

An observational study on usage of insulin and self-injection practises among patients with diabetes attending to Diabetic Centre and Medical outpatient clinics of a tertiary care hospital of Northern Sri Lanka

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Research Article

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Abstract

Background: Prevalence of diabetes increasing world-wide particularly in low income countries. Management of diabetes sometimes requires insulin injection due to various reasons. Proper usage of insulin and injection techniques are important for diabetes control among who requires insulin. This study was aimed to assess current insulin practices and associated complications.

Methods and material: This was a cross sectional study conducted among diabetes patients attended all medical clinics and Diabetic Centre in Jaffna teaching Hospital which is the only tertiary hospital in the Northern Sri Lanka in May 2020. Insulin practices retrieved by using interviewer administered questionnaire. Data was analysed by using SPSS 26.

Results: Out of 360 patients 64.2% were female and mean age was 58.19 (12-89). Majority (61.9%) of them belongs to low income category and most (73.3%) of them using insulin more than 1 year. Main reason for the insulin initiation was oral hypoglycaemic failure (81.7%) and majority of them (80.0%) were using twice daily premixed insulin regime followed by daily basal insulin (11.4%) and basal bolus insulin (5.6%) regime. Most of the participants (81.4%) reported they do cleaning of the injection site before injection and 89.7% usually rotate the injection site. Approximately half of them (50.8%) inject themselves and majority use syringes (91.4%). Common injection site complications reported were skin changes (25%), followed by 15.3% persistent swelling (15.3%) and thinning of skin (7.8%). Angle of injection ($P=0.039$) and insulin regime ($P<0.001$) showed statistically significant association with skin changes. High proportion of participants 68.6% (95%CI: 63.7%-73.2%) experienced hypoglycaemia, using syringes 2.21 times (95%CI: 1.05-4.64) more risk of compare to pen users and missing meals 2.22 times more risk of hypoglycaemic events (95%CI: 1.18-4.17). Majority of them reported reusing the needles for injection (83.6%) and 35% were disposing needle into common garbage bin.

Conclusion: This study revealed significant gaps in current insulin practices from expected norm and hypoglycaemic events alarmingly high among participants. Exploring Continuous Glucose Monitoring Devices or flash monitoring can be a mitigation strategy and urgent attention from health professionals needed to improve the safe insulin practices.

Background

Diabetes is one of the major non communicable diseases which causes morbidity and mortality (e.g.: blindness, kidney failures, heart attacks, stroke and lower limb amputation) around the world (1). Large amount of money are spent on this disease and its complications annually. According to World Health organisation the number of people with diabetes has risen from 108 million in 1980 to 422 million in 2014(2). The global prevalence of diabetes among adults over 18 years of age has risen from 4.7% in 1980 to 8.5% in 2014 (2) and rising prevalence is more rapid in middle- and low-income countries (2). Type 2 diabetes patients usually responds life style measures such as diet control and exercise and oral hypoglycaemic agents (OHA). But some of them acquires resistance to OHA and needs insulin ultimately.

Reported annual incidence of OHA failure varies from 3-30% (3). Main reasons for this are poor compliance with diet and beta-cell function deterioration. On the other hand Type 1 Diabetes patients and some diabetes Type 2 diabetes patients requires insulin right from the start (primary OHA failure)(3). Human insulin, insulin analogues, and glucagon-like peptide-1 receptor agonist are common injectable used in management of diabetes (4).

Many patients on insulin having highly fluctuating blood glucose level and ultimately end up in repeated hospital admissions. The knowledge regarding insulin and its injection practises (including correct injection techniques and storage practices) are important for keeping the blood sugar under control. Specific best practices recommendations regarding insulin injection techniques are essential for patients with diabetes as well as health professions (4) in order to address string blood sugar control. Insulin site local reactions (Lipodystrophy) are common due to repeated reuse of needles and improper or lack of rotation of injection sites (5). Two types of lipodystrophy reported in the literatures namely lipohypertrophy (LH) and lipoatrophy (LA) and LH is a thick firm “rubbery” feeling swelling which retards insulin absorption significantly and leads to adversely effect on diabetes control. So rotation of injection sites and avoidance of needle reuse can prevent LH which in turn improves glucose control (5, 6). So it is well known fact insulin type, injection techniques and site of injection can all affect the onset, degree, and duration of insulin activity (7). Management of diabetes requires regular blood sugar assessment, oral medications and insulin injections. These procedures generate sharps within the household and improper disposal has the potential to cause public health problems such as personal injury and propagation of blood borne infections via needle stick injuries. As such storage of insulin and proper sharp disposal education is a part of insulin management among patients (8).

Despite major studies which reveals that proper control of blood sugar can decrease the micro and macro vascular complications but still less importance is given to the proper technique, rather only insulin doses are being increased. Sri Lanka is a Lower Middle-Income country where 3 percent of the Gross Domestic Product (GDP) is spent on healthcare service and free medications (9). Proper insulin technique can reduce the amount of insulin medication and there by decrease the expenditure on this expensive drug and further, proper control of diabetes can reduce the complications and thereby reduce the burden of disease related complications. There are not many studies in Sri Lanka regarding insulin usage practices. A descriptive cross-sectional study among ambulatory patients with diabetes using insulin, who were being followed up at the North Colombo Teaching Hospital Sri Lanka revealed poor insulin usage related practices (10). But there has been no research done in Northern Sri Lanka in regards to insulin usage practices yet. So in this study the usage of insulin, the injection technique, storage practices and sharp disposal practices were assessed and associated factors explored with selected practices in addition to this study also identified the incidence of hypoglycaemic events and associated factors.

Methods And Materials

This was an institutional based descriptive cross sectional study conducted among diabetes patients all medical clinics and Diabetic Centre in Jaffna teaching Hospital which is the only tertiary hospital in the Northern Sri Lanka. Most of the patients in this region follow their clinic in this institution. All diabetes patients following medical and endocrinology clinics who are on insulin and age 12 years or more were included in the study during study period (1st May 2020 to 31st May 2020). As our clinic patients are adults with 12 or more years of age, it was difficult to explain and obtain the informed consent in children and mostly insulin injection practices are not carried out by themselves, only patients above 12 were included in the study. Also mentally incompetent or pregnant women were excluded from the study as many pregnant women use insulin for a transitional period. Sample size was calculated by using the following formula (11): $n = z^2 \times P(1-P) / d^2$

As it is a cross sectional study z is the Z score, ϵ is the margin of error, N is population size and \hat{p} is the population proportion a margin of error of (ϵ) 5%. Assumed a population proportion of 0.5. Z for a 95% confidence level is 1.96. Adding 10 % of non-responders gave estimated sample size of 425. On average 550 patients on insulin attend in all the medical clinics and Diabetic centre in Teaching hospital Jaffna monthly. Therefore, all the diabetic patients using insulin attended during study period to medical clinic and Diabetic Centre were included. The duplication was avoided by using clinic numbers. Altogether 360 patients (85% of the estimated sample) were completed the study. An interviewer administered questionnaire was used (**Additional File 1**). The study tool has been developed from personal long-time experience of the investigators on insulin usage and extensive literature review. These questions were also be used in many studies published in peer review journals and also validated by five physicians working in Teaching hospital Jaffna. Ethical approval was obtained from ethical review committee of Faculty of Medicine, University of Jaffna.

Data collection team consisted of two trained data collectors who are senior house officers in medicine and by the principal investigator (PI). Both data collectors were given adequate training by PI and guidelines to minimize observation variability and to increase the quality of data. Data were collected before and during clinic consultations. If the patient was not aware of the type of insulin and oral hypoglycaemic agents, information were abstracted from clinic book after the consent from patient. Skin changes (atrophy/hypertrophy) were confirmed by the principal investigator. Data were computerized and analysed with statistical packages of SPSS 26 version. The descriptive findings of the study were shown with the help of tables, pie charts and bar charts. Chi-square test was used to identify the association and P value < 0.05 considered as statistically significant. Findings of important percentage presented with a 95% confidence interval.

Results

Background characteristics of patients (socio demographic and insulin usage factors):

Three hundred and sixty (360) patients who are using insulin as part of their treatment completed the study. Socio demographic characteristics of the participants were summarised in **Table 1**. Majority

(64.2%) of them were female and mean age of the participants was 58.19(Range: 12-89).Two hundred fifty five of them (60.8%) reported completion of secondary school and 11 of them (3.1%) never attended a school. Most of them (86.4%) married and 27 (7.5%) were widowed. Two hundred and twenty three (61.9%) of them were falls into low income category (Less than Rs.25000 family income) and 33.3% were in middle income category (Rs-25001-Rs50000).

The background characteristics of insulin usage among the patients were summarized in **Table 2**. Majority (38.9%) of them were using insulin for 1-5 years and 124 (34.4%) were using it for more than 5 years. Main reason for the insulin initiation was oral hypoglycaemic failure (81.7%) and 17 patients (4.7%) preferred insulin over oral hypoglycaemic agents. Among the 360 insulin users 22 (**6.1%CI: 4.0-9.0**) were identified as Type I Diabetes. Majority of them (80.0%) were using twice daily premixed insulin regime followed by daily basal insulin (11.4%) and basal bolus insulin (5.6%) were common regime in use. Eight seven patients (24.2%) believed they can stop insulin at point in future. Concomitant use of oral hypoglycaemic agents were common among patients (55.8%).Metformin was the common oral hypoglycaemic agent (49.4%) prescribed as showed in **Figure 1**.

Insulin techniques related practices among participants

Various insulin technique related practices assessed among participants and results were summarized in **Table 3**.Large number (293) of participants (81.4%) reported they do cleaning of the injection site before injection site and 89.7% usually rotate the injection site while 8.9% do some times. As showed in **Figure 2**, 78 patients (21.7%) mentioned the use abdomen as sole injection site, 72 patients (20.0%) inject in upper arm only and 35 patients (9.7%) solely inject on thigh. Remaining participants (48.6%) use multiple sites of the body for injecting insulin.

Approximately half of the participants (50.8%) inject insulin themselves while approximately same percentage (49.2%) use other for injecting insulin. Majority patients (56.1%) pinch the skin before injection, 71.9% inject at the angle around 45degrees while 22.5% inject at 90 degree angle. Most the participants use syringes (91.4%) and only 8.6% uses pen insulin type. Significant proportion reported reusing the needles for injection (**16.4%CI: 12.8- 20.5%**) and 35% of participants disposing needle into common garbage pin. Further 11.4% of them disposing into garbage dump and 1.7 % dumping into the toilet pits. Significant proportion (**48.6%CI: 43.5%-53.8%**) of patients not received any health education regarding disposal of needles.

Injection site complications

Common complications assessed were tabulated in **Table 4**.Ninety participants (25%; CI: 20.7-29.7%) identified suffered from skin changes, followed by 15.3% (95%CI: 11.8-19.2) with persistent swelling and 7.8 %:(95%CI: 5.3%-10.9%) were reported wasting or thinning of skin. Association between skin changes and different injection techniques were analysed and summarized in **Table 5**.Among the several factors analysed angle of injection (P=0.039) and insulin regime (P<0.001) statistically significant association. Rotating the site, cleaning the site, reusing the needle, pinch the skin before injection, type of insulin used

(Syringe vs. Pen) and who inject insulin were not significantly associated with skin changes ($P>0.05$). Angle of injection practices (which was significantly associated with skin changes) analysed with several demographic factors to see whether in significant differences and results summarised in **Table 6**. Factors sex, civil status, family income and educational status not significantly influencing on angle injecting insulin practice ($P>0.05$).

Insulin storage practices:

Majority of the participants (91.1%) reported storing the insulin in refrigerator but 7.2% reported storing in natural containers and 1.7% storing in room temperature. Among the participants who storing in refrigerators 69.8% storing at door while 3.7% storing at deep freezer and 26.5% storing in shelf. While travelling 30.2 of them carrying in container with ice pack but 37.8% mentioned they carry in hand bag (**Table-7**).

Hypoglycaemia and associated factors:

Quite significant proportion of participants **68.6% (95%CI: 63.7%-73.2%)** experienced hypoglycaemia. Most commonly they reported palpitation and sweating (28.6%) symptoms followed by sweating only (12.2%), palpitation only (8.1%), and 5.3% reported palpitation and headache. 4.7% reported loss of consciousness and palpitation and 2.2% reported loss of conscious only (**Table-8**). Seventy three patients (20.3%) reported they miss meals after injection and also majority of them (64.4%) getting insulin injection after meals. Seventy one of the participants (19.7%) adjust their insulin doses on their own and 68.9% of them have glucometer but only 73.8% of them only used the glucometer less than one week duration before interview. Also majority of them (56.4%) did not carry glucose /jelly beans in case any hypoglycaemic event. Various factors examined to explore the association with hypoglycaemic events (**Table-9**). Type of insulin (Syringe) ($P=0.033$) and missing meals ($P=0.012$) were significantly associated with hypoglycaemic event. But socio demographic factors such as sex and educational status, concomitant use of oral hypoglycaemic or adjusting the insulin dose by themselves not significantly associated with hypoglycaemic events ($P>0.05$). Using syringes 2.21 times (**95%CI-1.05-4.64**) more risk of developing hypoglycaemia compare to pen users. Likewise missing meals 2.22 times more risk of hypoglycaemic events (**95%CI: 1.18-4.17**). Finally as showed in **Figure 3**, 37.2% of participants received information regarding insulin usage from doctors and for 21.39% main source was nursing officers. Meanwhile 28.3% of them were reported they get information from both doctors and nursing staffs.

Discussion

In spite of increased attention given by published literatures (7, 12, 13, 14 &15) on correct insulin usage practices and injection techniques, our study indicates significant gaps between recommended practices and current insulin injection techniques, storage and disposal practices among patients who requires insulin in Northern Sri Lanka as reported in previous studies in other parts of the world (16-19). It is also

well known fact that correct insulin technique is essential for desired glycaemic control (20). Even though insulin pens gaining popularity around the world, majority (91.4%) of our study population using syringes. In addition it was noted 7.2% of the participants storing the insulin in a natural containers and 1.7 % of them storing in room temperature. Even though current use insulin pens, cartridges and vials can be stored at room temperature between 15-25 degrees Celsius (C) for several days (8, 21) as in Northern Sri Lanka (Tropical country) most of day's temperature exceeds 25 degrees C and authors believe it has an impact of insulin potency which supported in the literature as well (22). Similarly non-use insulin (back up insulin) need to be store in refrigerator where freezing not possible such as door of refrigerator (22) but 3.7% of the patients reported they store the insulin deep freezer. Again this practice potentially affect the insulin potency. Further only 30.2 percent of the patients using a container with ice pack to carry insulin while travelling. Others not using the recommended practices (some carries in hand bag and some use plastic containers with cotton).

Common recommended body sites for insulin injection are abdomen, thigh and upper arm (23, 24). It is also recommended to rotate the sites. In this study most the participants inject insulin in abdomen followed by upper arm and thigh (**Figure 3**) when considering the alone site. And also majority of them (89.7%) reported they usually rotate the sites. So they use more than one sites for insulin injections. In the study done in Nepal reported all participants use thigh or/and abdomen for insulin injection (16). Similarly another study in India reported most of the Indian injectors use abdomen as main site followed by thigh and arm and some also used buttocks (25). But in our study around 8.9% of the participants reported they rotate the sites some times while another 1.4% not rotate the site at all. Even though cleaning of insulin injection sites not usually recommended in out of the hospital setting it is recommended use the clean hands and clean sites (8). In the current study majority of them (81.4%) reported cleaning the sites. Previous study in Nepal reported $\frac{3}{4}$ of their participants/their relatives clean their hands before injection (16). It is recommended to pinch the skin (1-2inch portion) and fat between thumb and the index finger and fold need to maintained for 5-10 seconds after injection(26). In our study 43.9% reported they did not pinch the skin before injection. Further around 16.4% of the participants reported they reuse the needle for injection. But this percentage was high in previous study reported in Nepal where patients reuse same needle on average (median) 16 times (16). Similarly a national survey in India reported 92.5% of the patients reused the needles (25) and another study in India reported patients used each needle on average 6 times (27). Reusing needle loose the sterility and sharpness (8, 28) might increase the local site reactions, injection site pain and infection (8, 28 & 29). As predicted significant high number of injection site complications reported among this study participants such as skin changes (25%), persistent swelling(15.3%) and wasting and thinning of skin(7.8%). Further our study also revealed significant association between skin changes and angle of injection (P=0.039) and insulin regime (P<0.0001). Even though rotating the injection site is a significant prevention measures for preventing LH (30) our study failed to show and association with skin changes and rotation of sites (P=0.169).

Hypoglycaemia is an important complication of insulin therapy but it is often overlooked (31). Most importantly our study showed significant number of patients (**68.6%95%CI: 63.7-73.2**) were experienced hypoglycaemic symptoms. Missing meals after injection (P=0.012) and type of insulin (syringe) (P=0.033)

were significantly associated with hypoglycaemia among our study participants. But most of the patients did not take mitigation action such as keeping glucose/Jelly beans (56.4%) ready in case of anticipated hypoglycaemia which raises the significant patient safety issue. A study in Ethiopia revealed same findings; majority (93.9%) experienced hypoglycaemia due to skipped meal and (51.9%) of them due to physical exercise without taking foods (32). Another study in Brazil also revealed 91.7% Type 1 Diabetes mellitus patients and 61.8% Type 2 DM patients experienced at least one hypoglycaemic incident in their study period but that study also revealed awareness regarding hypoglycaemia among the participants was poor (33). Due to the invent of devices of interstitial glucose level which is closely related to blood glucose level now it is possible to monitor blood glucose level continuously. Continuous Glucose Monitoring (CGM) or Flash Monitoring allow us to mitigate to improve the glycaemic control and mitigate any hypoglycaemic events. There are evidences supporting its use(34) but due to its cost and less evidences in Type 2 diabetes to support its use are big barriers to implement CGM (34). There are no CGM devices available yet in our region but authors recommends to explore its role in our population as high rate of hypoglycaemic events notes in this study. Finally we also assessed practices of needle disposal and 35% of participants disposed needle into common garbage bin, 11.4% of them disposed into garbage dump and 1.7 % dumping into the toilet pits. In spite of that majority **(48.6%CI: 43.5%-53.8%)** of patients did not received any health education regarding disposal of waste. Another study in Sri Lanka specifically looked the waste disposal practices also revealed same kind of results (68% disposed into a common household garbage bin) (10).

Limitation:

Our study also had few limitations as we conducted this study based on patients recall and records from the clinics there might be a potential information bias, direct observation of injection techniques by trained health care workers would avoid this bias. Even though this is single centre study, as Jaffna Teaching hospital only tertiary institution in Northern Sri Lanka findings of our study can be generalised to Northern Sri Lanka. However this study is probably first evidence from Sri Lanka comprehensively analysed various practices related to insulin therapy to add further value with existing literature around the world.

Conclusion

Our study revealed significant gaps between recommended practices in insulin usage and injection techniques and current practices among diabetes patients using insulin particularly injection techniques such as not pinching the skin before injection, angle of injection and reusing the needles. In addition storage of insulin and waste disposable were also particular concern. Further local site complications such skin changes, injection site swelling and wasting and thinning of skin were common among participants. Alarmingly hypoglycaemic incidents were common but awareness of preventing incidence was poor among the patients. This highlight the important patient's safety issue. Authors believe this is an urgent public health issue in our region and we recommend health professionals should give more attention to educate the insulin users regarding their proper use and injection techniques in addition to

promote proper storage and proper disposal habits. Not only educating patients using insulin but also continuous monitoring of techniques is essential to overcome this important diabetes management issue to improve the desirable glycaemic control and prevent diabetic related complications.

Declarations

Ethics approval and consent to participate Ethical clearance was obtained from the Ethical Review Committee of Faculty of Medicine, University of Jaffna. Permission to carry out this study was obtained from the Director, TH, Jaffna and written consent was obtained from the participants after explaining the purpose and the nature of the study

Consent to publish -Not applicable as there is no individual data in any form

Availability of data and material: Data can be provided on request from NS or NR

Competing interests-The authors declare that none of the authors has competing interests.

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Authors' contributions

SN, TP, MA conceived the study. SN, TP and MA involved in the data and sample collection. NR did analysis. NS and NR wrote the manuscript. All authors read and approved the manuscript.

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Abbreviations

DM-Diabetes Melleitus

LH-Lipohypertrophy

LA-Lipoatrophy

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Tables

Table 1: Sociodemographic characteristics of patients using insulin for their diabetes (n=360).

Variable	Categories	Statistics	
		Mean(+/_SD)	Range
Age		58.19(+/_13.59)	12-89
		No	Percentage (%)
Sex	Male	129	35.8
	Female	231	64.2
Educational Status	Never been to school	11	3.1
	less than grade 5	76	21.1
	Up to O/L	203	56.4
	Up to A/L	45	12.5
	Passed A/L without degree	7	1.9
	Graduate/Diploma	14	3.9
	Postgraduate/Profession	3	0.8
	Don't know	1	0.3
Civil status	Married	311	86.4
	Unmarried	19	5.3
	Divorced	2	0.6
	Separated	1	0.3
	Widowed	27	7.5
Family Income	Less than Rs25000	223	61.9
	Rs25001 to 50000	120	33.3
	Rs50001 to 75000	9	2.5
	Rs75001 to 100000	6	1.7
	More than Rs100000	2	0.6

Table2: Background features of Insulin Usage among Participants (n=360)

Variable	Categories	Number	Percentage (%)
Duration of Insulin Usage	Less than 1 year	96	26.7
	1 to 5 years	140	38.9
	More than 5 years	124	34.4
Reason for Insulin initiation	Oral hypo-glycaemic failure	294	81.7
	Type 1 Diabetes	22	6.1(CI:4.0-9.0)
	Patient preference	17	4.7
	Others	27	7.5
Insulin regime	Basal bolus regime	20	5.6
	Twice daily premixed insulin	288	80.0
	Daily basal insulin	41	11.4
	Others	11	3.1
Concomitant use of Oral Hypoglycaemic drugs	Yes	201	55.8
	No	159	44.2
About the Insulin Usage	Can Stop at one point	87	24.2
	Life long	273	75.8

Table 3: Insulin technique related practices among participants(n=360)

Variable	Categories	No	Percentage
Do you clean the injection site	yes	293	81.4
	No	67	18.6
Do you rotate the sites	Usually	323	89.7
	Some times	32	8.9
	No	5	1.4
Pinch the skin before injection	Yes	202	56.1
	No	158	43.9
Who injects the insulin	By themself	183	50.8
	By others	177	49.2
Angle of the injection	90 degree	81	22.5
	Around 45 degree	259	71.9
	Parallel to skin	20	5.6
Type of Insulin	Syringe	329	91.4
	Pen	31	8.6
Do you reuse the needle	No	301	83.6
	Yes	59	16.4
Health Education regarding disposal	yes	185	51.4
	No	175	48.6
Disposal of used needles	Common household garbage bin	126	35.0
	Sharp container	132	36.7
	Toilet pit	6	1.7

Garbage dump	41	11.4
Others	55	15.3

Table 4: Injection site complications

Variable	Categories	Number	Percentage
Skin Changes	Yes	90	25.0(95%CI:20.7-29.7)
	No	270	75.0
Persistent Swelling	Yes	55	15.3(95%CI:11.8-19.2)
	No	97	26.9
	No reported	208	57.8
Wasting or Thinning of Skin	Yes	28	7.8(95%CI:5.3-10.9%)
	No	124	34.4
	Not reported	208	57.8

Table 5: Factors associated with skin changes

Variable	Categories	Skin Changes		Statistics
		Present	Absent	
Do you rotate the sites	Usually	78(24.1%)	245(75.4%)	Chi. Sq 3.558,P-0.169
	Sometimes	9(28.1%)	23(71.9%)	
	No	3(60.0%)	2(40%)	
Angle of Injection	90 degree	26(32.1%)	55(67.9%)	Chi-Sq-6.507 P-0.039***
	Around 45 degree	63(24.3%)	196(75.7%)	
	Parallel to skin	1(5%)	9(95%)	
Do you clean the injection site	Yes	79(27.2%)	214(72.8%)	Chi.Sq-3.234 P-0.072
	No	11(16.4%)	56(83.6%)	
Reuse needles	Yes	79(26.2%)	222(73.8%)	Chi.Sq-1.520, P-0.218
	No	11(18.6%)	48(81.4%)	
Pinch the skin before injection	Yes	48(23.6%)	154(76.2%)	Chi.Sq-0.376 P-0.540
	No	42(26.6%)	116(73.4%)	
Do you use Insulin	Syringe	84(25.5%)	245(74.5%)	Chi.Sq-0.577 P-0.448
	Pen	6(19.4%)	25(80.6%)	
Who Inject Insulin	By them self	45(24.6%)	138(75.4%)	Chi Sq-0.033 P-0.855
	By others	45(25.4%)	132(74.6%)	
Insulin regime	Basal Bolus regime	6(30.0%)	14(70.0%)	Chi.Sq-29.798 P<0.0001***
	Twice daily premixed Insulin	56(19.4%)	232(80.6%)	
	Daily Basal	21(51.2%)	20(48.8%)	
	Others	7(63.6%)	4(36.4%)	

*** -statistically significant at 5% level

Table 6: Angle of injection of practice with socio demographic factors

Socio demographic Factor	P value
Sex	P-0.855
Educational status	P-0.068
Family Income	P-0.465
Civil status	P-0.082

Table 7: Storage of Insulin practices among participants (n=360)

Variable	Categories	Number	Percentage
Where do you store Insulin	Natural containers	26	7.2
	Refrigerator	328	91.1
	Room temperature	6	1.7
Where in the refrigerator (Among who stored at Refrigerator)	Deep freezer	12	3.7
	Door	229	69.8
	Shelf	87	26.5
Insulin Vials while travelling	Container with ice pack	109	30.2
	Hand bag	136	37.8
	Plastic containers with cotton	31	8.6
	Other ways	84	23.3

Table 8: Hypoglycaemia and related factors among participants

Variable	Categories	No	Percentage
Experienced Hypoglycaemic symptoms	Yes	247	68.6(63.7-73.2)
	No	113	31.4
Symptoms	palpitation	29	8.1
	Sweating	44	12.2
	Loss of consciousness	8	2.2
	Headache	6	1.7
	Confusion	8	2.2
	Others	27	7.5
	Palpitation, Sweating	103	28.6
	Palpitation, headache	19	5.3
	Palpitation, loss of consciousness	17	4.7
	All above mentioned symptom	10	2.8
	Missing values	89	24.7
Miss the meals after injection	Yes	73	20.3
	No	287	79.7
Gap between the meals and injection	5 minutes before meal	48	13.3
	10 minutes before meal	29	8.1
	15 minutes before meal	20	5.6
	20 minutes before meal	25	6.9
	After meal	232	64.4
	Not relevant to meal	6	1.7
Adjust the dose of Insulin on their own	Yes	71	19.7
	No	289	80.3
Keep the glucose/Jelly Beans	Yes	157	43.6
	No	203	56.4

Use the Glucometer	Yes	248	68.9
	No	112	31.1
When did you use the glucometer last?	less than one week	183	73.8
	less than one month	53	21.4
	Less than one year	10	4.0
	More than one year	2	0.8

Table 9: Factors associated with hypoglycaemia among participants

Variable	Categories	Hypoglycaemia		Statistics
		Reported- No (%)	Not Reported- No (%)	
Sex	Male	88(68.2%)	41(31.8%)	Chi Sq-0.014 P-0.904
	Female	159(68.8%)	72(31.2%)	
Educational status	No school	10(83.3%)	2(16.7%)	Chi Sq-5.085 P-0.166
	Primary	54(71.1%)	22(28.9%)	
	Secondary	175(68.6%)	80(31.4%)	
	Tertiary	8(47.1%)	9(52.9%)	
Concomitant use of oral hypoglycaemic	Yes	140(69.7%)	61(30.3%)	Chi Sq-0.29 P-0.632
	No	107(67.3%)	52(32.7%)	
Type of Insulin	Syringe	231(70.2%)	98(29.8%)	Chi Sq-4.551 P-0.033*** OR- 2.21(95%CI:1.05- 4.64)
	Pen	16(51.6%)	15(48.4%)	
Adjusting the insulin dose by themselves	Yes	51(71.8%)	20(28.2%)	Chi Sq-0.426 P-0.514
	No	196(67.8%)	93(32.2%)	
Missing Meals	Yes	59(80.8%)	14(19.2%)	Chi Sq-6.34 P-0.012*** OR- 2.22(95%CI:1.18- 4.17)
	No	188(65.5%)	99(34.5%)	
Using Glucometer	Yes	170(86.5%)	78(31.5%)	Chi Sq-0.001 P-0.97
	No	77(68.7%)	35(31.3%)	

*** -Statistically significant at 5% level

Figures

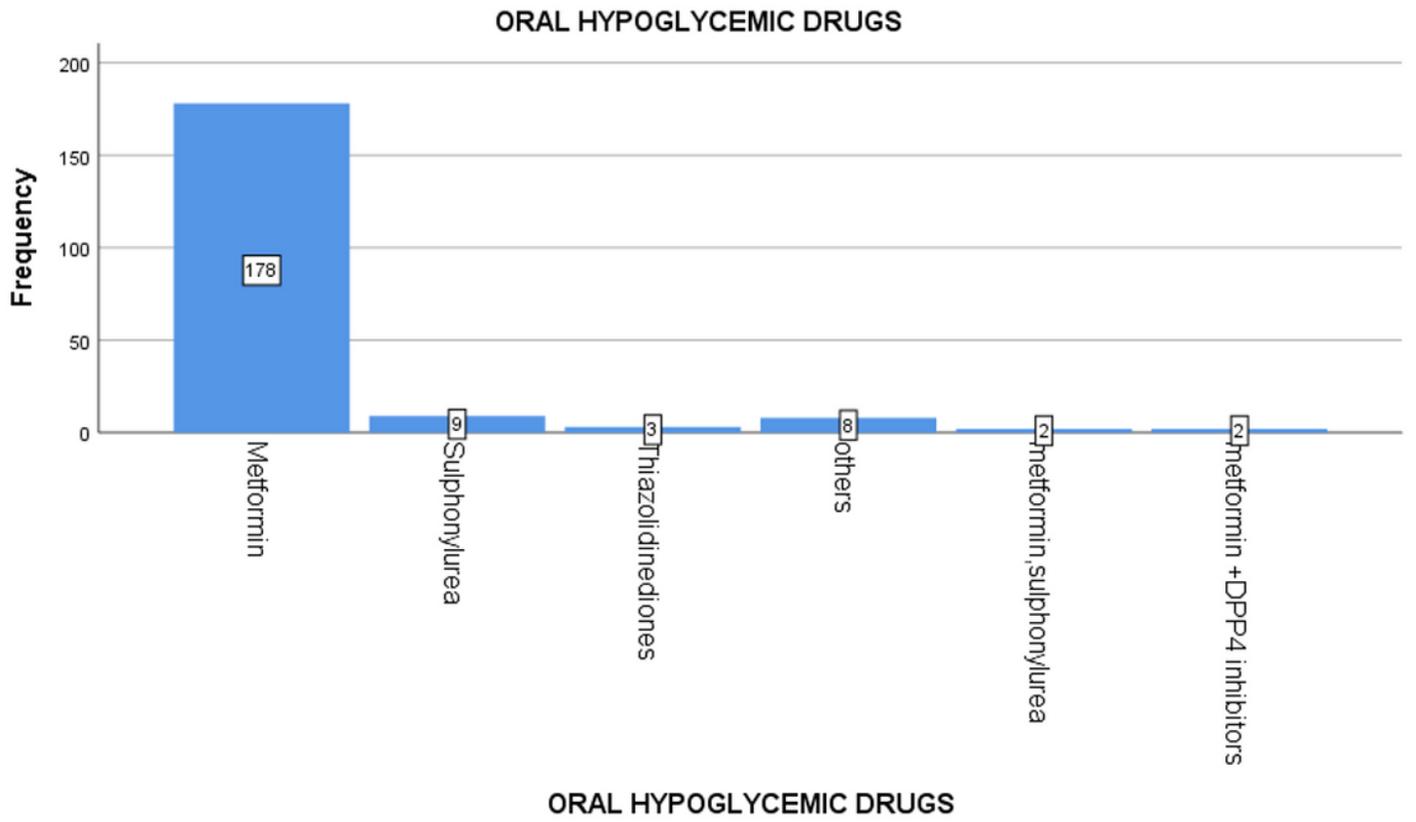


Figure 1

Types of oral hypoglycaemic drugs used concomitantly with Insulin

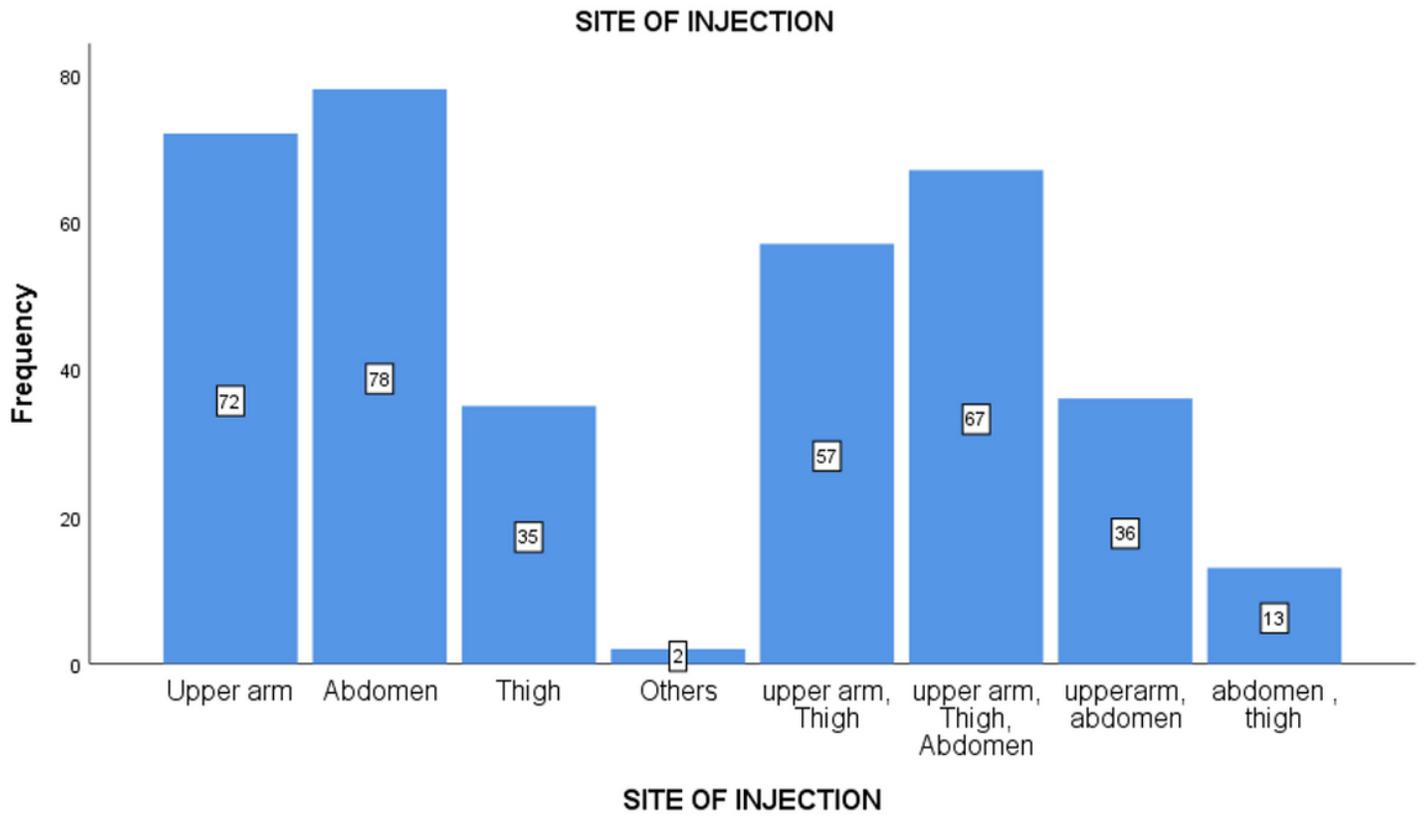


Figure 2

Injection site used by participants

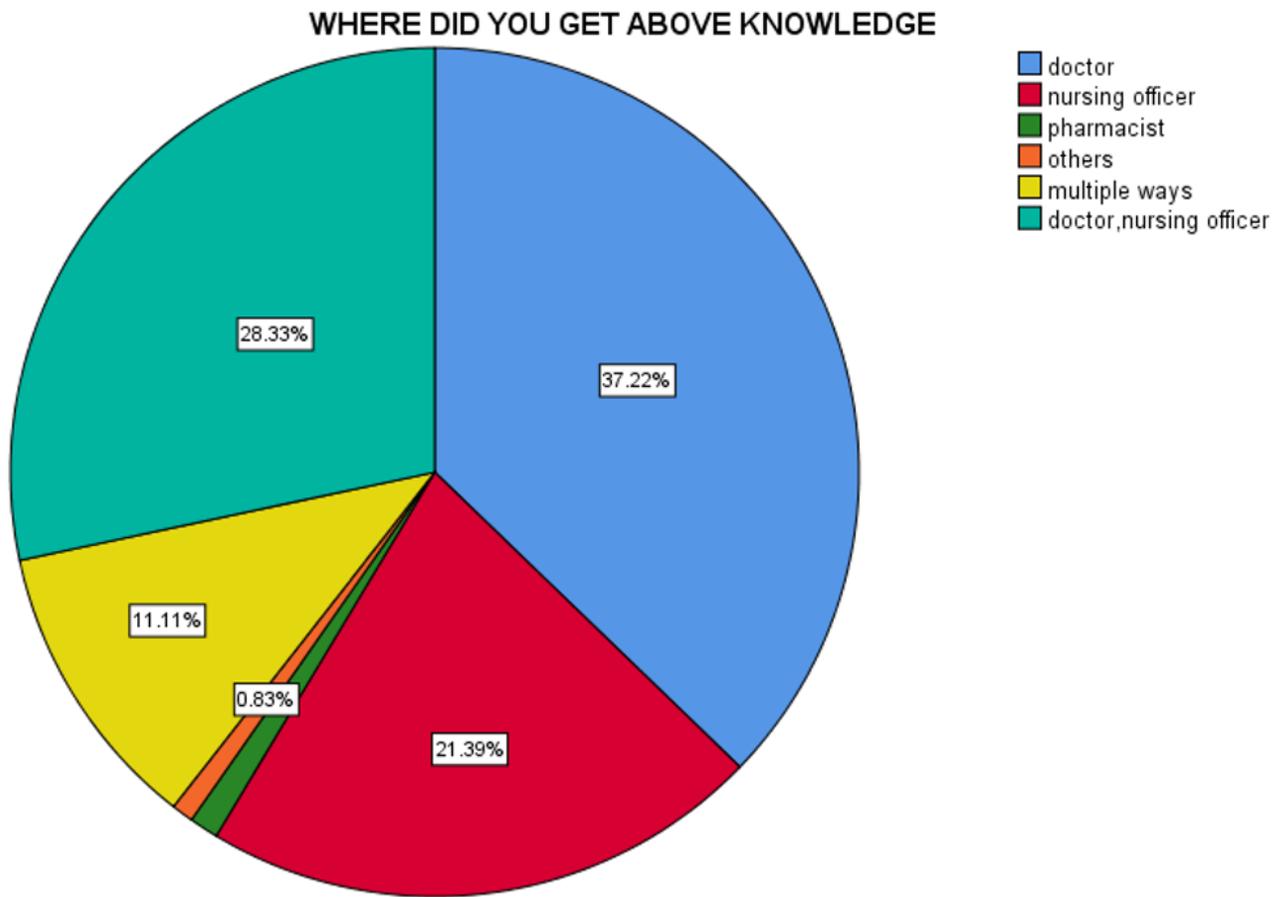


Figure 3

Main source of knowledge regarding Insulin