ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 8, Issue, 10, pp.39846-39852, October, 2016

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

ASSESSMENT OF KNOWLEDGE, ATTITUDE AND PRACTICE OF TYPE 2 DIABETES MELLITUS PATIENTS TOWARDS INSULIN THERAPY

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ARTICLE INFO

Article History:
Received 20th July, 2016
Received in revised form
22nd August, 2016
Accepted 08th September, 2016
Published online 30th October, 2016

Key words:

Type 2 Diabetes Mellitus,
Insulin therapy,
Knowledge,
Attitude and practice.

ABSTRACT

Background and Objectives: Strict insulin therapy is necessary for the proper control of blood sugar level in insulin requiring diabetic patients. This leads to elevated complications associated with insulin administration. Insufficient knowledge about insulin leads to preventable complications, adverse patient outcome, and poor glycaemic control. This study aims to assess the knowledge, attitude and practice of patients towards the insulin use, before and after patient counselling.

Methods: This is a prospective interventional study conducted in 70 Type 2 Diabetes Mellitus patients on insulin therapy. Knowledge, attitude and practice of patients towards the insulin therapy were assessed using a validated questionnaire at the baseline and reassessed during follow up after 3 months to assess the improvement. Data analysis were done by using SPSS (Statistical Package for Social Science) version 20.

Results & Discussion: Before counselling, the percentage of study population with good level of knowledge was very low (5.7%). It was then improved (81.4%) after patient counselling.

Conclusion: An improved knowledge about the proper administration and handling of insulin was observed. The study shows that the clinical pharmacist can play a vital role in disease management and creating awareness regarding the disease and drugs.

Citation: Soumya, P. V., Anil Babu, A., Dr. Anoop Kumar and Raju, R. 2016. "Assessment of knowledge, attitude and practice of type 2 diabetes mellitus patients towards insulin therapy", *International Journal of Current Research*, 8, (10), 39846-39852.

INTRODUCTION

Diabetes Mellitus

The term Diabetes Mellitus (DM) describes a metabolic disorder of multiple etiological factors characterised by chronic hyperglycaemia with disturbances of carbohydrate, fat, and protein metabolism resulting from defects in insulin secretion, insulin action or both (Joseph *et al*., 1999). The global prevalence of diabetes is predicted from 366 million people and it is estimated to reach 552 million people by 2030 (Shaw *et al*., 2010). India is considered as the diabetic capital of the world and it is found that every 5th person with diabetes will be an Indian (Jenny, 2004). Diabetes mellitus is one of the leading causes of death and disability globally (Lozano *et al*., 2012). Proper medical care and education is necessary to prevent acute and long term complications (Banimoghandum, 2008).

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Clinical presentation

The symptoms of DM include

- Polyuria
- Polyphagia
- Polydipsia
- Lethargy
- Weight loss
- Nocturia
- Blurring of vision

Diagnosis of DM

Diagnosis of DM is based on Fasting Blood Sugar (FBS), Random Blood Sugar (RBS), Post Prandial Blood Sugar (PPBS) and HbA_1C. Criteria for the diagnosis of DM includes symptoms of diabetes along with casual plasma glucose concentration≥200 mg/dL (11.1 mmol/L) or Fasting plasma glucose≥126 mg/dL (7.0 mmol/L) or 2-hour postload glucose≥200 mg/dL (11.1 mmol/L) during an Oral Glucose Tolerance Test (Joseph *et al*., 1999). HbA_1C is glycosylated haemoglobin, has recently been discovered to be abnormally

high in diabetics with chronic hyperglycaemia and reflects long term metabolic control. Since Haemoglobin (Hb) is exposed to the ambient glucose concentration in the blood, a higher concentration of glucose will result in more glycohaemoglobin formation. The result is that this Hb becomes a vital index of the long term control of diabetes and may be more reliable index than the degree of hyperglycamia or glucosuria. The advantage of measuring Hb as a parameter of diabetic control is that it indicates the level of control of the disorder for the previous 60 days when the red blood cells are about half way through their 120 days life cycle. The majority of the glycohaemoglobins is termed as HbA_1C (Eric *et al*., 1984).

Pathophysiology

The islets of Langerhans form the endocrine part of the pancreas, constituting 1% of the total pancreatic mass. Insulin is produced in the pancreatic β cells, initially as a polypeptide precursor, preproinsulin. Then it is rapidly converted in the pancreas to proinsulin. This forms equal amounts of insulin and c-peptide through removal of four amino acid residues. Glucose is the major stimulant for insulin release. The response is triggered both by the intake of food and the release of gastro-intestinal peptide hormones. Once released from the pancreas, insulin enters into the portal circulation. Liver rapidly degrade it and only 50% reaches the peripheral circulation. Insulin is primarily metabolised by liver and kidneys. In the kidneys, insulin is filtered by the glomeruli and reabsorbed by the tubules and degraded. The interaction of insulin with the receptor on the surface of cell, sets off a chain of messengers within the cell. This opens up transport processes for glucose, amino acids and electrolytes. Deficiency of insulin that leads to unrestrained hepatic glycogenolysis and gluconeogenesis with a consequent increase in hepatic glucose output. Also, glucose uptake is reduced in insulin sensitive tissues such as adipose tissue and muscle; hence hyperglycaemia ensues. Either as a result of the metabolic imbalances itself or secondary to infection or other acute illness, there is increased secretion of the counter regulatory hormones like glucagon, cortisol, catecholamine and growth hormones. All of these will further increase hepatic glucose production. At the same time the normal restraining effect of insulin on lipolysis is removed. Non – esterified fatty acids are released into the circulation and taken up by the liver, which produce acetyl co–enzyme A (acetyl co-A). The capacity of the tricarboxylic acid cycle to metabolize the acetyl co-A is rapidly exceeded. Ketone bodies, acetoacetate, and hydroxyl-butyrate are formed in large amounts and released into circulation. This results in a condition called diabetic ketoacidosis (Roger and Clive, 2003).

Management

A. Dietary management

Medical nutrition therapy is advised for all persons with DM. Ultimate aim of all medical nutrition therapy is to attain optimal metabolic outcomes and the prevention and treatment of complications. Most people with diabetes require a meal plan that is moderate in carbohydrates and low in saturated fat, with a focus on balanced meals. Fibre containing food should be included in diet, reduce intake of fatty foods. Also reduce sugar and sugary foods.

B. Exercise

In general, most patients with DM can benefit from increased activity (Nathan *et al*., 2009). Aerobic exercise improves insulin resistance and glycemic control in the majority of individuals, and reduces cardiovascular risk factors, contributes to weight loss or maintenance, and improves wellbeing (Joseph *et al*., 1999).

C. Oral Hypoglycaemic Agents (OHAs) (Roger and Clive, 2003)

Table 1. Oral Hypoglycaemic Agents

Class	Drug	Daily dose range
Sulphonyl ureas	1st generation	
	Tolbutamide	0.5-2g
	Chlorpropamide	100-500mg
	2nd generation	
	Glibenclamide	2.5-15mg
	Glipizide	2.5-40mg
	Gliclazide	40-320mg
	Glimepiride	1-6mg
Biguanides	Metformin	1-3g
Meglitinides	Repaglinide	1-16mg
	Nateglinide	180-540mg
Thiazolidinediones	Pioglitazone	15-30mg
Dipeptidtyl Peptidase-4	Sitagliptin	100mg
inhibitors	Vildagliptin	50 mg
	Saxagliptin	5mg
Incretin mimetics	Exenatide	10-20 mcg[9]
	Liraglutide	0.6-1.8mg[10]

Insulin therapy

Insulin therapy plays an important role in the management of type I diabetes mellitus and it is also important in the management of type II diabetes mellitu s (Bruston *et al*., 2006). Among adult patients diagnosed with type I or type II diabetes mellitus, 14% of patients use insulin only, 13% of patients take both insulin and oral medication, 52% of patients use oral medication only and 16 % of patients do not take either insulin or oral medication (National diabetes fact sheet, 2011). In initial stages of type II diabetes mellitus there occurs post prandial hyperglycaemia due to the loss of early insulin secretion. As the disease proceeds, there is fasting hyperglycaemia, due to decreased production (Cooppan, 2007). The proportion of patients using oral hypoglycaemic agents decreases over 15 years and many patients will need exogenous insulin therapy (American Diabetes Association, 1995). Since 1922 insulin has been used as monotherapy in patients with type I diabetes mellitus and since the late 1950's in combination or monotherapy in patients with type II diabetes. Insulin regimen should be individualised in accordance with patient's need, desired metabolic control and age. The clinical response of various particular type of insulin may vary with patients (Stephen *et al*., 2006).

Initiation of insulin therapy

Insulin therapy is indicated for patients in whom glycaemic target were not attained with 2 or more OHA and for patients whom are suffering from severe hyperglycaemia as indicated by fasting plasma glucose levels greater than 250mg/dl, HbA_1C levels more than 10% and/or symptoms of hyperglycaemia (Inzucchi *et al*., 2012). Insulin therapy is the last step of glucose lowering interventions which is normally being started 10-15 years after diagnosis (Nathan, 2002). According to ADA,

algorithm for the management of type 2 DM, insulin could be initiated with either once daily NPH insulin or a long acting insulin analogue (Hooman *et al*., 2007). The biphasic and prandial insulin preparation provide better glycaemic control than once daily basal insulin, but risk of hypoglycaemia and weight gain are higher (Hooman *et al*., 2007). Clinicians should consider 10 units of basal insulin at bed time, supper or in the morning a safe, effective recommendation for initiation of insulin therapy. This dose can be then adjusted based on how properly a patient has met individual glycaemic goals as measured by fasting blood glucose, post meal glucose levels, and self monitoring of blood glucose (IAFP, 1997).

Need for counselling in Diabetes Mellitus

Patient counselling is a process that improves patient's ability to make informed decisions regarding their disease and medication and motivate the patients to change their life style and dietary habits, which are harmful for their current health condition (Lewis, 1997). Pharmacists can play a vital role in patient's medication adherence and quality of life improvement. Consequently medical research and health care is becoming more patient focused, and there is a growing appreciation of the patient's perspective on health, disease and medical treatments (Miguel and Elaine, 2003). The diabetes education programmes should be combined along with counselling and psychological intervention. Psychological care will improve educational and medical intervention (Alder *et al*., 2000). Diabetes is a chronic condition that has great impact on the life of individual patient. The important task of the health care team is to give each patient knowledge, self- confidence and motivation (Palaian *et al*., 2004). The proper control is dependent on the patient's adherence to therapy, life style modifications, frequent blood glucose monitoring, etc and can be influenced by proper education and counselling of the patient (American Diabetes Association, 2004).

Need of better Knowledge, Attitude and Practice towards insulin therapy in diabetics

Strict insulin therapy is necessary for the proper control of blood sugar level in insulin requiring diabetic patients. This leads to an elevated complications associated with insulin administration. Insufficient knowledge about insulin leads to preventable complications, adverse patient outcome, and poor glycaemic control. Considering the risk involved in inappropriate insulin use, evaluation of knowledge of insulin use is important because nowadays insulin requiring diabetes patients are encouraged to own insulin delivery kits so as to ensure timely administration of basal Insulin (Unyime and Macmillian, 2014).

MATERIALS AND METHODS

Study design

Prospective interventional study.

Study site

General medicine outpatient department in a 500 bedded tertiary care teaching hospital.

Study duration

The total study period was 9 months.

Study population

70 patients.

Ethical approval

Ethical clearance was obtained from Institutional Ethics Committee

Study criteria

Inclusion Criteria

- Patients who are willing to participate in the study.
- Patients diagnosed with type 2 Diabetes mellitus
- Insulin self administering patients
- Out patients with age greater than or equal to 30 years
- Patients prescribed only with insulin as hypoglycaemic agent

Exclusion Criteria

- Patients who are not physically or mentally able to conduct the interview
- Pregnancy and lactation

Materials used

- Patient data collection form
- Informed consent form
- Patient information sheet
- Knowledge , Attitude & Practice questionnaire
- Patient information leaflets

Study procedure

It is a prospective interventional study conducted in 70 Type 2 diabetes mellitus patients on insulin therapy in General Medicine outpatient department in a 500 bedded tertiary care teaching hospital during the study period of 9 months. The knowledge, attitude and practice of patients towards insulin therapy were assessed using a validated questionnaire. Counselling about the use of insulin was provided to patients along with patient information leaflet. The improvement was reassessed during follow up after 3 months. A validated KAP questionnaire was used to assess the patient's knowledge, attitude and practice towards insulin therapy. This KAP Questionnaire has three sections. The first section is for gathering the demographic details as well as the details of the treatment. In the second section there are questions to assess the patient's knowledge, attitude and practice towards insulin therapy. In the third section, there are questions to assess the therapeutic outcomes. Second and third sections include question number 7-21. These questions have three options: a, b, & c. 'a' scores 2; 'b' scores 1 and 'c' scores 0. Maximum score of this questionnaire is 30. Patients with score, less than or equal to 50 % are considered as having poor knowledge. If score is 51-74% patients are considered as with average knowledge. Patients with score greater than or equal to 75% are considered as having good level of knowledge.

RESULTS AND DISCUSSION

It was a prospective interventional study. A total of 70 subjects in general medicine OP department were participated in the

study. The knowledge, attitude and practice of patients towards the insulin therapy were assessed using a validated questionnaire. Counselling about the use of insulin was provided to patients along with patient information leaflet. The improvement was reassessed during the follow up after 3 months.

1. Categorisation of study population based on age group

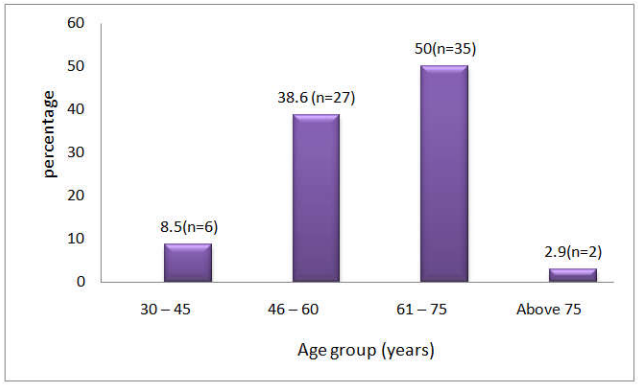

Figure 1. Categorisation of study population based on age group

The Figure 1 shows that 50 % (35) of the patients were between 61 and 75 years old. Only 2.9% (2) of the patients were above 75 years. 38.6% (27) & 8.5% (6) patients were in 46-60 & 30-45 years age group respectively. It indicates that the prevalence of diabetes increases with age. This was similar to the findings of the study conducted by Sarah *et al*. (2004), Harvey *et al*. (2003), Schulze *et al*. (2006).

2. Categorisation of study population based on gender

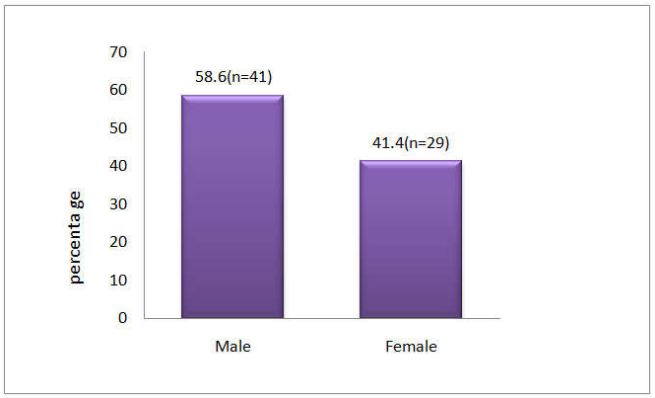

Figure 2. Categorisation of study population based on gender

Figure 2 indicates that 58.6% (41) of the study population were males and the remaining 41.4% (29) of the study population were females. The majority of the study population were males. This result was similar to the findings of the study conducted by Sarah *et al*. (2004).

3. Categorisation of study population based on educational status

Figure 3 shows the educational status of the study population. Out of 70 study population, 4.3% (3) were illiterate, 81.4% (57) of them were educated till 10th, 12.9% (9) of them were studied till HSC and only 1.4% (1) of them were graduate. This indicates that most of study population were literate till 10th only. Majority of diabetic population was found as illiterate in the study conducted by Sharon *et al*. (2010).

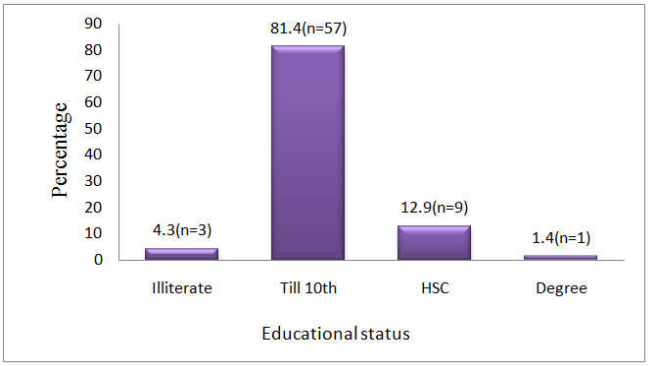

Figure 3. Categorisation of study population based on educational status

4. Categorisation of study population based on occupational status

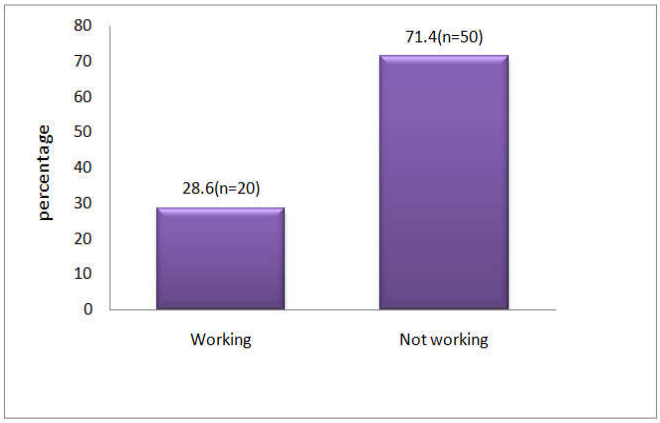

Figure 4. Categorisation of study population based on occupational status

Figure 4 indicates the categorisation of study population based on their occupational status. Out of 70, 20(28.6%) patients were working and 50 (71.4%) were not working. Majority of the patients were unemployed.

5. Categorisation of study population based on duration of insulin therapy

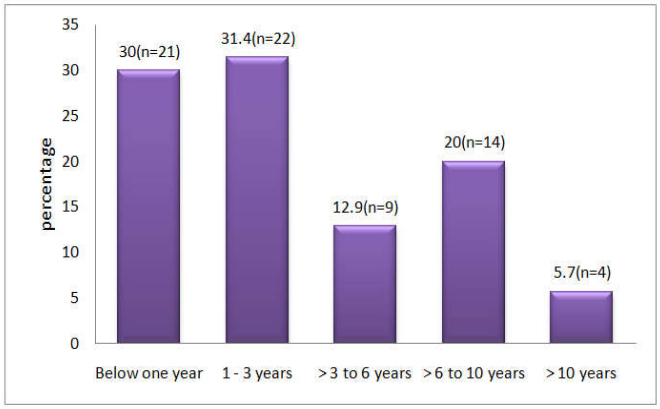

Figure 5. Categorisation of study population based on duration of insulin therapy

Figure 5 shows that, 21(30%) out of 70 participants, were using insulin for less than one year, 22(31.4%) patients were administering insulin for1-3 years, 9(12.9%) patients were using insulin more than 3 years up to 6 years, 14 (20%) patients were administering insulin more than 6 years up to 10 years, 4(5.7%) patients were using insulin more than 10 years.

6. Percentage score level of participants

Table 2. Percentage score level of participants

Score level of participants	Before counselling	After counselling
Good	4(5.7%)	57(81.4%)
Average	48(68.6%)	13(18.6%)
Poor	18(25.7%)	0(0%)

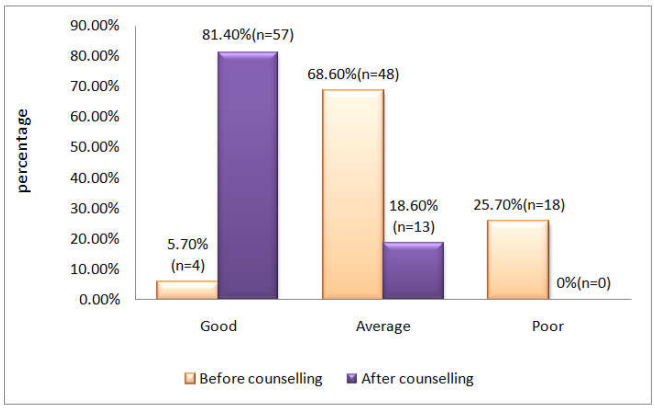

Figure 6. Percentage score level of participants

Figure No. 6 shows the percentage score level comparison of study population before and after counselling. Before counselling, 4(5.7%) patients had good level of knowledge, 48(68.6%) patients had average level of knowledge, and 18(25.7%) patients had poor knowledge. After counselling, 57(81.40%) patients had good level of knowledge, 13(18.60%) patients had average level of knowledge, and none patients had poor knowledge. This study indicates the improvement in the KAP score level of participants after counselling. This is due to the better understanding of the study population about the insulin usage as well as about the disease through counselling. This result is consistent with the result of study conducted by Okuno *et al*. (1999) which explains the effectiveness of pharmacist's intervention in increasing the knowledge, adherence and subsequently improving the glycaemic control.

7. Comparison of average percent score before and after counseling

Table 3. Comparison of average percent score before and after counseling

Kap score	Mean % kap score	Std deviation	Mean difference	Paired t value	P value
Before counselling	56.7	12.4	24.64	18.101	0.0001
After counselling	81.4	6.7			

Figure 7 shows the comparison of average percent score before and after counselling. The mean percent score before counselling was 56.7% with a standard deviation of 12.4, and after counselling was 81.4% with a standard deviation of 6.7. P value is 0.0001. It is a box plots in this the upper and lower ends of box in y axis indicate the deviation of percent scores from the mean. Cross line at the middle of the box indicate the mean percent score. Two bars at upper and lower edge of the box indicate the distribution of percent scores.

8. Assessment of knowledge, attitude and practice of patients towards insulin use

Table 3 indicates the knowledge, attitude and practice of patients towards insulin use. Out of total 70 patients, 33(47.2%) of them check expiry date of insulin always, 1(1.4%) patient check expiry date sometimes and 36 (51.4%) patients had never check expiry date.

Table 3. Assessment of knowledge, attitude and practice of patients towards insulin use

Questions	Always		Sometimes		Never	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Check expiry	33	47.2	1	1.4	36	51.4
Proper storage	68	97.1	0	0	2	2.9
Wash hands prior to injection	43	61.5	1	1.4	26	37.1
Sterilization of injection spot	10	14.3	3	4.3	57	81.4
Inject air into vial	15	24.1	4	6.5	43	69.4
Inject perpendicularly	41	58.6	12	17.1	17	24.3
Inject at correct time	41	58.6	18	25.7	11	15.7
Rub injected site	50	71.5	8	11.4	12	17.1
Rotation of injection site	66	94.2	2	2.9	2	2.9
Rolls vials prior to injection	16	22.9	4	5.7	50	71.4
Elevation of diabetic symptoms	33	47.1	20	28.6	17	24.3
Usage of insulin syringe	Once		2-5 times		More than 5 times	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
	2	2.9	30	42.8	38	54.3
Frequency of blood sugar monitoring	Daily		Weekly		Monthly	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
	1	1.4	20	28.6	49	70

Table 4. Comparative distribution of mean percentage scores among both genders

Gender	Kap score	Mean (%)	Std. Deviation	Mean difference	Paired t value	P value
Male (n=41)	Before	58.1	11.8	23.98	13.427	0.0001
	After	82.1	7.2			
Female (n=29)	Before	54.8	13.2	25.59	12.02	0.0001
	After	80.4	5.9			

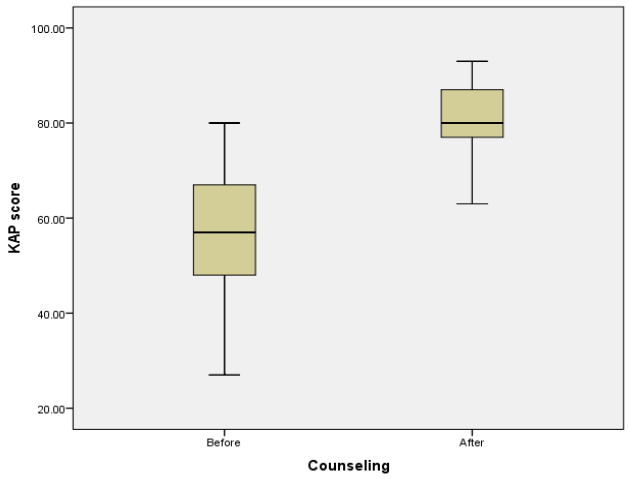

Figure 7. Comparison of average percent score before and after counselling

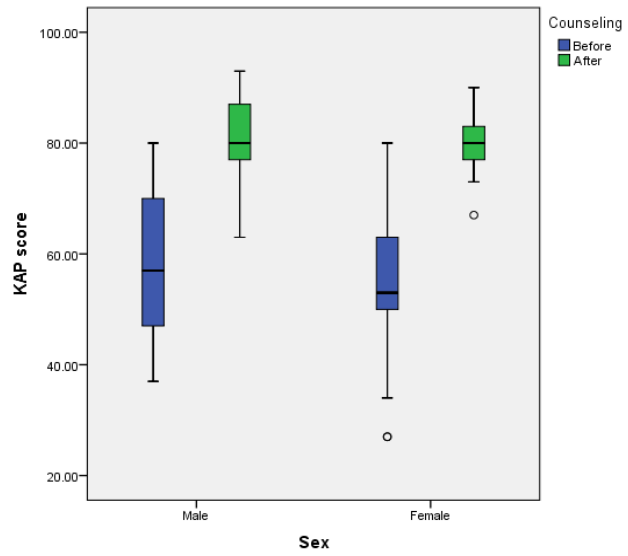

Figure 9. Comparative distribution of mean percentage scores among both genders

68(97.1%) patients always store insulin properly, but 2(2.9%) patients never stored insulin properly. 43(61.5%) patients were washed their hands always prior to injection, only one patient washed hands sometimes and 26(37.1%) patients never washed hands prior to injection. 10 (14.3%) patients always sterilized the injection spot, 3 (4.3%) patients sterilized injection spot sometimes, but 57(81.4%) patients never sterilized the injection spot. 15(24.1%) patients inject air into vial always, 4 (6.5%) patients inject air into vials sometimes and 43 (69.4%) patients never inject air into vial. 41(58.6%) patients always inject insulin perpendicularly, 12 (17.1%) patients sometimes inject insulin perpendicularly, and 17(24.3%) patients never inject insulin perpendicularly. 41(58.6%) patients always inject insulin at correct time, 18 (25.7%) patients sometimes inject insulin at correct time, and 11(15.7%) patients never injected insulin at correct time. 50(71.5%) patients always rub injected site, 8 (11.4%) rub injected site sometimes and 12 (17.1%) patients never rub injected site. 66(94.2%) patients always rotate their injection site, 2 (2.9%) patients sometimes rotate their injection site, and 2 (2.9%) patients never rotated injection site. 16(22.9%) patients always rolled vials prior to injection, 4 (5.7%) patients sometimes rolled vials prior to injection, 50(71.4%) patients never rolled vials prior to injection. 33(47.1%) patients had elevation of diabetic symptoms always, 20 (28.6%) patients had elevation of diabetic symptoms sometimes, and 17(24.3%) patients never had an elevation of diabetic symptoms. 2(2.9%) patients use an insulin syringe once, 30(42.8%) patients use the same syringe 2-5 times, and 38(54.3%) patients use a syringe more than 5 times. Only 1(1.4%) patient check blood sugar daily, 20(28.6%) patients check the blood sugar weekly, and 49(70%) patients check blood sugar monthly. This description indicates the poor knowledge level of patients about the insulin use.

9. Comparative distribution of mean percentage scores among both genders

Figure 9 shows the comparative distribution of percent score among male and female. For total 41 male patients, the mean percent score before counselling was 58.1% with a standard deviation of 11.8 and 82.1% after counselling with a standard deviation of 7.2. For total 29 female patients, mean percent score before counselling was 54.8% with a standard deviation of 13.2 and 80.4% after counselling with a standard deviation of 5.9.

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