Impact Of Insulin Pump On Quality Of Life/Psychological State Of Patients With Type 1 Diabetes Mellitus In King Fahad Armed Forces Hospital, Jeddah

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Abstract
Background: Diabetes is a burgeoning health concern that is increasingly prevalent in both developing and industrialized nations, exerting a significant economic and societal influence. The primary aim of our research was to assess the influence of insulin pump use on the overall quality of life, health-related depression and anxiety and diabetes appraisal experienced by individuals diagnosed with type 1 diabetes (T1D), in comparison to those who rely on an insulin pen for their treatment.
Methods: This study was a case control study in which authors compared quality of life and psychological state among patients with type 1 diabetes mellitus who are using insulin pump versus patients on multiple daily injections. This study was conducted at King Fahad Armed Forces Hospital in Jeddah during the period from May 1 to June 30, 2023. Study tool consisted of (1) sociodemographic and disease related data, (2) quality of life short form, (3) psychological assessment tool (Hospital Anxiety and Depression Scale), and appraisal of diabetes scale.
Results: The study included 50 participants; 23 were patients with T1DM on insulin pump (case group) while 27 were patients with T1DM not on insulin pump but using insulin injections (control group). The number of hypoglycemic episodes are significantly lower among patients on insulin pump than patients using insulin injections (P= 0.032). Mean score of all domains was found to be higher in patients using insulin pump as compared to patients not using insulin pumps, but without any statistical significance. In the anxiety subscale, the data reveal that there is a trend towards significance (p=0.087) in the frequency of anxiety between cases and controls. In the depression subscale, there is a trend towards significance (p=0.157) in the frequency of depression between cases and controls. Participants were asked about the perceived control of their disease. A significant difference (p=0.042) emerges between cases and controls.
Conclusion: The study found that patients with T1DM using insulin pumps experienced significantly fewer hypoglycemic episodes and perceived better control of their disease compared to those using insulin injections. While there were trends towards significance in anxiety and depression frequencies, the differences in overall domain scores between the two groups were not statistically significant.

INTRODUCTION

People with type 1 diabetes mellitus (T1DM) produce very little or no insulin at all. Exogenous insulin treatment in the form of MDIs or continuous subcutaneous insulin infusion (SCII) through insulin pumps is necessary for lifelong blood glucose control in persons with T1DM [1]. The prevalence of type 1 diabetes is increasing at a rate of 3-4% each year, according to epidemiological research [2], and people are being diagnosed at younger ages.

Young individuals with type 1 diabetes are experiencing an epidemic worldwide [3]. 35,000 children and adolescents in Saudi Arabia have type 1 diabetes, according to the eighth edition of the Diabetes Atlas [4]. This makes Saudi Arabia the seventh country with the most TIDM patients overall and the fourth country with the highest incidence rate (33.5 cases per 100,000 inhabitants) [3, 4]. Patients may experience "diabetes distress" [5] as a result of the daily struggles of dealing with diabetes and the pressures of self-management.

Managing a chronic ailment, such as diabetes, may be emotionally taxing. These issues make it harder to keep blood sugar levels steady. Understanding that diabetes pain is a predictor of worse glycemic outcomes [6] is also crucial. Diabetes is becoming a major problem in both developing and developed countries [7], with far-reaching economic and social consequences. Statistics show that 9.6% of the population in North America and the Caribbean are affected by it [8]. The globe Health Organization estimates that 347 million people throughout the globe have diabetes mellitus as of October 2013. Predictions put it as the #7 leading cause of mortality globally by 2030 [9,10]. Patients with type 1 diabetes should continue to work for tight control of their blood sugar levels. It drastically reduces the risk of potentially fatal complications associated with type 1 diabetes.

The risk of microvascular problems is reduced by 37% and the risk of myocardial infarction is reduced by 14% for those with diabetes if their HbA1c is reduced by only 1% [11]. Low blood sugar, or hypoglycemia, is a problem that may make it harder to control type 1 diabetes. Over the last decade, hypoglycemia has become more common among insulin injections - treated patients with type 1 diabetes. Severe morbidities, such as stroke, sudden heart failure, myocardial infarction, and ventricular arrhythmia, may be brought on by hypoglycemia [12]. Keep in mind that a person's attitude on their sickness and their long-term health is greatly impacted by quality of life considerations in these instances. The current research aimed to evaluate quality of life and psychological state among type 1 diabetes patients using insulin pump.

METHODS

Study Design
This study was a case control study in which authors compared quality of life and psychological state among patients with type 1 diabetes mellitus who are using insulin pump versus patients on multiple daily injections on carb counting.

Study Setting
This study was conducted at King Fahad Armed Forces Hospital in Jeddah during the period from May 1 to August 31, 2023.

Population
Patients with type 1 diabetes mellitus attending Endocrinology and Diabetes clinics at King Fahad Armed Forces Hospital in Jeddah.

Sample size and Sampling

This study contained two groups. First (Case group) is patients with type 1 diabetes mellitus on insulin pump. Second (Control group) is patients with type 1 diabetes mellitus on multiple daily injections (carb counting). Sample size was determined according to G* power analysis and participants were selected purposively.

Exclusion criteria

- Pediatric age group

Data collection

Data was collected by telephone interviews.

Instruments

Study tool consists of the following parts:

- Sociodemographic and disease related data
- Quality of life short form [13]
- Psychological assessment tool (Hospital Anxiety and Depression Scale) [14]
- Appraisal of diabetes scale [15]

Statistical analysis

After collecting data and entering data into the Statistical Package of Social Sciences (SPSS) software, a frequency analysis was done to assure no missing data. In the case of missing data, a case-wise deletion was performed. Once data integrity is achieved, frequency analysis was done to present baseline characteristics variables. Continuous variables are presented as means and standard deviations while categorical variables are presented as frequency and percentages. A statistically significant relationship was assumed at a P value of less than 0.05.

Ethical consideration

Ethical consideration was obtained from King Fahad Armed Forces Hospital and oral informed consent was gained from participants after explanation of study objectives for them.

RESULTS

The study included 50 participants; 23 were patients with T1DM on insulin pump (case group) while 27 were patients with T1DM not on insulin pump but using insulin injections and carb counting (control group). There were 30 female participants (60%) and 20 male participants (40%). The mean age of patients using insulin pump was 24.09 + 8.107 years while the mean age of patients no using insulin pump was 23 + 6.146 years (P= 0.593). Table 1 summarizes participants' demographic characteristics according to participant's group.

Table 1: Characteristics of study participants				
Variable		Cases	Controls	P value
Age (mean + SD)		24.09 + 8.1	23 + 6.1	0.593
Duration of T1dM (mean + SD)		11.57 + 8.3	9.07 + 6.9	0.255
Gender	Male	11	9	0.226
	Female	12	18	
Marital status	Single	18	21	0.632
	Married	5	5	
	Widow	0	1	
Educational level	University	16	21	0.367
	School	7	6	

Employment	Students	16	18	0.901
	Governmental or private sector	6	7	
	Self or freelancing	1	2	
Monthly income	Weak	3	2	0.53
	Average	16	25	
	High	4	0	
Residency place	Urban	22	25	0.561
	Rural	1	2	
Number of family members	=<3	3	4	0.282
	4-7	19	18	
	>=8	1	5	
Presence of comorbid conditions	Yes	7	6	0.367
	No	16	21	

The insulin pumps used among all cases was 780 Medtronic. The duration of insulin pump use varied among participants. It ranged from two months to five years. With most of cases using the pump for less than one year (n= 15). HbA1c was documented among 29 participants. The mean value was 6.9% + 0.99% with median level of 6.7% and it ranged from 5.4% to 10.6%. the mean HbA1c was higher among control group, but not statistically significant (6.62 vs 7.06, P=0.257).

All participants using insulin injections are measuring their blood glucose level regularly before taking insulin regimen. The number of hypoglycemic episodes are significantly lower among patients on insulin pump than patients using insulin injections (P= 0.032) (Table 2).

Table 2: Number of hypoglycemic episodes among study participants				
Number of hypoglycemic episode		Cases	Controls	P value
During week without exercise	Less than 2	21	16	0.032
	3-5	2	9	
	More than 5	0	2	
During week with exercise	Less than 2	20	19	0.358
	3-5	2	6	
	More than 5	1	2	

Quality of life among study participants was assessed using short form -36 (SF-36). Annex table 1 presents the results of a quality of life assessment among study participants, comparing responses between cases and controls. This table encompasses a wide range of health-related aspects and emotional well-being, providing valuable insights into the participants' self-reported perceptions of their health and life quality.

The table begins with an assessment of general health, where participants were asked to rate their health on a scale ranging from "Excellent" to "Poor." The data reveal a statistically significant difference between cases and controls, with a higher proportion of cases rating their health as "Excellent," indicating potential variations in overall health perception between the two groups (P<0.001). Continuing on, the table evaluates changes in health compared to the previous year, physical activity limitations, pain levels, emotional states, and expectations about

future health. These assessments offer a comprehensive view of the participants' physical and emotional well-being. Notably, several items indicate no significant differences between cases and controls, suggesting that the groups may share similar perceptions and experiences in certain aspects of their quality of life (Annex 1). It was found that psychological results were not related to the presence of other comorbid conditions.

Welch's test was performed to assess whether difference in scores between the two groups was significant or not. Mean score of all domains was found to be higher in patients using insulin pump as compared to patients not using insulin pumps, but without any statistical significance (Table 3).

Table 3: Mean score of case group versus control group in quality of life scale domains

Quality of life scale domain	Case	Control	P value
Physical function	93.24 ± 8.87	57.47 ± 32.22	0.078
Role physical	87.19 ± 13.74	65.78 ± 28.24	0.064
Bodily pain	97.24 ± 0	65.49 ± 42.42	0.148
General health	87.11 ± 17.53	57.42 ± 27.43	0.085
Vitality	87.10 ± 18.45	47.73 ± 23.76	0.067
Social functioning	83.71 ± 17.31	74.70 ± 21.56	0.241
Role-emotional	84.47 ± 12.44	68.77 ± 21.33	0.083
Mental health	84.59 ± 12.85	63.73 ± 28.58	0.073
Physical health	87.74 ± 8.74	66.12 ± 27.75	0.167
Overall mental health	78.39 ± 12.26	46.47 ± 37.44	0.098

Table 4 presents the frequency and severity of anxiety and depression among the study participants using the Hospital Anxiety and Depression Scale (HADS). In the anxiety subscale, the data reveal that there is a trend towards significance (p=0.087) in the frequency of anxiety between cases and controls. The majority of both cases and controls fall into the "No anxiety" category, but cases show a slightly higher proportion with mild, moderate, and severe anxiety compared to controls. However, this difference does not reach statistical significance, suggesting that anxiety levels may be relatively similar between the two groups. Similarly, in the depression subscale, there is a trend towards significance (p=0.157) in the frequency of depression between cases and controls. The "No depression" category is more prevalent in both groups, but cases exhibit a slightly higher proportion with mild, moderate, and severe depression compared to controls. Again, the difference does not reach statistical significance, indicating that depression levels may be comparable between the two groups.

Table 4: Frequency and severity of anxiety and depression on HADS among study participants

Subscale of HADS	Case	Control	P value
Anxiety			
No anxiety	10	15	0.087
Mild	9	10	
Moderate	3	1	
Severe	1	1	
Depression			

No depression	12	10	0.157
Mild	8	7	
Moderate	2	6	
Severe	1	4	

Annex table 2 provides an overview of the impact of diabetes on study participants. The first item assesses how bothered participants are by diabetes. Interestingly, the majority of both cases and controls express minimal to moderate levels of bother, with no significant difference between the two groups. This suggests that the emotional impact of diabetes is somewhat consistent regardless of diabetes status. Next, participants were asked about the perceived control of their disease. A significant difference (p=0.042) emerges, with a higher proportion of cases reporting "A lot" and "Very much" when compared to controls. This indicates that individuals using pumps tend to perceive their disease control as more challenging or less effective than those using daily injections and carb counting. The table also explores the level of uncertainty regarding diabetes and the perceived likelihood of developing related conditions in the future. These aspects show no significant differences between cases and controls, suggesting that uncertainty and perceived risk related to diabetes are similar across the two groups. Additionally, the table delves into participants' perceptions of their efforts in managing diabetes, revealing that cases are more likely to report a higher level of effort (p=0.055). Lastly, the extent to which diabetes hinders life development displays no significant differences between cases and controls.

DISCUSSION

Type 1 diabetes mellitus (T1DM) is a chronic condition that makes even the simplest tasks difficult. Long-term microvascular, macrovascular, and neurological problems may be avoided with these measures, which involve constant monitoring of blood glucose levels and the delivery of insulin. People with type 1 diabetes also need to take precautions to prevent hypoglycemic spells. The mental health and well-being of patients with T1DM are typically negatively impacted as a result of the illness burden and the complexity of self-management. Among patients with type 1 diabetes, 28% had significant diabetes-related distress, according to the Australian branch of the Management and Impact for Long-term Empowerment and Success (MILES) research [16]. Worry, shame, and doubt about whether or not one's emotions are influenced by one's diabetes all contributed to this anguish. There are also reportedly significant rates of anxiety (27%), sadness (20%), and clinical depression (12%) [17-18]. There seems to be a self-perpetuating loop between diabetes and the emotional toll it takes. Optimal glycemic management is made more difficult by comorbid depression and the emotional discomfort that comes from living with a chronic disease [19]. Consistent mental health concerns and poor glycemic control are intertwined, making it crucial to comprehend the obstacles to T1DM self-management. There is a need for a holistic approach to diabetes treatment that incorporates psychological support services [20] since studies show that when persons with diabetes are better educated and more motivated, they are more likely to have improved diabetic control and enjoy a greater quality of life.

The insulin pump (or continuous subcutaneous insulin infusion [CSII]) and multiple daily insulin injections (MDII) are now two well-established methods for regulating glycaemic levels. About 40 years ago, CSII treatment was initially reported, and ever since then, it has

been hailed as the best method for enhancing glycaemic control in those with T1DM [21]. Multiple meta-analyses [22–25] have shown that CSII improves diabetes treatment by lowering glycated haemoglobin levels (HbA1c) and the frequency and severity of hypoglycemic episodes. The combination of such compelling evidence with more compact, user-friendly gadgets has boosted its appeal [26].

However, research into the psychological and social effects of these therapies is few. Quantitative studies assessing CSII users' quality of life are few. When comparing CSII treatment to MDII, one quantitative systematic literature review found no evidence to show an increase in quality of life [27]. Additionally, the study found that preexisting research yields contrasting results owing to uneven evaluation or inadequate methodology. Rather than the pump treatment not improving patients' quality of life, the authors speculate that the lack of reported benefit of CSII is the product of subpar research. The quality of life of CSII users was compared to that of MDII users in a Cochrane study conducted by Misso et al. [22]. Using the reliable Diabetes Quality of Life Scale, two of the included studies found that MDII users had a higher quality of life than CSII users [28, 29]. The validated Diabetes Treatment Satisfaction Questionnaire was utilized in a further four research, with two of those studies included individuals younger than 18. Four studies [30–33] found that CSII users were more satisfied with their therapy than MDII users. Misso et al. [22] found that overall, patients treated with the CSII were happier than those treated with the MDII.

T1DM is often self-managed by the patient [34-43], unlike other chronic conditions in which the patient plays a secondary role in therapy. Users of insulin pumps often claim that the tool has encouraged them to take more control of their lives. However, a difference was found between users with high and low HbA1c by Ritholz et al. [44]. Users with poor glucose control were less likely to take initiative when it came to managing their condition. They tested the boundaries of their increased mobility and adaptability made possible by the pump, doing so with the full knowledge that their actions were not only legal but morally laudable.

Patients who use insulin pumps expect the therapy to reduce their hemoglobin A1c levels, normalize their blood sugar, and reduce the frequency with which they suffer hypoglycemia. If CSII isn't working, stopping therapy is an option [41]. Everett et al. [40] showed that while CSII medication made glycaemic control easier to achieve, it still required devotion on the side of pump users. Additional barriers to achieving appropriate HbA1c levels include a fear of hypoglycemia, unwillingness to commit to a highly limited lifestyle, and skepticism regarding the value of HbA1c measurements. This assertion is at odds with the findings of other research, such as Garmo et al.'s [45], which show that patients are aware of the relevance of HbA1c numbers owing to its link with the risk of complications of the illness. Examining the differences amongst pump users with varied degrees of diabetes control may shed light on these apparently contradictory results. Although they recognized the need for ongoing effort, those with low HbA1c felt that the pump was beneficial in achieving optimal diabetes management. Those with higher HbA1c levels who used the pump were under the impression that it would miraculously reverse their diabetes. It was shown that these attitudes had an impact on glycaemic control overall, with more optimistic expectations being more likely to come true.

Insulin pump users often describe feeling better in command of their type 1 diabetes. Blood glucose levels were shown to be more steady and near to normal in many trials [38, 39, 44-46]. Some people who use insulin pumps also say they are better able to see the warning signals of a hypoglycemic episode and react properly. These benefits, it was hoped, will one day aid in

the prevention of diabetes. The improvement in quality of life was due in part to the knowledge that hypoglycemia episodes were occurring less often and that glycaemic control was more stable.

If you suffer from a chronic illness, getting through each day might be challenging. Because diabetes is a chronic condition, self-management involves paying constant attention to many details beyond the basics of one's day-to-day life, including one's diet, exercise routine, weight, body measurements, medication schedule, and blood glucose levels. This results in a desire for regularity and meticulous planning, as well as a sense of being hemmed in in one's everyday activities [47].

There are three ways of looking at the insulin pump that are significant here. Many folks have found that CSII therapy was the key to finally getting well. Users who have managed to get their blood sugar levels under control generally report feeling more in control of their lives. The pump makes it easier to sever relationships, which leads to more independence, which leads to more control over one's food, daily schedule, and ability to drop everything and hang out with friends whenever the mood strikes.

Changes in pumpers' attitudes about food over time have also been studied. Because of the pump, patients have to adopt a new diet. Eating was no longer seen as a chore because of the influence it had on glycemic control and the need for supplementary insulin injections to offset these effects. Eating should not be regulated so strictly, but rather allowed for more enjoyment and self-control. The obvious benefits of this were mentioned, including portability, improved sleep quality, increased energy, and increased strength. These benefits allow for a less stressful way of life and a quicker ability to adjust to new situations. Even after using the pump to free themselves, several persons still felt the restrictions imposed by the therapy to be too restrictive. Another disadvantage of CSII therapy is the cost, which varies widely depending on the patient's health care system and available resources. Controlling Type 1 Diabetes with an insulin pump may need increased time commitments. However, there is a group of persons for whom the pump provides little to nothing to ease the limitations brought on by the disease. It's not like they're reclaiming their life from a machine; it's more like they're surrendering. Those in this predicament either fail to complete CSII therapy or need substantial assistance from their social network. [41].

People with type 1 diabetes who use pumps may find that increasing their knowledge of available therapies helps them better control their disease. Everett et al. [40] conducted an extensive investigation of how people who use pumps learn to do so. It's possible that patients who were just beginning pump treatment found it difficult to make sense of all the information available to them and determine whether the therapy was good for them. However, the pump's regulars consistently uncovered fresh information. Everett et al.[40] suggested that the best ways to learn self-management skills are via hands-on experience, interpersonal communication, and technological aids. The latter method, which takes use of emerging telehealth technologies and electronic resources, is anticipated to expand. However, it seems that the most beneficial method was instruction on the complexity of their unique diabetes pattern combined with active exploration, which helped them overcome some of the difficulties of the therapy. This is shown in the more responsible behavior of young individuals who use pumps, as pointed out by Tullman [48].

The use of an insulin pump adds to the already significant emotional burden of living with Type 1 Diabetes. Many people who use pumps report an improvement in their quality of life as a result of the increased happiness and independence they experience. Some people also

saw a lessening of their mood swings [45]. Users not only feel more in charge of their type 1 diabetes, but also a sense of empowerment and relief. As a result, they felt better about themselves, had less worry, and were more motivated to keep striving to better their health. Not failing at self-care made them feel worse about themselves [47].

Despite encouraging reports of improved quality of life, the difficulties associated with pump dependence persist. Many insulin users report feeling nervous because of their hypervigilance for signs of hypoglycemia [40]. Everett et al. [40] suggested addressing these worries early on in order to prevent the development of avoidance behaviors, which would make CSII therapy less successful. Constant worry and monitoring were required in case there was a malfunction in the technology. The potential life-threatening effects of a pump failure are not lost on most patients.

In fact, several users reported feeling unsafe in a variety of ways, including psychologically, socially, and physically. However, as time and experience progressed, self-acceptance arose, and users began to feel more personally responsible for their own care. Researchers Ritholz et al. [44] observed that those who used insulin pumps and had lower HbA1c levels also felt more comfortable discussing their condition in public. Those with higher HbA1c levels said they were disappointed with the pump since it did not alleviate all of their health problems. It was expected by these scientists that those whose first reactions to a diabetes diagnosis were similar would reap additional benefits from utilizing an insulin pump. One potential explanation is that addressing the feelings brought on by pump therapy helps with adaptation and treatment adherence.

The question of how type 1 diabetes and insulin pump use impacts a person's sense of self-worth is raised when considering the possibility that pathological levels of food intake monitoring might develop. A poor diet is a risk factor for type 1 diabetes [50, 51]. Tullman [48] looked at how pump therapy influenced the self-perception and self-esteem of young women. Her heightened awareness of her own body was the first sign of change. Type 1 diabetes and the pump have intricate effects on a person's feeling of value because of their similarity. Nonetheless, it seems that the effect on one's sense of self-worth is quite unique. Tullman [48] argued that it might be detrimental to one's sense of self-worth to accept that one's body is faulty or malfunctioning in some way. However, for others, the discovery that they have type 1 diabetes has been empowering.

According to Browne et al. [52], people with type 1 diabetes in Australia face stigma and discrimination. This prejudice stems largely from the fact that people with type 1 diabetes are often stereotyped as having type 1 diabetes. This review compiles many studies that examine the effects of the general public's understanding of type 1 diabetes and insulin pumps on those who have the disease. According to Ritholz et al. [44], the use of an insulin pump has the potential to lessen the negative stigma associated with having diabetes. Some people, however, discovered that wearing pumps made them feel awkward and self-conscious.

Garmo et al. [47] drew parallels between this stigmatization and normalization. The diagnosis of diabetes might become a person's only defining characteristic. Some people with type 1 diabetes (T1DM) feel stigmatized by their diagnosis and the therapy they must undergo every day—the insulin pump. Nonetheless, there were many who recognized a metaphor for overcoming an illness. The pump wasn't considered an accessory, but rather an integral component of human anatomy. Therefore, it represented the status quo. The repercussions of this pursuit of normality are substantial. Researchers Hood and Duke [53] found that using

an insulin pump helped patients become more independent and confident in themselves, two key factors in the quest for normality.

The study aimed to investigate the impact of insulin pump therapy on the quality of life, frequency of hypoglycemic episodes, and emotional well-being among individuals with Type 1 Diabetes Mellitus (T1DM). The comparison between patients using insulin pumps and those relying on insulin injections and carb counting revealed noteworthy findings. Firstly, participants on insulin pumps experienced significantly fewer hypoglycemic episodes compared to those using insulin injections. This aligns with previous literature suggesting that insulin pump therapy can provide better glycemic control, reducing the risk of hypoglycemia [57-60].

In examining the quality of life, the study utilized the Short Form-36 (SF-36) questionnaire to assess various domains. While mean scores in all domains were higher among patients using insulin pumps, the differences did not reach statistical significance. This outcome may suggest that, despite potential benefits in glycemic control, the overall impact of insulin pump therapy on quality of life may not be conclusive. This finding diverges from some previous research, which has indicated positive associations between insulin pump use and improved quality of life [60-63].

The assessment of anxiety and depression using the Hospital Anxiety and Depression Scale (HADS) demonstrated a trend toward significance, with slightly higher proportions of anxiety and depression in the insulin pump group, although not reaching statistical significance. This nuanced result highlights the complexity of the psychological aspects associated with different diabetes management methods. Interestingly, the perceived control of diabetes was reported as more challenging among insulin pump users, indicating a potential psychological burden associated with this mode of treatment. Overall, the study adds valuable insights to the existing literature by providing a nuanced perspective on the multifaceted impact of insulin pump therapy on individuals with T1DM [64-67].

By examining pump use, O'Kane et al. [42] provided a novel perspective that may inform the development of cutting-edge medical equipment. The authors found a large variation in use, which they attribute mostly to individuals' distinct social comfort zones. So while some preferred to be alone, others took advantage of the 'dead' time to ride the bus or train more often. Some participants were open about their Type 1 diabetes at work, while others took a more discreet approach. Patients with diabetes were also shown to be more likely to try to hide their insulin pumps when they were suffering emotional or social distress. Although many users choose to hide their pumps, some used the opportunity to let people know they have diabetes.

Given these findings, it is evident that the social implications of utilizing an insulin pump differ considerably amongst individuals. Nonetheless, increasing awareness of type 1 diabetes and insulin pumps was a shared objective.

CONCLUSION

This study sheds light on the multifaceted impact of insulin pump therapy on individuals with Type 1 Diabetes Mellitus (T1DM). The findings revealed that patients utilizing insulin pumps experienced a significant reduction in the frequency of hypoglycemic episodes, aligning with previous literature emphasizing the potential benefits of insulin pump therapy in achieving better glycemic control. However, despite the observed improvements in glycemic outcomes,

the study did not find statistically significant differences in the overall quality of life between patients on insulin pumps and those relying on insulin injections and carb counting. This nuanced result suggests that while insulin pump therapy may offer advantages in specific aspects of diabetes management, its impact on the broader quality of life remains complex and may vary among individuals.

Furthermore, the study delved into the emotional well-being of participants, assessing anxiety and depression levels. Although a trend towards significance was noted in both anxiety and depression, the differences did not reach statistical significance, indicating that emotional aspects may not be decisively influenced by the choice of diabetes management method. Notably, the perceived control of diabetes was reported as more challenging among insulin pump users, introducing a psychological dimension to the discussion. This research contributes valuable insights to the existing literature by providing a nuanced understanding of the outcomes associated with insulin pump therapy in T1DM patients. It highlights the need for a comprehensive and individualized approach to diabetes management, considering not only glycemic control but also the psychosocial aspects that influence the overall well-being of individuals living with T1DM. As advancements in diabetes care continue, further research is warranted to explore the intricate interplay between treatment modalities, psychological well-being, and overall quality of life in individuals with T1DM.

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Annex 1: Quality of life among study participants

Annex table 1: Quality of life assessment among study participants				
Item		Case	Control	P value
In general, would you say your health is:	Excellent	17	7	0.003
	Very good	6	12	
	Good	0	7	
	Fair	0	1	
	Poor	0	0	
Compared to one year ago,	Much better now than one year ago	18	13	0.014
	Somewhat better now than one year ago	4	2	
	About the same	1	10	
	Somewhat worse now than one year ago	0	2	
	Much worse now than one year ago	0	0	
Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports	Yes, Limited a Lot	2	1	0.144
	Yes, Limited a Little	3	9	
	No, Not Limited at All	18	14	
Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	Yes, Limited a Lot	2	0	0.086
	Yes, Limited a Little	0	3	
	No, Not Limited at All	21	24	
Lifting or carrying groceries	Yes, Limited a Lot	1	0	0.388
	Yes, Limited a Little	1	3	
	No, Not Limited at All	21	24	
Climbing several flights of stairs	Yes, Limited a Lot	1	2	0.358
	Yes, Limited a Little	2	6	
	No, Not Limited at All	20	19	
Climbing one flight of stairs	Yes, Limited a Lot	0	1	0.157
	Yes, Limited a Little	0	3	
	No, Not Limited at All	23	23	
Bending, kneeling, or stooping	Yes, Limited a Lot	1	1	0.411
	Yes, Limited a Little	0	2	
	No, Not Limited at All	22	24	
	Yes, Limited a Lot	0	2	0.121

Walking more than one and half kilometer	Yes, Limited a Little	3	8	
	No, Not Limited at All	20	17	
Walking for half kilometer	Yes, Limited a Lot	0	2	0.359
	Yes, Limited a Little	1	2	
	No, Not Limited at All	22	23	
Walking for 100 meter	Yes, Limited a Lot	1	2	0.359
	Yes, Limited a Little	0	2	
	No, Not Limited at All	22	23	
Taking a shower or wearing clothes	Yes, Limited a Lot	1	1	0.898
	Yes, Limited a Little	1	2	
	No, Not Limited at All	21	24	
Cut down the amount of time you spent on work or other activities	Yes	4	6	0.474
	No	19	21	
Accomplished less than you would like	Yes	3	7	0.219
	No	20	20	
Were limited in the kind of work or other activities	Yes	4	5	0.606
	No	19	22	
Had difficulty performing the work or other activities (for example, it took extra effort)	Yes	5	6	0.620
	No	18	21	
Cut down the amount of time you spent on work or other activities	Yes	4	4	0.552
	No	19	23	
Accomplished less than you would like	Yes	5	6	0.620
	No	18	21	
Didn't do work or other activities as carefully as usual	Yes	5	7	0.497
	No	18	20	
During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?	Not at all	15	15	0.627
	Slightly	4	6	
	Moderately	3	5	
	Quite a bit	0	1	
	Extremely	1	0	
How much bodily pain have you had during the past 4 weeks?	None	16	19	0.361
	Very mild	1	1	
	Mild	3	5	
	Moderate	2	0	

	Severe	0	2	
	Very severe	1	0	
During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?	Not at all	19	23	0.722
	A little bit	2	2	
	Moderately	1	1	
	Quite a bit	0	1	
	Extremely	1	0	
Did you feel full of pep?	All of the Time	2	2	0.226
	Most of the Time	10	10	
	A Good Bit of the Time	0	6	
	Some of the Time	7	7	
	A Little of the Time	3	2	
	None of the Time	1	0	
Have you been a very nervous person?	All of the Time	2	0	0.515
	Most of the Time	3	3	
	A Good Bit of the Time	0	2	
	Some of the Time	5	5	
	A Little of the Time	7	9	
	None of the Time	6	8	
Have you felt so down in the dumps that nothing could cheer you up?	All of the Time	0	1	0.211
	Most of the Time	3	1	
	A Good Bit of the Time	1	0	
	Some of the Time	0	4	
	A Little of the Time	5	4	
	None of the Time	14	17	
Have you felt calm and peaceful?	All of the Time	3	6	0.314
	Most of the Time	9	11	
	A Good Bit of the Time	2	6	
	Some of the Time	6	2	
	A Little of the Time	2	2	
	None of the Time	1	0	
Did you have a lot of energy?	All of the Time	1	0	0.526
	Most of the Time	8	13	
	A Good Bit of the Time	2	2	
	Some of the Time	9	6	
	A Little of the Time	3	5	
	None of the Time	0	0	
Have you felt downhearted and blue?	All of the Time	1	1	0.914
	Most of the Time	0	1	
	A Good Bit of the Time	0	0	
	Some of the Time	3	4	
	A Little of the Time	6	6	
	None of the Time	13	15	
Did you feel worn out?	All of the Time	1	1	0.766

	Most of the Time	2	4	
	A Good Bit of the Time	0	0	
	Some of the Time	6	5	
	A Little of the Time	4	8	
	None of the Time	10	9	
Have you been a happy person?	All of the Time	2	5	0.337
	Most of the Time	12	8	
	A Good Bit of the Time	2	7	
	Some of the Time	5	4	
	A Little of the Time	2	2	
	None of the Time	0	1	
Did you feel tired?	All of the Time	2	2	0.379
	Most of the Time	1	4	
	A Good Bit of the Time	1	4	
	Some of the Time	4	6	
	A Little of the Time	8	8	
	None of the Time	7	3	
During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?	All of the time	0	0	0.419
	Most of the time	3	2	
	Some of the time	5	3	
	A little of the time	3	8	
	None of the time	12	14	
I seem to get sick a little easier than other people	Definitely True	3	3	0.899
	Mostly True	2	1	
	Don't Know	3	3	
	Mostly False	6	10	
	Definitely False	9	10	
I am as healthy as anybody I know	Definitely True	1	5	0.403
	Mostly True	7	6	
	Don't Know	2	5	
	Mostly False	8	6	
	Definitely False	5	5	
I expect my health to get worse	Definitely True	0	1	0.314
	Mostly True	5	1	
	Don't Know	4	7	
	Mostly False	6	7	
	Definitely False	8	11	
My health is excellent	Definitely True	9	11	0.519
	Mostly True	12	12	
	Don't Know	0	2	
	Mostly False	1	2	

	Definitely False	1	0	

Annex 2: Impact of diabetes on life

Annex table 2: Impact of diabetes on study participants				
Item		Case	Control	P value
How bothered are you by diabetes?	Not at all	9	9	0.706
	A little	6	6	
	Moderately	5	7	
	A lot	2	1	
	Very much	1	4	
How well is your disease controlled?	Not at all	0	0	0.042
	A little	0	1	
	Moderately	4	14	
	A lot	9	7	
	Very much	10	5	
What level of uncertainty do you have now as a result of diabetes?	Not at all	18	16	0.612
	A little	1	3	
	Moderately	2	3	
	A lot	2	4	
	Very much	0	1	
What is your likelihood of developing or developing a condition due to your diabetes in the coming years?	Not at all	11	12	0.354
	A little	10	8	
	Moderately	2	5	
	A lot	0	2	
	Very much	0	0	
Do you think your diabetes control depends on your efforts as well as other factors?	Not at all	0	0	0.534
	A little	17	16	
	Moderately	2	4	
	A lot	3	3	
	Very much	1	4	
How effective are you in managing your diabetes?	Not at all	1	0	0.055
	A little	0	1	
	Moderately	1	8	
	A lot	12	14	
	Very much	9	4	
To what extent does diabetes hinder the development of your life to use?	Not at all	12	15	0.338
	A little	8	5	
	Moderately	1	4	
	A lot	1	3	
	Very much	1	0	