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ASSESSMENT OF PATIENT KNOWLEDGE, PRACTICE AND ADVERSE EVENTS OF INSULIN ADMINISTRATION AND STORAGE TECHNIQUES IN PATIENTS WITH DIABETES

Antriya Annie Tom, Namitha Antony, Pavithra Ashok, Muhammad Abdul Khadir PS, Juhy Jojo*

*Nirmala College of Pharmacy, Muvattupuzha, Kerala

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Abstract

Diabetes mellitus is a group of metabolic disorder characterised by hyperglycaemia. For effective therapy, correct injection procedures, adequate storage, insulin dose adjustment, meal timing, site rotation, and compliance. The aim of this work is to assess the knowledge and practice of insulin administration and storage techniques in diabetes patients. It is a survey based cross sectional study conducted through both online and offline modes among diabetic patients consuming insulin in Ernakulam district. 213 cases were included and it consist of diabetic patients on insulin therapy. About 54.4% of patients were males and 45.6% patients were females. Majority 57.3% experienced hypoglycaemia and 17.3% never experienced it. 51.6% patients were educated by nurse, 25.6% by doctors and only 17.6% were educated by pharmacist. The study presented an insight into the practices of insulin administration and awareness to the diabetic patients, study also extended to other health care professionals in the society.

***Corresponding Author**
Juhy Jojo

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Introduction

Insufficient insulin secretion, insulin resistance, excessive glucose generation, and/or aberrant lipid and protein metabolism are all factors that play a role in the pathogenesis of diabetes. Diabetes patients are at an increased risk for cardiovascular, peripheral vascular, and cerebrovascular illness. Diabetes affects one out of every five persons in various Indian cities. Early detection and implementation of appropriate therapeutic strategies result in the anticipated glycaemic outcomes and avoid vascular complications. Although there are various types of short, intermediate, and long acting insulins that can be administered with a syringe or a pen, optimal administration technique and procedures are critical for their effectiveness. India is rapidly emerging as the diabetes capital of the world .India has an estimated 77 million people with diabetes, which makes it the second most affected in the world. India leads the world with the largest number of diabetic patients earning the dubious distinction of being termed the “diabetes capital of the world.

Symptoms of Type 1 and Type 2 Diabetes

The classic symptoms of diabetes such as polyuria, polydypsia and polyphagia occur commonly in type 1 diabetes, which has a rapid development of severe hyperglycemia and also in type 2 diabetes with very high levels of hyperglycemia. Severe weight loss is common only in type 1 diabetes or if type 2 diabetes. Because of the disease's continuous course, many people ignore the signs and symptoms of diabetes. Many people are unaware that damage might begin several years before symptoms appear. This is unfortunate because early detection of symptoms can assist to quickly treat the condition and prevent vascular problems.

Insulin

Insulin plays a critical role in long-term diabetes, including medication failure, diabetic micro and macrovascular complications, and beta cell failure. Insulin is obtained from pork pancreas or is made chemically identical to human insulin by recombinant DNA technology or chemical modification of pork insulin. Insulin from pigs is being replaced with human insulin made with recombinant DNA technology. Insulin analogs have been developed by modifying the amino acid sequence of the insulin molecule.

Storage of Insulin Insulin is available in rapid-, short-, intermediate-, and long-acting types that may be injected separately or mixed in the same syringe. Vials of insulin not in use should be refrigerated. Extreme temperatures (<36 or

>86°F, <2 or >30°C) and excess agitation should be avoided to prevent loss of potency, clumping, frosting, or precipitation.

Administration of Insulin

Injections are made into the subcutaneous tissue. Most individuals are able to lightly grasp a fold of skin, release the pinch, then inject at a 90° angle. Thin individuals or children can use short needles or may need to pinch the skin and inject at a 45° angle to avoid intramuscular injection, especially in the thigh area. Routine aspiration (drawing back on the injected syringe to check for blood) is not necessary. Particularly with the use of insulin pens, the needle should be embedded within the skin for 5 s after complete depression of the plunger to ensure complete delivery of the insulin dose. Insulin may be injected into the subcutaneous tissue of the upper arm and the anterior and lateral aspects of the thigh, buttocks, and abdomen (with the exception of a circle with a 2-inch radius around the navel) [5]. Insulin is used by more than 30% of diabetics, either alone or in combination with oral diabetes medications.The goals of insulin therapy in both type 1 and type 2DM are to reach the target HbA1C level with a low rate of hypoglycemic episodes and the least amount of weight gain.

Insulin site reactions

Insulin site reactions are common local adverse events of insulin therapy. Lipodystrophy (LD), often caused by repeated reuse of needles, manifests as a localized lesion at the repeated injection site. If needles are reused or used improperly, it can also results in pain with bleeding and bruising, chances of breaking off and lodging under the skin, risk of contamination, infection, dosage inaccuracy.

If bruising, soreness, welts, redness, or pain occur at the injection site, the patient's injection technique should be reviewed by a physician or diabetes educator. Painful injections may be minimized by the following:

- Injecting insulin at room temperature.
- Making sure no air bubbles remain in the syringe before injection.
- Waiting until topical alcohol (if used) has evaporated completely before injection.
- Keeping muscles in the injection area relaxed, not tense, when injecting.
- Penetrating the skin quickly.
- Not changing direction of the needle during insertion or withdrawal.
- Not reusing needles.

Recapping, bending, or breaking a needle increases the risk of needle-stick injury and should be avoided. Insulin syringes and pens, needles, and lancets should be disposed of according to local regulations

Mixing of insulin

In some patients, a combination of rapid- or short-acting and intermediate- or long-acting insulins will result in a more normal glycemia than a single insulin. Insulin products come in a variety of formulations and particle size ranges. When rapid-acting and ultralente insulins are mixed, the rapid-acting insulin's beginning of action is not slowed. When rapid-acting and protamine-stabilized insulin (NPH) are mixed, the absorption rate decreases slightly but not the total bioavailability. However, in clinical trials, the postprandial blood glucose response was comparable.

- Patients who are well controlled on a particular mixed-insulin regimen should maintain their standard procedure for preparing their insulin doses.
- No other medication or diluent should be mixed with any insulin product unless approved by the prescribing physician.
- Insulin glargine should not be mixed with other forms of insulin due to the low pH of its diluent.
- Use of commercially available premixed insulins may be used if the insulin ratio is appropriate to the patient's insulin requirements.
- Currently available NPH and short-acting insulin formulations when mixed may be used immediately or stored for future use.
- Rapid-acting insulin can be mixed with NPH, lente, and ultralente.
- When rapid-acting insulin is mixed with either an intermediate- or long-acting insulin, the mixture should be injected within 15 min before a meal.
- Mixing of short-acting and lente insulins is not recommended except for patients already adequately controlled on such a mixture. If short-acting and lente mixtures are to be used, the patient should standardize the interval between mixing and injection.
- Phosphate-buffered insulins (e.g., NPH) should not be mixed with lente insulins.

Insulin formulations may change; therefore, the manufacturer should be consulted in cases where its recommendations appear to conflict with the American Diabetes Association guidelines

Materials and Method

Study site

It is a survey based cross sectional study conducted through online as well as offline modes among diabetic patients consuming insulin in Kerala

Study design:

cross-sectional study

Data collection method

- ✓ A questionnaire will be prepared and pilot study will be conducted by circulating the tools. Also, the questionnaire will be validated by experts.
- ✓ Based on the pilot study and validation, necessary modifications will be done.
- ✓ Finally, the questionnaire will be circulated through online and offline modes to diabetes patients in Ernakulam district and data will be collected.

Sample size: 200-300 [19, 20]

Study Criteria:

Selection of study population:

Inclusion criteria:

- Patients with type I and type 2 diabetes who are taking insulin.

Exclusion criteria:

- Patients with diabetes who are taking only Oral hypoglycemic agents.
- Those patients who are not willing to cooperate.

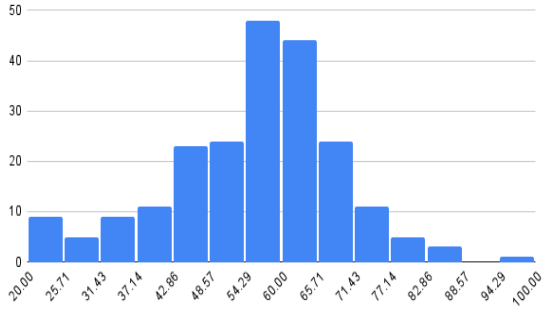
Data Analysis

All the data obtained were subjected to analysis by converting into percentage; the data thus compiled was used as the base for final result and discussion.

Result and Discussion

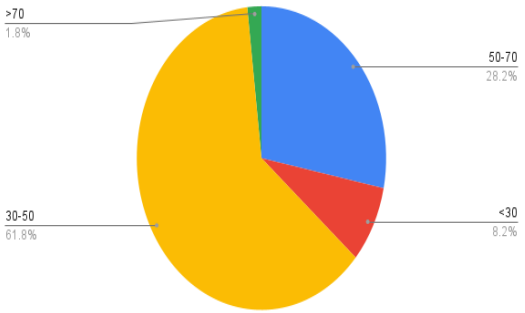
In this research work, a total of 213 cases were included and study population consisted of diabetic patients (type I and type II) on insulin therapy in Kerala.

Histogram of age

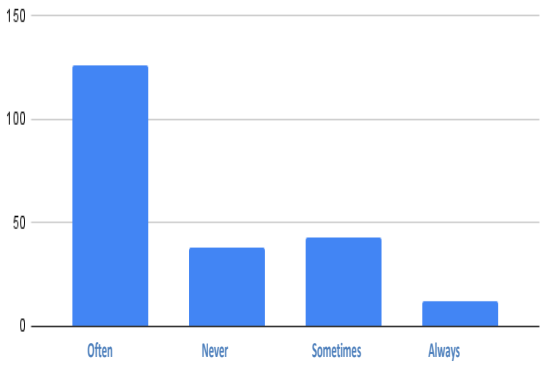


The age at which diabetes were diagnosed

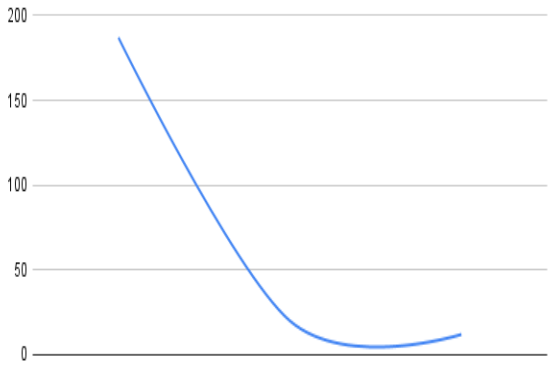
Age group	Frequency	Per cent
<30	18	8.2
30-50	136	61.8
50-70	62	28.2
>70	4	1.8



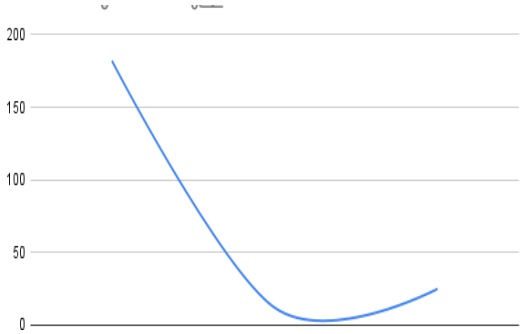
Patients experiencing hypoglycaemia during insulin therapy Majority of the patients (57.3%) experienced hypoglycaemia often during insulin use. Only 17.3% patients never experienced hypoglycaemia .



Storage of insulin vial/catridge

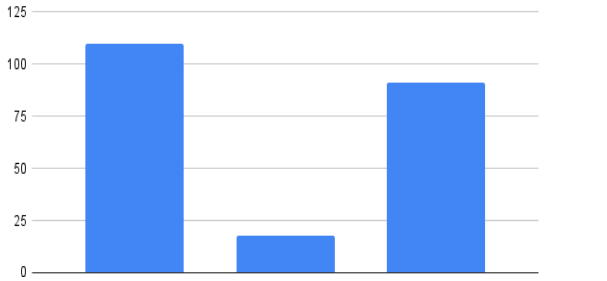


Unopened Insulin Vial/Catridge

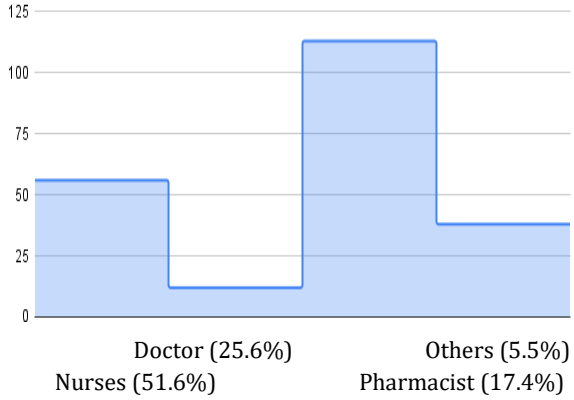


OPENED INSULIN VIAL/CATRIDGE

Storage of insulin at room temperature once it is opened



About 51.6% patients were educated by nurses regarding insulin administration technique while 25.6% of them were educated by doctors. Pharmacists were only able to educate 17.6% of diabetic patients about insulin usage technique

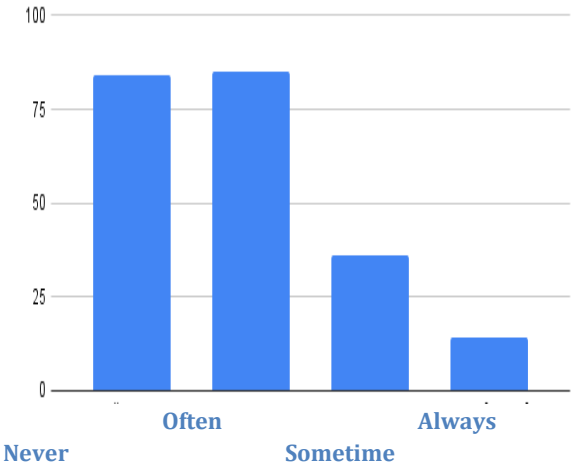


Devices used for injecting insulin

DEVICES	FREQUENCY	PER CENT (%)
SYRINGE	127	58
PEN	71	32.4
BOTH SYRINGE AND PEN	11	5
OTHERS	6	2.7

On analysing the site of insulin injection practices, 169 (77.2%) patients were about the correct insulin site to administer while 50(22.8%) of them were not aware about it. It was also found that 131 patients knew where to inject insulin properly while 88 patients didn't knew about it.

Shaking of insulin before use



Conclusion

This study was intended to assess the knowledge and practice of insulin administration including storage techniques among patients with diabetes. The maximum number of the patients were in the age group of 30-50(61.8%). During insulin use, the majority of the patients (57.3%) had hypoglycemia often. Only 17.3% of patients have never had hypoglycemia .Among 213 study cases, 54.4% of patients were males and 45.6 % patients were females. Most of the patients stored insulin in refrigerator and the opened insulin vials were stored for about 28 days. For the patients the major source of knowledge regarding insulin administration was provided by nurses (51.6%), doctors(25.6%) and pharmacists(17.6%).Most of the patients used syringes for the administration of insulin(58%).About 169 (77.2%) patients were about the correct insulin site to administer while 50(22.8%) of them were not aware about it. It was evident that most of the patients shake insulin vials before use, which may lead to dose variations. The study presented an insight into the common practices of insulin administration among patients and the effective awareness to the diabetic patients. The study provided more information on diabetes and insulin administration among diabetic patients. This study can be extended to other health care professionals in the society and create awareness among them by proper education will eventually help to improve the insulin administration in clinical practices.

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No

Conflict of interest

No Conflict of interest

Ethical approval and Inform Consent

Not Required

Reference

1. Pharmacotherapy Handbook ,seventh edition by Barbara G.Wells,Joseph .T. Dipiro,Terry L. Schwinghammer,Cecily.V.Dipiro,page no:210
2. https://www.thewellproject.org/hiv-information/diabetes
3. https://www.thehindu.com/sci-tech/health/india-has-second-largest-number-of-people-with-diabetes/article29975027.ece
4. Ramachandran A. Know the signs and symptoms of diabetes. The Indian journal of medical research. 2014 Nov;140(5):579.
5. American Diabetes Association. Insulin administration. Diabetes Care. 2004 Jan 1;27(suppl 1):s106-7.
6. Netere AK, Ashete E, Gebreyohannes EA, Belachew SA. Evaluations of knowledge, skills and practices of insulin storage and injection handling techniques of diabetic patients in Ethiopian primary hospitals. BMC public health. 2020 Dec; 20(1):1-0.
7. DeWitt DE, Hirsch IB. Outpatient insulin therapy in type 1 and type 2 diabetes mellitus: scientific review. JAMA. 2003 May 7;289(17):2254-64. doi: 10.1001/jama.289.17.2254. PMID: 12734137
8. Kapoor U, Ramasamy G, Selvaraj K, Sahoo JP, Kar SS. Does one-to-one demonstration with insulin pads by health-care providers improves the insulin administration techniques among diabetic patients of a Tertiary Care Teaching Hospital in South India? Indian journal of endocrinology and metabolism. 2016 Nov;20(6):767.
9. Yosef T. Knowledge and attitude on insulin self-administration among type 1 diabetic patients at Metu Karl referral hospital, Ethiopia. Journal of diabetes research. 2019 Dec 14;2019.
10. Trief PM, Cibula D, Rodriguez E, Akel B, Weinstock RS. Incorrect insulin administration: a problem that warrants attention. Clinical Diabetes. 2016 Jan 1;34(1):25-33.
11. Konstantinos Papatheodorou, Maciej Banach, Michael Edmonds, Nikolaos Papanas, Dimitrios Papazoglou, "Complications of Diabetes", *Journal of Diabetes*

Research, vol. 2015, Article ID 189525, 5 pages, 2015. https://doi.org/10.1155/2015/189525

12. Xu WL, von Strauss E, Qiu CX, Winblad B, Fratiglioni L. Uncontrolled diabetes increases the risk of Alzheimer's disease: a population-based cohort study. Diabetologia. 2009 Jun;52(6):1031-9.
13. Konstantinos Papatheodorou, Maciej Banach, Eleni Bekiari, Manfredi Rizzo, Michael Edmonds, "Complications of Diabetes 2017", *Journal of Diabetes Research*, vol. 2018, Article ID 3086167, 4 pages, 2018. https://doi.org/10.1155/2018/3086167
14. Chakrabarti A, Das A, Mandal J, Shivaprakash MR, George VK, Tarai B, Rao P, Panda N, Verma SC, Sakhuja V. The rising trend of invasive zygomycosis in patients with uncontrolled diabetes mellitus. Sabouraudia. 2006 Jun;44(4):335-42.
15. Baruah MP, Kalra S, Bose S, Deka J. An audit of insulin usage and insulin injection practices in a large Indian cohort. Indian journal of endocrinology and metabolism. 2017 May;21(3):443.
16. Shafi I, Parveen K, Hussain M, et al. Knowledge and practice on self-insulin administration among diabetic patients in tertiary care hospital Lahore. J Intensive Crit Care Nurs. 2020;3(3):1-7.
17. Alhindi Y, Sharaf S, Almeflahi A, Felemban R, Hamza E, Aljehani A, Mukhtar S. Investigating The Effect of Pharmacist Educational Intervention on the Proper Use of Insulin Pen in Older Patients with Type 2 Diabetes Mellitus in Primary Health Care and Diabetic Centers in Makkah Al-Mukarramah, Saudi Arabia. Indian Journal of Public Health Research & Development. 2020 Dec 1;11(12).
18. Gupta M, Verma S, Agarwal S. Knowledge, attitude, and practices of insulin use among type 1 diabetes patients in North India–A cross-sectional study. Eastern Journal of Medical Sciences. 2021 Jan 18.
19. Ghosh K, Dhillon P, Agrawal G. Prevalence and detecting spatial clustering of diabetes at the district level in India. Journal of Public Health. 2020 Oct;28(5):535-45.
20. Vijayakumar G, Manghat S, Vijayakumar R, Simon L, Scaria LM, Vijayakumar A, Sreehari GK, Kutty VR, Rachana A, Jaleel A. Incidence of type 2 diabetes mellitus and prediabetes in Kerala, India: results from a 10-year prospective cohort. BMC public health. 2019 Dec;19(1):1-0.
21. Priscilla S, Malarvizhi S, Das AK, Natarajan V. The level of knowledge and attitude on insulin therapy in patients with diabetes mellitus in a teaching hospital of southern India. Journal of family medicine and primary care. 2019 Oct;8(10):3287.
22. Manjula MJ, Nalini GK, Bindu CB. Study to assess insulin injection practices and awareness among type 2 diabetic patients in a government tertiary care center. National Journal of Physiology, Pharmacy and Pharmacology. 2021;11(7):715-20.
23. Niguse H, Belay G, Fisseha G, Desale T, Gebremedhn G. Self-care related knowledge, attitude, practice and associated factors among patients with diabetes in Ayder Comprehensive Specialized Hospital, North Ethiopia. BMC research notes. 2019 Dec;12(1):1-7.
24. Poudel RS, Shrestha S, Piryani RM, Basyal B, Kaucha K, Adhikari S. Assessment of insulin injection practice among diabetes patients in a tertiary healthcare centre in Nepal: a preliminary study. Journal of diabetes research. 2017 Jan 1;2017.
25. Kalra S, Mithal A, Sahay R, John M, Unnikrishnan AG, Saboo B, Ghosh S, Sanyal D, Hirsch LJ, Gupta V, Strauss KW. Indian injection technique study: population characteristics and injection practices. Diabetes Therapy. 2017 Jun;8(3):637-57.
26. Venkataraman AP, Kamath L, Shankar S. Knowledge, Attitude and Practice of Insulin Use of Diabetic Patients in India. medical care. 2020 Apr 21;5:6.
27. Mahdy AY, Alhojele MF. Exploring Local Insulin Injection Complication & Patients Knowledge and Practice and Offer Recommendation for Patient.