tool was obtained from the author, while other standardised tools were available to public domain. All the tools were translated in Hindi and back translated to ensure that they retain their meanings. At the end of the interview, incorrect responses of the caregivers were corrected by giving appropriate explanation.

**Data analysis:** Data analysis was done using SPSS 20.0 version. Frequency, percentage, mean, standard deviation, range were calculated in descriptive statistics. One way ANOVA and Kruskal Wallis test as part of inferential statistics were used to find the association between continuous and categorical variables and Karl Pearson coefficient of correlation for assessing correlation between knowledge and practices of caregivers. The level of significance was set at p value <0.05.

## RESULTS

Majority of caregivers were mothers (72.2%) with the mean age (years) 36.7±2.8. Most of the caregivers had completed college education (37.8%), housewives (64.4%). Majority of children (87.8%) were more than 5 years of age with mean age (years) 9.5±2.8 and majority of the children were females (53.33%) and 46.67% were males. Demographic details are described in Table 1.

**Table 1. Demographic profile of caregivers and children with T1DM (n=90)**

Demographic variable		Frequency (%)
Related to caregivers		
Age (in years)		36.7±8.2*
Relationship with child	Father Mother Siblings Grand parents	19 (21.1) 65 (72.2) 02 (2.2) 04 (4.4)
Gender	Male Female	21 (23.3) 69 (76.7)
Number of children in the family	One Two More than two	09 (10) 44 (48.9) 37 (41.1)
Type of family	Nuclear Joint	59 (65.6) 31 (34.4)
Area of living	Urban Rural	73 (81.1) 17 (18.9)
Caregiver's education	Illiterate Primary school High school Secondary school College	12 (13.3) 08 (8.9) 21 (23.3) 15 (16.7) 34 (37.8)
Caregiver's occupation	Employment Unemployment Agriculture House wife	22 (24.4) 06 (6.7) 04 (4.4) 58 (64.4)
Family Income (per month, Rs)	<20,000 20,000	52 (57.8) 38 (42.2)
Family history of T1DM	None Parent Siblings only	88 (97.8) 01 (01.1) 01 (01.1)
Related to child		
Age (in years)	5years >5years	9.5±2.8* 11 (12.2) 79 (87.8)
Gender	Male Female	42 (46.7) 48 (53.3)
Educational status	Not started Pre-primary Primary	07 (7.8) 25 (27.8) 58 (64.4)
BMI	Normal for age Less than normal	17 (18.8) 73 (81.2)

\*Mean±SD

Significant number of children had either suboptimal (41.6%) or poor glycaemic control (39.3%) with mean HbA<sub>1c</sub> value of  $8.9 \pm 1.8$ . More than 25% of children reported of 5 or more episodes of hypoglycaemia, while 13% of children reported of DKA in last 3 months. Nearly 73.5% were taking combination preparations of long and short or intermediate and short acting insulin. Disease and treatment profile is described in Table 2.

**Table 2. Disease and treatment profile of children with T1DM (n=90)**

Variable		Frequency (%)
HbA <sub>1c</sub>		8.86 $\pm$ 1.80*
Glycemic control	Good (<7.5%)	17 (19.1)
	Sub-optimal (7.5-9%)	38 (41.6)
	Poor (>9%)	35 (39.3)
Episode of Hypoglycemia (last 3 months)	0-4	64 (71.2)
	5-10	13 (14.4)
	>10	13 (14.4)
Episode of DKA (last 3 months)	No episode	78 (86.7)
	>1	12 (13.3)
Local complications	Lipo-hypertrophy	22 (24.4)
	Bruising	13 (14.4)
	No evidence	55 (61.2)
Type of insulin used	NPH + Regular	37 (40.2)
	Lispro + Lantus	30 (33.3)
	Others	23 (25.5)
Insulin regimen (frequency/day)	One - two	03 (03.3)
	>Two	87 (96.7)
Administration of insulin	Self	15 (16.7)
	Parents	45 (50)
	Both	25 (27.8)
	Others	05 (05.5)
Site for insulin Administration (more than one site)	Abdomen	85 (94.4)
	Thigh	77 (85.6)
	Buttock	47 (52.2)
	Arm	47 (52.2)
Rotation of sites	Yes	89 (98.88)
	No	01 (1.11)
Needle reuse	None	10 (11.1)
	2 to 5 times	52 (57.8)
	6 to 10 times	16 (17.8)
	More than 10 times	12 (13.3)
Adherence to prescribed diet	Good	33 (36.7)
	Poor	
	Less than prescribed More than prescribed	48 (53.3) 09 (10)
Frequency of consuming sweets	Daily	03 (03.3)
	Usually	05 (05.6)
	Sometimes	18 (20)
	Rarely	28 (31.1)
	Never	36 (40)
Type of exercise	No exercise	12 (13.3)
	Low to moderate (walking)	27 (30)
	Moderate(play)	40 (44.5)
	Severe(gym/aerobics)	11 (12.2)
Frequency of doing exercise (In a week)	Every day (6-7 times)	63 (70)
	Sometimes (3-5 times)	07 (07.8)
	Rarely (1-2 times)	08 (08.9)
	Never	12 (13.3)

\*Mean  $\pm$  SD

Most of the caregivers had fair knowledge (64.4%) and practices (56.7%) with the mean knowledge and practice scores of  $16.1 \pm 2.9$  and  $18.1 \pm 2.0$  respectively. Mean scores of caregivers for insulin preparation and administration using insulin pen (n=47) and insulin syringe (n=43) were  $8.3 \pm 1.2$  and  $12.0 \pm 1.2$  respectively. Majority of the caregivers demonstrated excellent technique of insulin preparation and administration [Table 3]. There was no significant correlation between knowledge and overall practices ( $r = 0.106$ ,  $p = 0.321$ ), knowledge and technique of insulin administration (using pen/ syringe) ( $r=0.218$ ,  $p= 0.141$ ,  $r=0.093$ ,  $p=0.553$ ) [Table 4].

**Table 3. Knowledge and practices scores of caregivers of children with T1DM (n=90)**

		Mean scores	Frequency (%)
Knowledge	Good ( 19)	$16.1 \pm 2.9$	24 (26.7)
	Fair ( 12)		58 (64.4)
	Poor (<12)		8 (8.9)
Practices	Good ( 19)	$18.1 \pm 1.2$	38 (42.2)
	Fair ( 12)		51 (56.7)
	Poor (<12)		1 (1.1)
Insulin preparation/ administration	Pen (n= 47)	Excellent	$8.3 \pm 1.2$ 35(74.7)
		Good	12(25.5)
	Syringe (n= 43)	Excellent	$12.1 \pm 1.2$ 33(76.7)
		Good	10(23.3)

A significant relationship of overall practices of caregivers of children with T1DM with glycaemic control ( $p < 0.009$ ) [Table 5] and gender of caregivers ( $p < 0.04$ ) [Table 6] were observed, however no statistically significant association of knowledge and practices of caregivers with selected demographic variables of caregivers such as age, education, occupation, relationship with child, type of family, area of residence and monthly family income ( $p > 0.05$ ) [Table 7].

## DISCUSSION

Major findings of the study reveal that caregivers of children with T1DM had fair knowledge and practices related to diabetic care. Majority of children had sub-optimal or poor glycaemic control. More than half of the caregivers administered injection insulin to their children. The most commonly used sites were the abdomen followed by the thighs with frequent rotation of sites. Most of the children were multiple needle users. Nearly 60% of children did not adhere to the prescribed diet. More than 70% of caregivers demonstrated excellent techniques related to pen and syringe use. There was a significant relationship between overall practices of caregivers and glycaemic control of diabetic children and gender of the caregiver. More than 5 years old children had poor glycaemic control but it was not found statistically significant ( $p > 0.05$ ), might be clinically relevant. The existing literature suggest that most of the time, mothers as caregivers provide diabetic care to their children (Friedemann-Sánchez *et al.*, n.d.; Niba *et al.*, 2017; Noorani *et al.*, 2016a). Similar findings were observed in the present study, in which more than 70% of caregivers were mothers. Therefore, there is need to empower them with knowledge and improve their practices related to diabetic care. The HbA<sub>1c</sub> report reflects on the overall picture of blood sugar levels in children in last 3 months. Children with high HbA<sub>1c</sub> level are at greater risk of developing diabetes-related complications. In the present study majority of children had either sub-optimal or poor glycaemic control similar to previous study findings by V. Alexander (Dundee) *et al.* (2001) (*Factors influencing glycaemic control in young people with type 1 diabetes in Scotland: A population-based study (DIABAUD2)*). - PubMed—NCBI, n.d.), (Anderson *et al.*, 1997) in which the number of children achieving good to sub-optimal glycaemic control varied from 10 to 67%. Some studies (McKinney *et al.*, 2008; Rosilio *et al.*, 1998; Stallwood, 2006) have reported good glycaemic control in younger children with T1DM, similar findings were observed in the present study, though not statistically significant, but may be of clinical relevance. Most common complications in children and adolescents with T1DM, include hypo/hyperglycaemia and diabetic ketoacidosis (DKA) (Ngwiri *et al.*, 2015).

**Table 4. Correlation between knowledge and practices among the caregivers of children with T1DM (n=90)**

Practice scores (mean $\pm$ SD)	Knowledge	r value <sup>#</sup>	p value
Overall practices (18.12 $\pm$ 2.03)	(16.1 $\pm$ 2.92)	0.1059	0.3206
Techniques of insulin administration (pen) (8.34 $\pm$ 1.18)		0.2181	0.1408
Techniques of insulin administration (syringe) (12.02 $\pm$ 1.164)		0.0929	0.5534

<sup>#</sup> Pearson correlation coefficient, level of significance ( $p < 0.05$ )

**Table 5. Association of practices of caregivers with disease profile of child with T1DM (n=90)**

VARIABLE	Overall practices related to diabetic care n (%)			p Value
	Good	Fair	Poor	
Age at diagnosis <sup>#</sup>	7 (1,11)	6 (1,11.5)	0	0.990
Duration with disease(years) <sup>#</sup>	3 (0.5,10)	3 (0.5,10)	0	0.544
Family history of T1DM	37 (42.05)	50 (56.82)	1 (1.14)	0.682
None	1 (100)	0	0	
Parent	0	1 (100)	0	
Siblings only				
Glycemic control	11 (64.71)	6 (35.29)	0	0.009*
Good (<7.5%)	18 (48.65)	18 (48.65)	1 (2.70)	
Sub-optimal (7.5-9%)	8 (22.86)	27 (77.14)	0	
Diet adherence	12 (31.58)	20 (39.22)	1 (100)	0.318
Adequate	20 (52.63)	28 (54.90)	0	
Less than prescribed	6 (15.79)	3 (5.88)	0	
More than prescribed				
Episode of Hypoglycemia	22 (34.38)	41 (64.06)	1 (1.56)	0.108
0-4	7 (53.85)	6 (46.15)	0	
5-10	9 (69.23)	4 (30.77)	0	
>10				
Episode of DKA	35 (44.22)	42 (53.85)	1 (1.28)	0.326
No episode	3 (25)	9 (75)	0	
>1				
Local Evidence	7 (31.82)	14 (63.64)	1 (4.55)	0.077
Lipohypertrophy	9 (69.23)	4 (30.77)	0	
Bruising	22(40)	33(60)	0	
No evidence				

Kruskal Wallis test (categorical variables), Fisher's exact test, level of significance ( $p < 0.05$ )

<sup>#</sup>Median(Range)

**Table 6 : Association of practices with selected demographic variables of caregivers of children with T1DM(n=90)**

VARIABLE	Overall practices related to diabetic care n(%)			p Value
	Good	Fair	Poor	
Age of caregiver <sup>#</sup>	35.342 $\pm$ 6.878	37.686 $\pm$ 9.078	0	0.186
Relationship with child				0.074
Father				
Mother	11 (57.89)	7 (36.84)	1 (5.26)	
Siblings	26 (40)	39 (60)	0	
Grand parents	1 (50)	1 (50)	0	
	0	4 (100)	0	
Sex				0.045*
Male	12 (57.14)	8 (38.10)	1 (4.76)	
Female	26 (37.68)	43 (62.32)	0	
Type of family				0.884
Nuclear	24 (40.68)	34 (57.63)	1 (1.69)	
Joint	14 (45.16)	17 (54.84)	0	
Area of living				0.123
Urban	33 (45.21)	40 (54.79)	0	
Rural	5 (29.41)	11 (64.71)	1 (5.88)	
Caregiver's education				0.530
Illiterate				
High school	04 (33.33)	08 (66.67)	0	
Secondary school	14 (48.28)	15 (51.72)	0	
College	07 (46.67)	07 (46.67)	1 (6.67)	
	13 (38.24)	21 (61.76)	0	
Caregiver's occupation				0.085
Employment				
Unemployment	11 (50)	11 (50)	0	
Agriculture	01 (16.67)	05 (83.33)	0	
House wife	2 (75)	1 (25)	1 (25)	
	24 (41.38)	34 (58.62)	0	
Income (per month) Rs				0.808
<20,000	23 (44.23)	28 (53.85)	1 (1.92)	
20,000	15 (39.47)	23 (60.53)	0	

One way ANOVA (continuous variable), Fisher's exact test, level of significance ( $p < 0.05$ )<sup>#</sup>Mean  $\pm$  SD

**Table 7. Association of knowledge with selected demographic variables of caregivers of children with T1DM (n=90)**

Variable	Knowledge n(%)			p Value
	Good	Fair	Poor	
Age of caregiver*	38±4.294	35.934±8.954	38.625±11.363	0.466
Relationship with child				
Father	5 (26.32)	12 (63.16)	6 (10.53)	0.679
Mother	19 (29.23)	41 (63.08)	5 (7.69)	
Siblings	0	2 (100)	0	
Grand parents	0	3 (75)	1 (25)	
Caregiver's gender				
Male	5 (23.81)	14 (66.67)	2 (9.52)	1.000
Female	19 (27.54)	44 (63.77)	6 (8.70)	
Type of family				
Nuclear	15 (25.42)	39 (66.10)	5 (8.47)	0.942
Joint	9 (29.03)	19 (61.29)	3 (9.68)	
Area of living				
Urban	19 (26.03)	49 (67.12)	5 (6.85)	0.284
Rural	5 (29.41)	9 (52.94)	3 (17.65)	
Caregiver's education				
Illiterate	02 (16.67)	08 (66.67)	2 (16.67)	0.068
High school	05 (1.24)	20 (68.97)	4 (13.79)	
Secondary school	02 (13.33)	13 (86.67)	0	
College	15 (44.12)	17 (50)	2 (05.88)	
Caregiver's Occupation				
Employment	05 (22.73)	15 (68.18)	2 (09.09)	0.707
Unemployment	0	05 (83.33)	1 (16.67)	
Agriculture	01 (25)	03 (75)	0	
House wife	18 (31.03)	35 (60.34)	05 (08.62)	
Monthly family Income Rs				
<20,000	10 (19.23)	36 (69.23)	6 (11.54)	0.169
20,000	14 (36.84)	22 (57.89)	2 (5.26)	

One way ANOVA (continuous variable), Fisher's exact test, level of significance ( $p < 0.05$ ) \*Mean  $\pm$  SD

Significant number of children with diabetes mellitus had poor glycemic control (Ngwiri *et al.*, 2015). In the present study, nearly 29% of children had more than 5 episodes of hypoglycaemia and 13.3% children had DKA and nearly 40% of children had local complications in last 3 months. Problem of lipohypertrophy at the site of injection is directly related to the technique of insulin injection administration. Incidence of lipohypertrophy are found to be higher in adolescents and children than in adults.(De Coninck *et al.*, 2010). In the present study nearly 40% of children had presented with lipohypertrophy and/or bruising. Treatment regimens for T1DM are complex and outcome primarily depends on caregivers' knowledge and practices. Caregivers require initially intensive and then ongoing education and support in order to manage their children with T1DM and improve clinical outcomes and quality of life (Brink & Chiarelli, 2004).

It is important for caregivers to understand the importance of diet, physical activity, proper blood glucose and urine monitoring for glucose and ketone bodies, sick day guidelines; recognition, treatment, and prevention of hypoglycaemia and DKA as evident by the findings of the study. Frequent rotation of injection sites is recommended to avoid bumps and scar tissue on the skin. There is reportedly a high association between needle reuse and lack of injection site rotation with the presence of lipohypertrophy, which most often caregivers are unaware of(Kalra *et al.*, 2017). In the present study, majority of caregivers rotated the injection sites and injected insulin more frequently in the abdomen followed by thighs and less frequently on buttocks and arms. Our findings have also revealed that alarmingly very high number of caregivers (nearly 90%) reused needles 2 to more than 10 times for giving insulin injection. Lack of financial support from the government or non-government agencies in buying single use needles could be the reason for the caregivers to adopt this kind of practice.

The Indian guidelines state clearly that "HCP should create awareness in caregivers and their children regarding the potential adverse effects of needle reuse and discourage this practice of reusing needles or lancets due to high associated risk of transmission of blood-borne pathogens" (Tandon *et al.*, 2015). Availability of syringes and needles at subsidized rates by the government can help in solving the issue of multiple use of syringe and needles. Multiple daily injections (MDI) regimen consists of combining long-acting insulin analog with pre-meal boluses of rapid or short-acting insulin has shown more stable glycaemic control and fewer episodes of hypoglycaemia than the conventional approach, illustrated in a controlled cross-over trial on 28 adolescents with T1DM along with reduced incidence of nocturnal hypoglycaemia (Murphy *et al.*, 2003). In the present study, majority of children received more than 2 forms of injections/day as per the recommendations of the pediatric endocrinologist. Despite that significant number of children developed complications of hypoglycemia and DKA in last 3 months, which needs to be explored.

Dietary modification along with introduction of exercise regime in day to day practice is the key to the successful management of T1DM. The caregivers must learn to closely estimate the amount of carbohydrate their children consume in order to regulate blood glucose levels and adjust the insulin doses especially during sickness. Failure to do so, can lead to complications like hyperglycaemia or hypoglycaemia. Some studies have reported a link between adherence to diet and exercise by the children with glycaemic control (Gulve, 2008; K. Pillay MScDiet *et al.*, 2009; Mehta *et al.*, 2008). In the present study poor adherence to prescribed diet (as per 24 hour dietary recall history) and exaggerated self-claim of exercise schedules are needed to be given due attention. Involvement of caregiver in diabetes related tasks of children is crucial in improving health outcomes (Niba *et al.*, 2017).

Good knowledge and practices among the caregivers about the diabetic care are essential for achieving good glycaemic control in children. Certain studies have reported good awareness among the caregivers about the general diabetic knowledge (Al-Odayani *et al.*, 2013; Alonso Martín *et al.*, 2016; Moreira *et al.*, 2016; Sherwood, n.d.), while another study reported of more than one third of family caregivers had poor level of knowledge about T1DM (Ahmad, *et al.*, 2012). In the present study most of the caregivers had fair knowledge and practice scores which can be enhanced by planning detailed counselling for the parents and their children by the multi-disciplinary team. Success of diabetes treatment can be ensured if the both the children and caregivers are motivated and encouraged to attend the sessions in small groups together (Alonso Martín *et al.*, 2016; Anderson *et al.*, 1997; Chowdhury & Escudier, 2003; Friedemann-Sánchez *et al.*, n.d.; Niba *et al.*, 2017; Sahasrabudhe *et al.*, 2017). In the present study, most of the caregivers demonstrated fair to good knowledge and practices. There was a significant association observed between practices of caregivers of children with T1DM and their gender. Children who were looked after by mothers for diabetic control were found to be doing better than those who were looked after by other caregivers. This result is congruent with some studies (Niba *et al.*, 2017; Noorani *et al.*, 2016b), who reported that children having mothers as the primary caregivers had a significantly lower mean HbA<sub>1c</sub>.

**Implications for Nursing Practice:** The results of this study indicate the need of diabetic nurse educator to empower the caregivers and children with T1DM regarding diabetes and its management in terms of insulin therapy and glucose monitoring, complications, diet, exercise and adherence in treatment regimen in each follow up. Nurses working in paediatric setup should be prepared in all the areas of diabetes and its management, so that they can deliver comprehensive care. Present study has some strengths such as the direct observation of insulin administration and 24 hour recall of one day dietary intake and its conversion to calories (Kcal), but some of the practices were self-reported. Therefore, chances of caregivers giving socially acceptable responses is there. The cross-sectional study design limit to establish causal relationships between T1D care and glycemic control. In view of only one diabetic nurse educator, there is need for having more trained nursing personnel posted in the OPD to supervise the diabetic care provided by the caregivers of children with T1DM. The study needs to be replicated in large sample size, multiple settings with more exploration on dietary aspects, physical activity and parenting style over glycaemic control using longitudinal study design.

**Conclusion:** There exists gap in knowledge and practices of the caregivers related to T1DM attributing to poor or suboptimal glycaemic control in children.

**Funding:** This study received no funding.

#### List of Abbreviation

**DKA:** Diabetic Ketoacidosis  
**HCP:** Health Care Provider  
**ITQ:** Injection Technique Questionnaire  
**MCQ:** Multiple Choice Questions  
**MDI:** Multiple Daily Injections  
**OPD:** Outpatient Department  
**T1DM:** Type 1 Diabetes Mellitus

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