

A Study of Oral Antihyperglycemic Medication Adherence in Type 2 Diabetes Patients. A Cross Sectional Study.

V.Naganjani Ch¹, K.Monika²

¹(Assistant Professor of Pharmacology / Siddhartha Medical, College/ Dr.NTRUHS, India)

²(Post Graduate of Pharmacology / Siddhartha Medical, College/ Dr.NTRUHS, India)

Abstract: Background: Oral antihyperglycemic drugs are integral for glycemic control in diabetes. Non-adherence to drugs can alter blood glucose levels, resulting in complications. Adherence to oral antihyperglycemic drugs reported by diabetes patients were explored. Methods: This cross-sectional study was done among type II diabetes mellitus patients attending the General Medicine OPD of GGH, Vijayawada, AP. Consecutive patients were selected, data regarding their medication adherence was collected using a questionnaire. Data analysis was carried out using SPSS-20. The t test was performed to examine the associations between categorical variables; a P Value < 0.05 was considered significant. Results: A total of 100 patients participated in the study (21% males; 79% females). The mean age (standard deviation) of the respondents was 52 years (SD 0.77). The self-reported adherence rate to oral antihyperglycemics was 96% and the adherence rate was more in males (100%) compared to females (96%). Glycemic control was also significantly higher (p < 0.05) in males compared to females. Majority of the patients were on double drug therapy (51%) compared to triple drug therapy (28%) and monotherapy (21%). Conclusion: The self-reported adherence rate to oral antihyperglycemic medications was 96%. Medication adherence rate and Glycemic control was significantly higher in males compared to females.

Keywords: diabetes mellitus, Glycemic control, oral antihyperglycemic drugs, patient adherence, questionnaire.

Date of Submission: 18-04-2019

Date of acceptance: 04-05-2019

I. Introduction

Diabetes mellitus (DM) is a common chronic metabolic disorder that affects nearly 8.8% of the total world population^[1]. India, now has more than 50 million people with type 2 diabetes (more than any other nation.)^[2]. More than 80% of diabetes deaths occur in low- and middle-income countries. WHO projects that diabetes deaths will double between 2005 and 2030^[3]. Adherence to pharmacotherapy is a critical aspect of medical treatment, particularly the treatment of chronic conditions such as diabetes^[4]. Good long-term glycemic control is essential for preventing diabetes patients from developing microvascular and macrovascular complications, which result in substantial medical resource uses and medical care costs^[5-7]. Despite the importance of adherence, medication non-adherence is a serious problem, with WHO noting that the average non-adherence rate is 50% among those with chronic illnesses^[4].

1.1. Background and rationale

Medication adherence or compliance is defined as the extent to which patients take medications as prescribed by their health care providers⁸. The word "adherence" is preferred by many health care providers, because "compliance" suggests that the patient is passively following the doctor's orders and that the treatment plan is not based on a therapeutic alliance or contract established between the patient and the physician⁹. Oral antihyperglycemic drugs and insulin injections are recommended for glycemic control. There is evidence showing that poor glycemic control leads to higher health resource use and medical care costs^[10].

A literature review indicated that out of nine studies, seven found greater adherence was associated with improved glycemic control,^[11-18] of eight studies that evaluated hospitalization, seven showed higher adherences were associated with fewer hospitalizations;^[11,16,18-24] and of three studies that evaluated emergency department (ED) visits, two found higher adherences were associated with fewer visits^[11,19,21].

1.2. Causes of non adherence in diabetes patients

- demographic factors (age, gender, educational achievements, socio-economic status, employment),
- patient's knowledge, attitudes, beliefs and perceptions about illness and its severity, cause, prevention and treatment,
- support by family members, peers, healthcare providers, the local community^[25,26,27].

II. Aims and Objective

- 1.To assess oral antihyperglycemic medication adherence among type 2 diabetes patients.
- 2.To assess gender variations in antihyperglycemic medication adherence among type 2 diabetes patients.
- 3.To assess gender variations in glycemic control among type 2 diabetes patients.

III. Material And Methods

This is a cross sectional study.The protocol was approved by the institutional ethics committee.100 patients of either sex, aged between 30-60 years who visited the Diabetic OPD of Government General Hospital,Vijayawada were included in the study.Study period was from January 2019 to March 2019. Only those who qualified the inclusive criteria and was willing to give written consent were included in the study. Medication adherence was measured using the Medication Adherence Report Scale (MARS-10). MARS-10 is the latest generic self-reported, medication-taking behaviour scale.It is a multidimensional instrument describing : medication adherence behavior (items 1-4), attitude toward taking medication (items 5-8) and negative side effects and attitudes to medication (items 9-10). Medication adherence behavior refers to the intensity of drug use during the duration of therapy and persistence during the overall duration of therapy. Each question has a yes or no response. A response consistent with non-adherence is coded as 0, whereas a response consistent with adherence is coded as 1. For questions 1-6 and 9-10, a no response is indicative of adherence and is coded as 1, while for questions 7 and 8, a yes response is indicative of adherence and is coded as 1. The MARS was developed by Thompson et al.^[28] as an improvement on the Drug Attitude Inventory and the Morisky Adherence Questionnaire, and has several advantages and qualities.It is a widely used instrument,^[28,29] which reflects an understanding of adherence as a continuous variable. It satisfactorily predicts non-adherence.^[28,30] Total scores obtained from MARS-10 range from 0 to10. Patients with total MARS-10 scores < 4.5 or lower was considered non-adherent,while patients with a mean MARS score of 4.5 or higher was considered as good adherers.^[31]

3.1.Inclusion criteria

1. Patients diagnosed with T2DM at least 1 year before (to ensure familiarization with DM);
2. Patients over 18 years of age of both sexes;
3. Patients who had complete medical records;
4. Patients who were on prescribed oral anti diabetic medications for more than three months (to ensure familiarization with the prescribed antihyperglycemic medications)
5. Patients who were not taking any insulin injection therapy.

3.2.Exclusion criteria

1. Newly diagnosed less than 1 year ,
2. Patients who were on dietary control alone,
3. Patients who were on any form of insulin therapy, or
4. Patients who had intellectual or cognitive impairment as stated in their medical record, were excluded.

3.3.Investigations

Blood glucose was estimated by Glucose oxidase-peroxidase method using Auto analyser (RANDOX company) and expressed in mg%. Fasting blood sugar (early morning levels after 8 hours of over night fasting) , Post prandial blood sugar (2 hours after breakfast) were measured .

3.3.Statistical method of analysis

Data recorded was entered in Microsoft Excel version 2007. Data was analysed using the statistical Package for Social Science (SPSS) version 20.Data was expressed in actual number,mean values \pm Standard deviations(SD),percentages. t-test was performed to determine the associations between categorical variables , and p value less than 0.05 was considered significant.

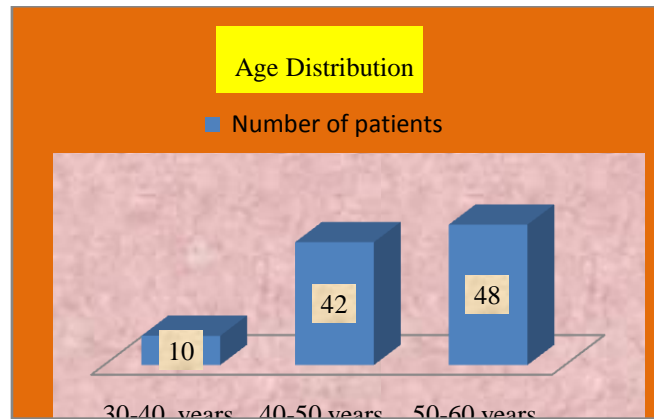
IV. Results

4.1.Age Distribution of the study population

Table – 1: Age Distribution

Age in years	Number Of Patients
30-40	10
40-50	42
50-60	48

In the present study, out of 100 patients 10% patients were aged between 30-40 years,42% patients were aged between 40-50 years, 48% patients were aged between 50-60 years.Mean age (standard deviation) of the patients is 52 (SD 0.769) years (51.63 rounded off the next near number).



Graph-1: Age Distribution

4.2. Gender Distribution of the study population

Table – 2: Gender Distribution

Gender	Number Of Patients
Male	21
Female	79

In the present study , out of 100 patients – 21% of patients were males and 79% of patients were females.

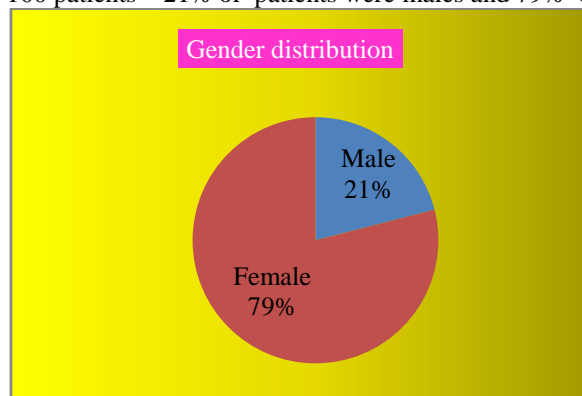


Figure 2: Gender Distribution

4.3. Medication Adherence Among The Study Population

Table – 3: Medication Adherence

Patients	Adherent	Nonadherent
Males	21	0
Females	75	4

In the present study , out of 100 patients all the 21 males were adherent to oral antihyperglycemic medication. Among the 79 females - 75 were adherent to oral antihyperglycemic medication whereas 4 were nonadherent to oral antihyperglycemic medication.

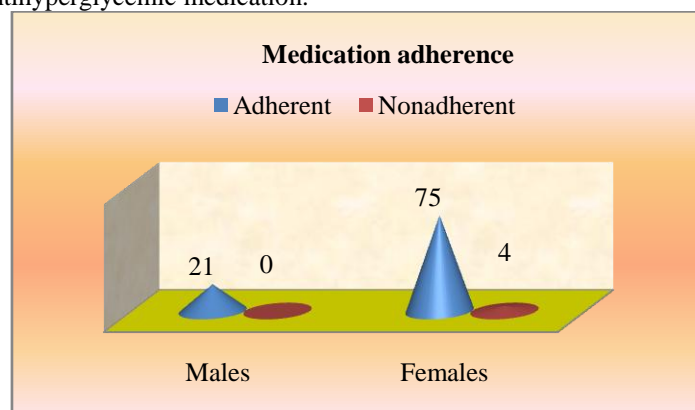


Figure -3: Medication Adherence

4. 4.Glycemic Control of the study population

Table- 4: Glycemic control

Blood sugar	Males	Females
Controlled	13	29
Uncontrolled	8	60

Out of 21 males – the blood sugar values were significantly (p value < 0.05) controlled in 13 patients and uncontrolled in the remaining 8 patients. Out of 89 females – the blood sugar values were insignificantly (p value > 0.05) controlled in 29 patients and uncontrolled in the remaining 60 patients.

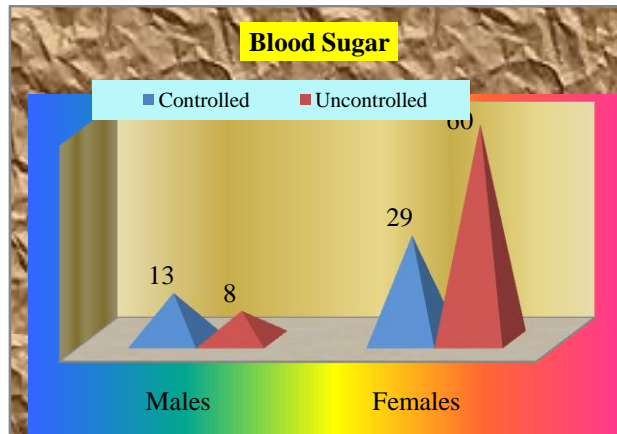


Figure - 4: Glycemic Control

4.5.Number Of Medication used by the study population

Table- 5: Number Of Medication

Number of medication	Number of patients
Single	21
Double	51
Triple	28

Out of 100 patients – 21% were on monotherapy ,51% patients were on double drug therapy and 28% patients were on triple drug therapy.

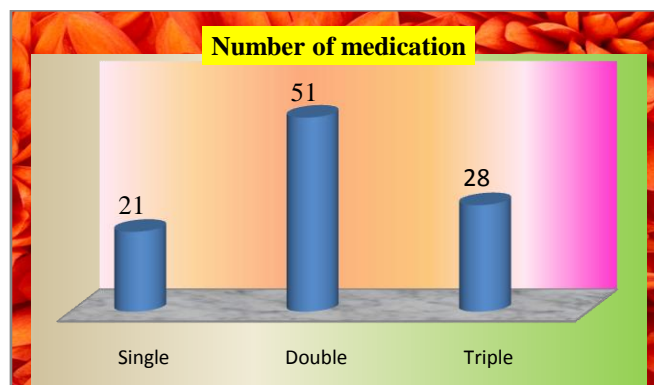


Figure 5: Number Of Medication

V. Discussion

Antihyperglycemic drug therapy plays a pivotal role in the glycemic control of patients with diabetes^[31]. Adherence Implies the self-initiated choice of the patient to closely follow a treatment plans. The prescribers have to monitor the patient’s adherence to the medication, usage instruction so that they are benefited from the therapy^[32]. Patients with chronic illnesses often experience difficulty in adhering to treatments recommended to them and consequently do not always receive optimal benefit from their prescribed drug therapy. Poor medication adherence can have negative consequences for the patients, the provider, the physician, and the sustainability of the healthcare system^[33].

Measurement of Medication adherence can be challenging in clinical practice. There is no single measure which can be used as the gold standard, so a mixed method is considered best to estimate MA^[34]. Considering the feasibility of the research in terms of time and cost, self-reported medication adherence by patients was the method used for measuring adherence rates. Moreover, it has been reported that the estimation of adherence rates by different methods provides similar estimates of overall adherence^[35]. The primary outcome measure used in this research was the adherence rate for anti-diabetic medications.

In the present study, mean age (standard deviation) of the patients is 52 (SD 0.769) years (51.63 rounded off the next near number). Out of 100 patients 10% patients were aged between 30-40 years, 42% patients were aged between 40-50 years, 48% patients were aged between 50-60 years. In the present study, out of 100 patients – 21% patients were males and 79% patients were females. In the present study, out of 100 patients 96% of the patients were adherent to oral antihyperglycemic medication. All the 21 males were adherent to oral antihyperglycemic medication. Among the 79 females - 75 were adherent to oral antihyperglycemic medication whereas 4 were nonadherent to oral antihyperglycemic medication. Out of 100 patients – the blood sugar values were significantly controlled in 42 patients (p value < 0.05) and uncontrolled in the remaining 58 patients. Out of 89 females – the blood sugar values were insignificantly (p value > 0.05) controlled in 29 patients and uncontrolled in the remaining 60 patients. Out of 21 males – the blood sugar values were significantly controlled in 13 (p value is < 0.05) patients and significantly uncontrolled in the remaining 8 patients (p value < 0.05).

In the present study, mean age of the patients is 52 years (SD 7.69). In comparison to this finding, Mohammed Arifulla et al^[36] investigated the mean age (standard deviation) of the respondents was 54 years (SD 10.2). In the study conducted by Kishor Khotkar et al^[37], the mean age (standard deviation) of the patients was 54 years ± 10.3.

In the present study, out of 100 patients - 21% patients were males and 79% patients were females. In comparison to this finding, in Mohammed Arifulla et al^[36] study out of 132 patients; 63% were males and 69% were females.

In the present study, out of 100 patients 96% of the patients were adherent to oral antihyperglycemic medication. In comparison to this finding, Mohammed Arifulla et al^[36] investigated among patients with type II diabetes to evaluate the patients' self-reported adherence to their anti-diabetic drug therapy. The prevalence of adherence to anti-diabetic medications was 84%. A cross-sectional survey conducted by Grant et al. showed that the patients' self-reported adherence rate to anti-diabetic medications was 95.7%^[45] and a retrospective cohort study by Donnan et al.^[38] reported an adherence rate of 90%. Two other studies by Gimenes et al.^[39] and Tiv et al.^[40] documented lower self-reported adherence rates of 78.3% and 39% to anti-diabetic medications. In Schectman et al^[41], the adherence rate, as measured by prescription refill data from the pharmacy, was 79.7%.

In the present study, all the 21 males were adherent to oral antihyperglycemic medication but some females were non-adherent. In comparison to this finding, the adherence rates were similar in both genders in the Mohammed Arifulla et al^[36] study. In contrast, Gimenes et al.^[39] documented non-adherence to be more common among male patients^[39]. Raising awareness of patients about medication adherence, the consequences of non-adherence and improving communication with health care professionals could improve adherence level.

In the present study, out of 100 patients – the blood sugar values were significantly controlled in 42 patients (p value < 0.05) and uncontrolled in the remaining 58 patients. In comparison to this finding in Almadhoun MR, et al^[42]. study on Assessment of Medication Adherence and its Association with Glycemic Control among Type-2 Diabetes Mellitus Patients in Gaza, more than half the patients (56.1%) were poorly glycemic controlled (HbA1c >7). Poor glycemic control was significantly associated with non-adherence (P-value < 0.001). Similarly, Ashur et al. found that only 21.8% of T2DM patients were glycemic controlled.^[43] Similar findings were also reported in previous studies^[44-46]. In contrast to these findings, Ward et al. found that medication adherence was not significantly associated with glycemic control status^[47].

In the present study, the blood sugar values were significantly (p value < 0.05) controlled in males and insignificantly controlled in the females (p value > 0.05). Similar findings were also reported in studies by Janghorbani M et al^[48] and Setoodeh et al^[49]. In their study, the majority of patients were females. Being female is an independent risk factor for poor glycemic control. Usually, females have a high rate of nutritional and psychological problems and they are less adherent to lifestyle changes and to exercise due to traditional and cultural restrictions^[48,49].

VI. Limitations

Our study has a few limitations. First, it was only undertaken in one governmental clinic in India. Moreover, the study excluded T2DM patients using insulin. This restricts the applicability of the study's results to a considerable subset of T2DM patients that constitutes 64.5% of them. Second, the study used only blood glucose but did not use HbA1c which is the most recent measure for glycemic control. Third, a self report method was used to assess adherence. This may overestimate adherence in the study sample. Finally, patients'

selection method might have created a bias toward positive beliefs since patients who attend the clinic are those who usually care about their health.

VII. Conclusion

Majority of the study population were females. Most patients were medication adherents. Males were highly adherent to medication compared to females. Glycemic control was also statistically significant in males compared to females. Medication non-adherence was significantly associated with the poor glycemic control. Future studies on strategies to improve adherence rate should be considered.

Acknowledgements

We acknowledge the timely help and support offered by Statistician of Siddhartha Medical College, Vijayawada for the data entry. Dr. Praveen, Haardhik, Joshvika, my parents and family for their valuable support.

Conflict of Interest

None.

Funds

None.

References

- [1]. Guariguata L, Nolan T, Beagley J, Linnenkamp U, Jacqmain O. IDF Diabetes Atlas Federation, *International Diabetes Federation* 6th Edn, 2013
- [2]. Jared Diamond. Diabetes in India. *NAT U R E* 27 January 2011; 469: 478, 479.
- [3]. WHO Fact sheet N°312 August 2011.
- [4]. Gottlieb H. Medication nonadherence: finding solutions to a costly medical problem CME. *Drug Benefit Trends* 2000;12:57–62.
- [5]. Zoungas S, Chalmers J, Ninomiya T, *et al.* Association of HbA1c levels with vascular complications and death in patients with type 2 diabetes: evidence of glycaemic thresholds. *Diabetologia* 2012;55:636–43.
- [6]. Caro JJ, Ward AJ, O'Brien JA. Lifetime costs of complications resulting from type 2 diabetes in the US. *Diabetes Care* 2002;25:476–81.
- [7]. Ward A, Alvarez P, Vo L, *et al.* Direct medical costs of complications of diabetes in the United States: estimates for event-year and annual
- [8]. Oglesby AK, Secnik K, Barron J, *et al.* The association between diabetes related medical costs and glycemic control: a retrospective analysis. *Cost Eff Resour Alloc* 2006;4:1.
- [9]. Menzin J, Korn JR, Cohen J, *et al.* Relationship between glycemic control and diabetes-related hospital costs in patients with type 1 or type 2 diabetes mellitus. *J Manag Care Pharm* 2010;16:264–75.
- [10]. state costs (USD 2012). *J Med Econ* 2014;17:176–83.
- [11]. Asche C, LaFleur J, Conner C. A review of diabetes treatment adherence and the association with clinical and economic outcomes. *Clin Ther* 2011;33:74–109.
- [12]. Adams AS, Trinacty CM, Zhang F, *et al.* Medication adherence and racial differences in A1C control. *Diabetes Care* 2008;31:916–21.
- [13]. Donnelly LA, Morris AD, Evans JM; DARTS/MEMO collaboration. Adherence to insulin and its association with glycaemic control inpatients with type 2 diabetes. *QJM* 2007;100:345–50.
- [14]. Horswell RL, Wascom CK, Cerise FP, *et al.* Diabetes mellitus medication assistance program: relationship of effectiveness to adherence. *J Health Care Poor Underserved* 2008;19:677–86.
- [15]. Lawrence DB, Ragucci KR, Long LB, *et al.* Relationship of oral antihyperglycemic (sulfonylurea or metformin) medication adherence and hemoglobin A1c goal attainment for HMO patients enrolled in a diabetes disease management program. *J Manag Care Pharm* 2006;12:466–71.
- [16]. Morris AD, Boyle DIR, McMahon AD, *et al.* Adherence to insulin treatment, glycaemic control, and ketoacidosis in insulin-dependent diabetes mellitus. *The Lancet* 1997;350:1505–10.
- [17]. Pladevall M, Williams LK, Potts LA, *et al.* Clinical outcomes and adherence to medications measured by claims data in patients with diabetes. *Diabetes Care* 2004;27:2800–5.
- [18]. Rozenfeld Y, Hunt JS, Plauschinat C, *et al.* Oral antidiabetic medication adherence and glycemic control in managed care. *Am J Manag Care* 2008;14:71–5.
- [19]. Balkrishnan R, Arondekar BV, Camacho FT, *et al.* Comparisons of rosiglitazone versus pioglitazone monotherapy introduction and associated health care utilization in medicaid-enrolled patients with type 2 diabetes mellitus. *Clin Ther* 2007;29:1306–15.
- [20]. Colombi AM, Yu-Isenberg K, Priest J. The effects of health plan copayments on adherence to oral diabetes medication and health resource utilization. *J Occup Environ Med* 2008;50:535–41.
- [21]. Hepke KL, Martus MT, Share DA. Costs and utilization associated with pharmaceutical adherence in a diabetic population. *Am J Manag Care* 2004;10:144–51.
- [22]. Karve S, Cleves MA, Helm M, *et al.* An empirical basis for standardizing adherence measures derived from administrative claims data among diabetic patients. *Med Care* 2008;46:1125–33.
- [23]. Lau DT, Nau DP. Oral antihyperglycemic medication nonadherence and subsequent hospitalization among individuals with type 2 diabetes. *Diabetes Care* 2004;27:2149–53.
- [24]. Sokol MC, McGuigan KA, Verbrugge RR, *et al.* Impact of medication adherence on hospitalization risk and healthcare cost. *Med Care* 2005;43:521–30.
- [25]. Mahesh PA, Parthasarathi G. Medication Adherence, Text Book of Clinical Pharmacy Practice, Essential Concepts and skills. Parthasarathi G, Hansen KN, Nahata MC, *Orient Longman, Pvt Ltd* 2004;54-71.
- [26]. World Health Organization, Report on Medication Adherence, Disease Specific Reviews, Section 3, Chapter 10, WHO Geneva 2003, Pages 93-107
- [27]. Steiner JF, Earnest MA. The language of medication-taking. *Ann Intern Med.* 2000;132:926–30. [PubMed]
- [28]. Thompson K, Kulkarni J, Sergejew AA. Reliability and validity of a new Medication Adherence Rating Scale (MARS) for the psychoses. *Schizophr Res.* 2000;42:241-7. [Links]

- [29]. Arute JE, Eniojukan JF, Eboigbe N. Adherence to psychotropic medications by outpatients in psychiatric hospital, Urelu Benin City, Nigeria. *Value Heal.* 2014;17:A460-1. [Links]
- [30]. Fialko L, Garety PA, Kuipers E, Dunn G, Bebbington PE, Fowler D, et al. A large-scale validation study of the Medication Adherence Rating Scale (MARS). *Schizophr Res.* 2008;100:53-9.
- [31]. Cohen JL¹, Mann DM, Wisnivesky JP, Home R, Leventhal H, Musumeci-Szabó TJ, Halm EA. Assessing the validity of self-reported medication adherence among inner-city asthmatic adults: the Medication Adherence Report Scale for Asthma, *Ann Allergy Asthma Immunol.* 2009 Oct;103(4):325-31
- [32]. Mahesh PA, Parthasarathi G. Medication Adherence, Text Book of Clinical Pharmacy Practice, Essential Concepts and skills. Parthasarathi G, Hansen KN, Nahata MC, *Orient Longman, Pvt Ltd* 2004;54-71.
- [33]. Improving the sustainability of healthcare systems through better adherence to therapies: a multi-stakeholder approach: background briefing [article online]. <http://www.eu-patient.eu/globalassets/policy/adherence-compliance-concordance/adherence---joint-briefingpaper.pdf>.
- [34]. Lee CS, et al. *BMJ Open* 2017;7:e016317. doi:10.1136/bmjopen-2017-016317
- [35]. Grant RW, Devita NG, Singer DE, Meigs JB. Polypharmacy and medication adherence in patients with type 2 diabetes. *Diabetes Care.* 2003;26(5):1408-1412.
- [36]. Mohammed Arifullal, Lisha Jenny John¹, et al. Patients' Adherence to Anti-Diabetic Medications in a Hospital at Ajman, UAE, *Malays J Med Sci.* Jan-Feb 2014; 21(1): 44-49
- [37]. Kishor Khotkar et al. Assessment of medication adherence in Type II diabetic patients- A Cross Sectional Study. *MGM J Med Sci* 2017;65-69
- [38]. Donnan PT, MacDonald TM, Morris AD. Adherence to prescribed oral hypoglycemic medication in a population of patients with type 2 diabetes: a retrospective cohort study. *Diabet Med.* 2002;19(4):279-284.
- [39]. Gimenes HT, Zanetti ML, Haas VJ. Factors related to patient adherence to antidiabetic drug therapy. *Rev Latinoam Enfermagem.* 2009;17(1):46-51.
- [40]. Tiv M, Viel J-F, Mauny F, Eschwège E, Weill A, Fournier C, et al. Medication Adherence in Type 2 Diabetes: The ENTRED Study 2007, a French Population-Based Study. *PLoS One.* 2012;7(3):e32412. doi: 10.1371/journal.pone.0032412.
- [41]. Schectman JM, Nadkarni MM, Voss JD. The association between diabetes metabolic control and drug adherence in an indigent population. *Diabetes Care.* 2002;25(6):1015-1021.
- [42]. Almadhoun MR, Alagha HZ (2018) Assessment of Medication Adherence and its Association with Glycemic Control among Type-2 Diabetes Mellitus Patients in Gaza-Palestine. *Clin Exp Pharmacol* 8: 250.
- [43]. Bakar ZA, Fahrmi ML, Khan TM (2016) Patient satisfaction and medication adherence assessment amongst patients at the diabetes medication therapy adherence clinic. *Diabetes Metab Syndr* 10: S139- S143.
- [44]. Ashur ST, Shah SA, Boseri S, Fah TS, Shamsuddin K (2016) Glycaemic control status among type 2 diabetic patients and the role of their diabetes coping behaviours: a clinic-based study in Tripoli, Libya. *Libyan J Med* 11: 31086.
- [45]. Abebe SM, Berhane Y, Worku A (2014) Barriers to diabetes medication adherence in North West Ethiopia. *Springerplus* 3: 195.
- [46]. Al-Majed HT, Ismael AE, AL-Khatlan HM, El-Shazly MK (2014) Adherence of type-2 diabetic patients to treatment. *Kuwait Med J* 46:225-32.
- [47]. Tiv M, Viel JF, Eschwege E, Weill A, Fournier C, et al. (2012) Medication adherence in type 2 diabetes: the ENTRED study 2007, a French Population-Based Study. *PLoS One* 7: e32412.
- [48]. Janghorbani M, Amini M (2012) Patterns and predictors of long-term glycemic control in patients with type 2 diabetes. *ISRN Endocrinol* 2012:526824.
- [49]. Setoodeh A, Mostafavi F, Rabbani A, Hedayat T (2011) Female sex as a risk factor for glycemic control and complications in Iranian patients with type one diabetes mellitus. *Iran J Pediatr* 21: 373-8.

V.Naganjani Ch. "A Study of Oral Antihyperglycemic Medication Adherence in Type 2 Diabetes Patients. A Cross Sectional Study." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, vol. 18, no. 05, 2019, pp 27-33.