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Impact Factor 3.79
ISSN (e)-2347-176x



Journal Of Medical Science And Clinical Research

An Official Publication Of IGM Publication

Evaluation of Medication Adherence in Diabetes Mellitus Patients by Using 8- Item Morisky Scale

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Abstract

Background: Medication adherence is the extent to which a patient's medication taking behavior coincides with intention of the physician. The aim of the study was to evaluate self reported medication adherence and to identify factors related to poor adherence in type-2 Diabetes mellitus and make them adherence to the medication to prevent complications.

Methods: A 6 months Cross sectional study was conducted at Narayana Hrudayalaya-MallaReddy Hospital(tertiary care) with 150 Diabetic patients to assess the adherence to medication. Adherence was measured by using 8-item Morisky Medication Adherence Questionnaire consisting of 8 questions. Other data such as patient demographics, family history, duration of DM, smoking & alcoholic, BMI, comorbidities and treatment were also collected from patient medical records.

Results: A total of 150 patients were recruited in the study and they were assessed for their adherence rate in three reviews. Approximately 60% of patients in the study were non-adherent in first review and 10% of patients in the study were non-adherent in second review and 6.66% of patients in the study were non-adherent in third review. Age from 40-49 years (30.66%) were more nonadherent and duration <6 months (33.33%) were more and Whereas 37.33% of obese patients and 33.33% over weight patients were observed and comorbidities were 48.66%

Conclusion: Adherence to medication in T2DM patients in the tertiary care hospital was found to be poor. This is a cause of concern, because nonadherence could lead to a worsening of disease. Improving medication knowledge by paying particular attention to different age groups and patients with comorbidities could help to improve adherence.

Keywords: Type 2 diabetes mellitus, adherence, tertiary care

Introduction

The epidemic of type 2 diabetes mellitus (T2DM) has become a major concern because it affects all age groups. The incidence of diabetes was estimated to have risen by 55% between 1995 and 2010.¹ The global figure is set to rise from 220 million in 2010 to 300 million in 2025,² further demonstrating the large impact of T2DM on the growing population. It is not surprising that T2DM is, at present, one of the most prevalent chronic diseases. Interestingly, it is strongly associated with obesity and a sedentary lifestyle³; thus, lifestyle modification is an important step in addressing this issue. However, controlling blood glucose through lifestyle modification alone is a challenging feat; therefore, a more rapid method of controlling blood glucose is required. The use of medication is thus vital in the management of T2DM. However, the effectiveness of the treatment is largely dependent on the level of adherence toward prescribed medication.⁴ Adherence is defined as the extent to which a person's behavior in terms of taking medications, following diets, or executing lifestyle changes coincides with medical or health advice.⁵ Apart from lifestyle modifications, adherence to medication treatment is essential in order to obtain the full therapeutic benefit of diabetes management. Adherence with regard to medication is a serious problem especially for patients with chronic diseases such as T2DM, hypertension, ischemic heart disease, and bronchial asthma. Previous work on patients with diabetes mellitus, asthma, and hypertension in a primary health clinic in Malaysia demonstrated

that more than half of the study population was nonadherent to their medication.⁶

Current methods used to assess adherence have been through the use of direct or indirect techniques. However, at present, there is no gold standard available for measuring medication adherence. Interestingly, questionnaires have been found to provide a more accurate assessment of adherence in comparison with other methods such as pill counts or biological assays.⁷ They provide greater sensitivity and specificity than any other technique.^{8,9}

Adherence to medication is influenced by several factors such as lack of information, complexity of regimen, concomitant disease, perceptions of benefit, side effects, medication cost, and emotional well being.^{10,11} A few studies have also identified age as a factor that influenced adherence.¹¹⁻¹³ However, race and sex were not consistently associated with the level of patient adherence.¹⁴ A diabetic patient with other concomitant disease usually requires several drugs to achieve glycemic goals and clinical targets. The complex regimens often required to achieve the desired level of glycemic control poses a challenge for patients.^{13,15} Therefore, this study was performed to assess adherence to medication among T2DM patients at primary health clinics and to identify the factors associated with nonadherence.

Adherence was measured using the eight-item Morisky Medication Adherence Scale (MMAS-8)⁶, translated into Brazilian Portuguese (chart 1) and validated for the present study. To obtain conceptual equivalence, the MMAS-8 was

translated in accordance with the recommendations for translation and cultural adaptation of Beaton et al.¹⁴, Wild et al.¹⁵, which require the translation and back-translation by bilingual translators, some of which are independent. After evaluation and approval by the author of the scale, the translated version was tested in a group of 20 patients with hypertension to check for understanding of the questions in accordance with its original meaning. The questions were understood identically by all, and subsequent alterations were not considered necessary⁽⁹⁾.

The MMAS-8, an update with greater sensitivity of the four-item scale published in 1986 and considered the most commonly used self-reporting method to determine adherence, contains eight questions with closed dichotomous (yes / no) answers, designed to prevent the bias of positive responses from patients questions asked by health professionals, by reversing the responses related to the interviewee's adherence behavior^{6,16}. Thus, each item measured a specific adherence behavior, with seven questions that must be answered negatively and only one positively, with the last question being answered according to a scale of five options: never, almost never, sometimes, often, and always⁽¹⁰⁾.

The degree of adherence was determined according to the score resulting from the sum of all the correct answers: high adherence (eight points), average adherence (6 to < 8 points) and poor adherence (< 6 points)¹⁷. In this study, patients were considered adherent when they had a score equal to eight in the MMAS-8. To assess

the internal consistency, we used the item-total correlation and Cronbach's alpha⁽¹¹⁾.

In this context, the most widely used method of adherence assessment is the Morisky Medication Adherence Scale (MMAS 4- item version)⁵. Recently, a new eight-item scale (MMAS-8), which has greater reliability ($\alpha = 0.83$ vs. $= 0.61$)⁶, created with the objective of determining adherence to antihypertensive treatment, was developed from the MMAS-4 and supplemented with additional items designed to address several aspects of adherence behavior. In Brazil, studies evaluating non-adherence with the new scale are still recent and scarce⁽¹²⁾.

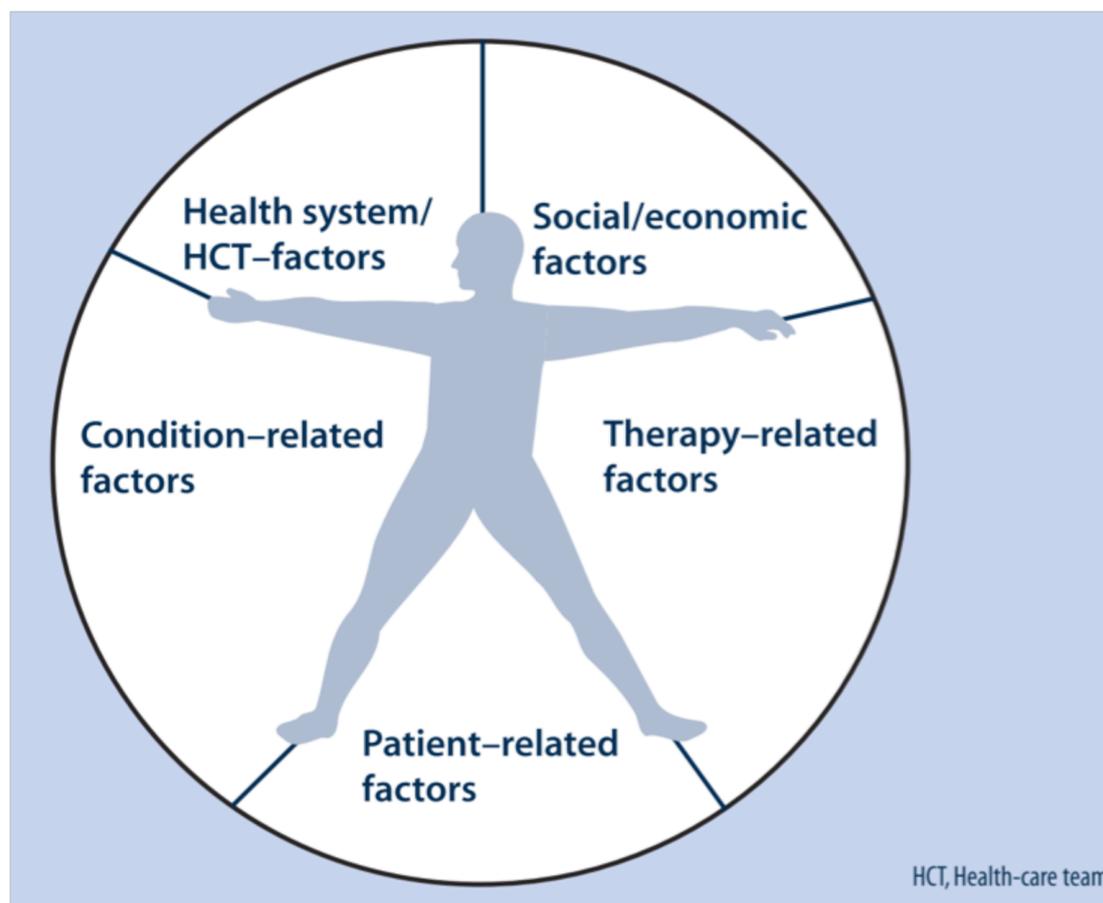
Factors Affecting Medication Adherence

Age by itself is not a determining factor in medication no adherence. Rather, there are many factors that may combine to render older persons less able to adhere to their medication regimens. However, there is evidence to suggest that with the proper motivation, education, and support, older persons can overcome many barriers to medication adherence⁽¹³⁾.

The Five Dimensions of Adherence

Adherence is a multidimensional phenomenon determined by the interplay of five sets of factors, termed "dimensions" by the World Health Organization:

1. Social/economic factors
2. Provider-patient/health care system factors
3. Condition-related factors
4. Therapy-related factors
5. Patient-related factors



1. Social and Economic Factors

Low literacy, lack of health insurance coverage, poor social support, family instability, and homelessness are the most consistently reported factors to impact medication adherence (Krueger et al., 2005). People who have social support from family, friends, or caregivers to assist with medication regimens have better adherence to treatment. Unstable living environments, limited access to health care, lack of financial resources, cost of medication, and burdensome work schedules have all been associated with decreased adherence rates. The amount of education a person has may influence adherence; however, understanding the importance of the treatment and

the treatment instructions may be more important factors than level of education⁽¹⁴⁾.

2. Health Care System-Related Factors

The quality of the doctor-patient relationship is one of the most important health care system-related factors impacting adherence (Krueger et al., 2005). A good relationship between the patient and health care provider, which features encouragement and reinforcement from the provider, has a positive impact on adherence (Krueger et al., 2003). Poor provider communication concerning the benefits, instructions for use, and side effects of medications can also contribute to no adherence, especially in older adults with memory problems⁽¹⁵⁾.

3. Condition-Related Factors

Medications have to be taken indefinitely for many chronic illnesses, and adherence to such treatment regimens often declines significantly over time (Berger et al., 2004). This is especially true for chronic illnesses that have few or no symptoms - e.g., high blood pressure, osteoporosis, and hyperlipidemia and lack the cues that may remind people to take their medication. Without symptoms, a person may not be motivated to adhere to a treatment regimen. It is important that the older adult understand the illness and what will happen if it is not treated⁽¹⁶⁾.

4. Therapy-Related Factor

The complexity of the medication regimen, which includes the number of medications and number of daily doses required; duration of therapy; therapies that are inconvenient or interfere with a person's lifestyle and medications with a social stigma attached to its use have been associated with decreased adherence.

When medications such as antidepressants, are slow to produce effects, the older person may believe the medication is not working and may stop taking it (Tabor and Lopez, 2004). If administration of a medication requires the mastery of specific techniques, as with injections and inhalers, adherence may also be affected. Medication side effects can decrease adherence if patients believe they cannot control or manage them⁽¹⁷⁾

5. Patient-Related Factors

Physical impairments and cognitive limitations may increase the risk for no adherence in older adults⁽¹⁸⁾.

Materials and methods

This cross-sectional survey was performed within a 6-month period in Malla Reddy hospital and Narayana Hrudayalaya Hospital is a 300 bedded tertiary care hospital with departments like Cardiology, Neurosurgery, General Medicine, neurology, nephrology, gastroenterology, orthopedics, urology, gynecology etc., with a prime focus on variety of patient care processes including safe administration of medications. It is situated in the heart of the city with basic objective of providing treatment to diseases.

The sample size of the study was 150. Patients were included after they gave both oral and written informed consent. Patients who were included in the study were identified through a systematic random sampling of every fifth T2DM patient who attended the clinic based on their scheduled appointments as well as inclusion and exclusion criteria. Patients who were included were all T2DM patients over 20 years of age, with ongoing treatment. Patients who had incomplete medical records, who had mental problems, or who were not able to answer the questionnaire were excluded. Interviews were conducted to obtain patient demographic data, medication knowledge, and assessment of adherence through the 8- item Morisky medication adherence scale. Comorbidities included in the study were hypertension, dyslipidemia, or both.

The medication knowledge consisted of eight specific items of information regarding the patient's medication: name, dose, frequency, indication, how the patient administered the medication and etc., The knowledge score was calculated based on the number of questions answered correctly. Each correct answer was given a score of "1," with a total score of "8". The medication knowledge was then calculated as a percentage of correct answers. Patients were assessed by using 8-item Morisky Scale and the patients who were low and moderately adherent, they were counselled about the proper use of medications and its importance and the patient information leaflets were provided and they were advised for further reviews. Patients were again assessed to know their adherence during their further visits. Approval from the Institutional Ethics Committee and permission from the hospital before starting the study.

Statistical analysis

Data obtained from the study was entered in EXCEL SHEET. Results was summarised using EXCEL form and data analysis was carried out by differentiating based on age, gender, duration of diabetes, occupational status, habit of smoking & alcohol, educational status, family history, BMI, only diabetes & diabetes with comorbids, oral Vs insulin and calculate the adherence rate.

Results

All the patients who were invited to participate in the study agreed to participate. A total of 150 patients between 18 and 84 years of age were

included in the study. Reviewing the demographic data, it was found that 30.66% of the patients were aged 40-49 years. Whereas 37.33% of obese patients and 33.33% over weight patients were observed, greater extent in my study. In this study the comorbidities observed were hypertension, dyslipidemias and asthma etc along with diabetes mellitus. The patients with comorbidities were 48.66% and only diabetes were 51.33%.

Medication adherence is a key component of treatment for patients with diabetes. This study found gradual increases of medication adherence in diabetic patients, the patient medication adherence is evolved through 8-item Morisky medication adherence scale in three time visits of patients presence, comparing the first visit to third visit, the patients were adherent more by the clinical pharmacist giving of patient counseling, reminders about medication taking for forgetfulness, health education, dietary approach and complications ⁽²⁹⁾. In our study total patients 150 members were present, in that second visit are as 80 (remaining 70 patients are no response) ,in third visit 55 patients are present (remaining 70+25 patients are no response) in the first visit low medication adherence peoples were 60% ,when it compared to with second 10% ,third visit 6.66% This means that for many diabetic patients, medication adherence was improved. This result is slightly similar to what has been reported from Malaysia (53%). However, the lack of standard measurements prevents comparisons being made between studies and across populations.

The overall rate of good adherence to antidiabetic agents (42%) and medium adherence (68%) was

slightly similar to the french population based study, good adherence (39%) and medium

adherence (49%) among patients of national health insurance system.⁽²⁷⁾

Table 1 : Age distribution of the patients

Age in years	Males	Females	Total n=150	Percentage%
20-29	1(0.66%)	1(0.66%)	2	1.33%
30-39	14(9.33%)	15(10%)	29	19.33%
40-49	17(11.33%)	29(19.33%)	46	30.66%
50-59	7(4.66%)	25(16.66%)	32	21.33%
60-69	11(7.33%)	24(16%)	35	23.33%
70-79	2(1.33%)	0(0%)	2	1.33%
80-89	1(1.33%)	3(2%)	4	2.66%
Total			150	

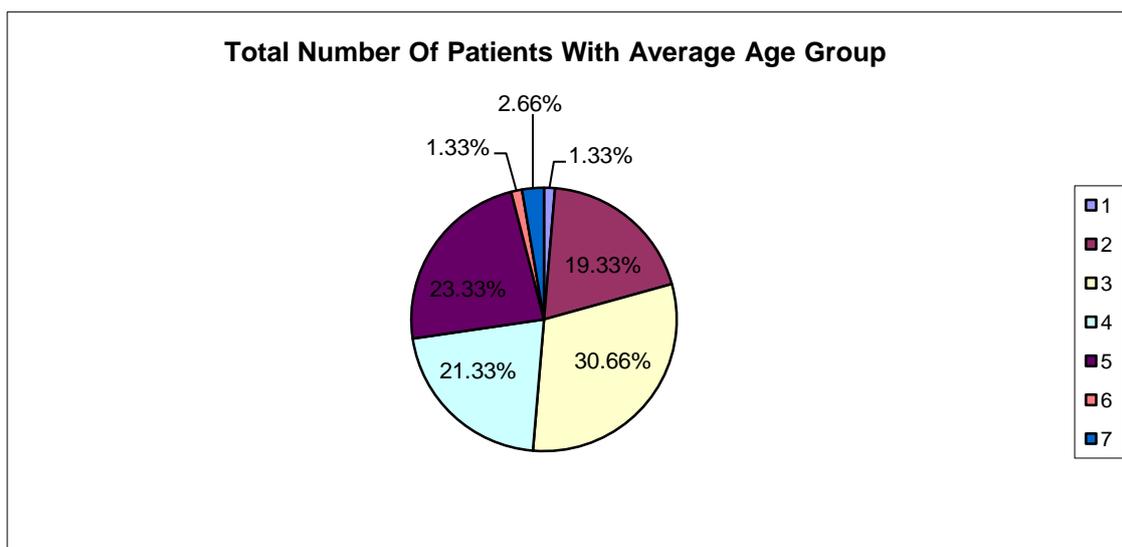


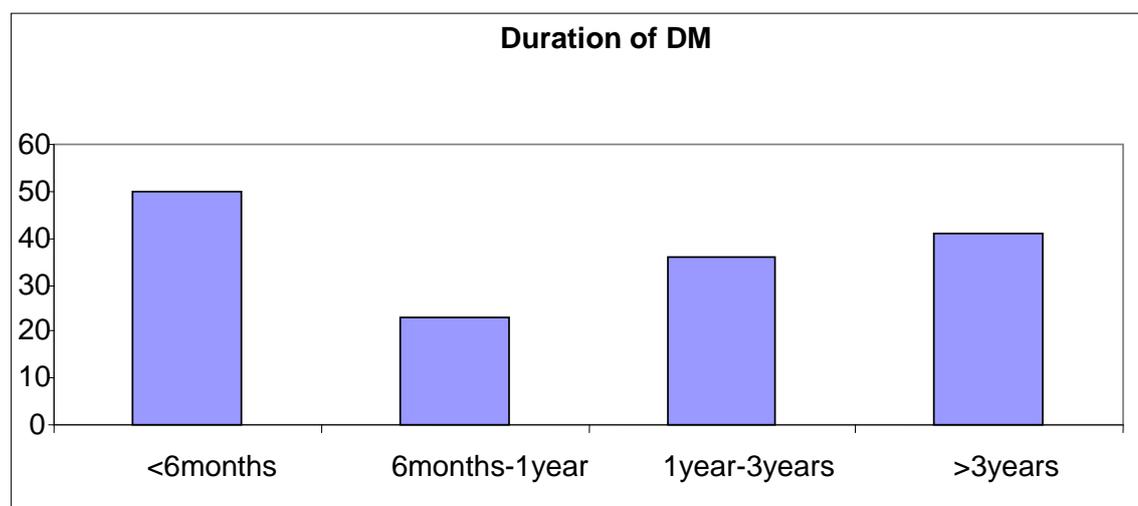
Figure.1: Total number of patients with average age group

A total of n=150 diabetic patients were participated in our study ,out of 150 ,majority of population were females n=99 and males were n=51 .out of 99 female diabetic patients with average age group of 40-49 years n=29(19.93%)

were more and male diabetic patients with average group of 40-49 years n=17(11.3%) out of 51 male diabetic patients, the reason for more female diabetic patients may be due to obesity, physiology, and life style conditions.

Table 2: Duration of the patients suffering from diabetes:

Duration Period	Number of Patients	Percentage (%)
<6months	50	33.33%
6months-1year	23	15.33%
1year-3years	36	24%
>3years	41	27.33%

**Figure 2:** Duration of DM

Among n=150 diabetic patients, the patients were suffering from diabetes, less than 6 months is 50(33.33%), 6 months to 1 year is 23(15.33%), 1 year to 3 years is 36 (24%) and more than 3 years as 41(27.33%) patients.

BMI:

A measurement of the relative percentage of the fat and muscle mass in the human body, in which mass in kilograms is divided by height in meters squared and result used as index of obesity.

$$\text{BMI} = \text{weight (kg)}/\text{height (m)}^2$$

Table 3: BMI of the patients

Body mass index	No of patients	Percentage (%)
Under weight(BMI<18.50)	2	1.33%
Normal weight (BMI 18.50-24.99)	42	28%
Over weight (BMI 25.00-29.99)	50	33.33%
obese (BMI>_ 30.00)	56	37.33%

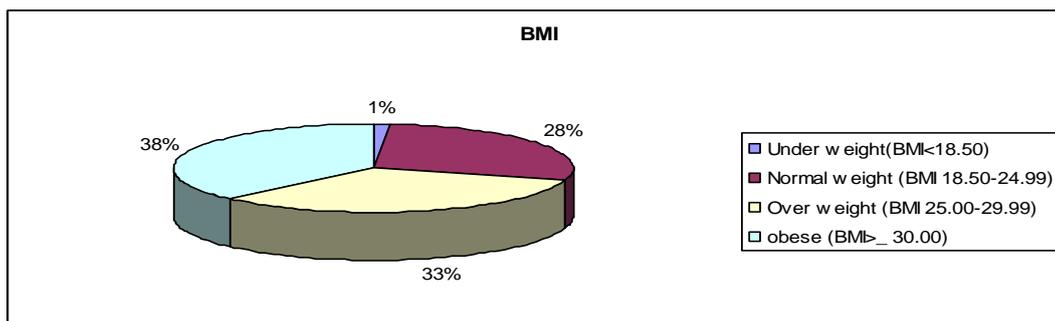


Figure 3: BMI of patients

BMI was calculated using weight (in Kilograms) and height (in meters)² taken from patients. Out of 150 patients 2 (1.33%) were under weight, 42 (28%) were normal weight, 50 (33.33%) were

overweight and 56(37.33%) were obese. In our study it was observed that most of the patients were obese and overweight

.Table 4: DM WITH COMORBIDS

TYPE	No.Of Patients	Percentage
Only DM	77	51.33%
DM with Comorbids	73	48.66%

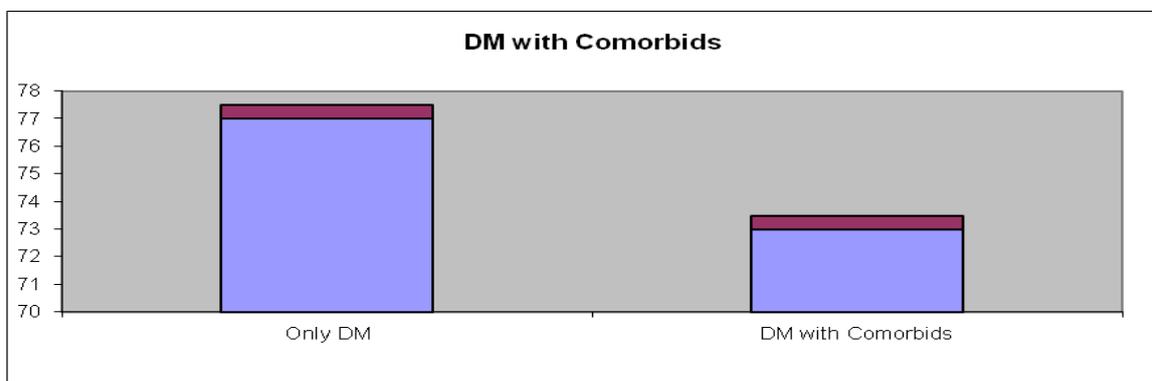


Figure 4: DM with comorbids

The above table indicates that among 150 patients, 77(51.33%) patients were with diabetes and the remaining 73(48.66%) patients were with other

comorbidities like hypertension, UTI, Dyslipidemias, etc...

First Time Adherence Scale:

Table 5: WHO Adherence Scale of the patients population.

Adherence scale	Number of patients(150)	percentage(%)
High Adherence	20	13.33%
Low adherence	90	60%
Medium adherence	40	26.66%

The above table indicates adherence pattern of the patient population of the study. The entire population was divided in to three categories i.e. high adherence, low adherence and medium adherence. In our study the patient population

with low adherence were 90(60%), followed by patients with medium adherence 40(26.66%) and finally high adherence 20(13.33%). The reason for medium & low adherence may be due to lack of health education and lack of awareness.

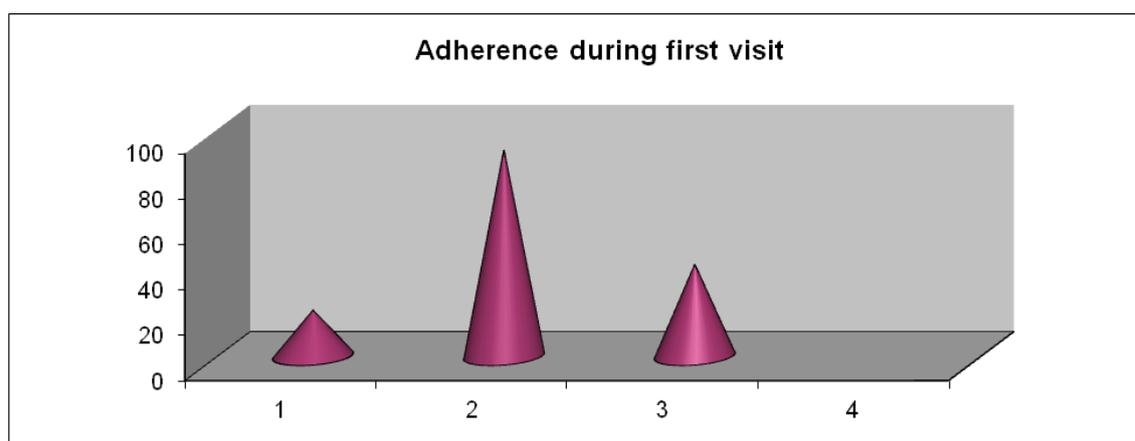


Figure 5: WHO Adherence Scale of the patients population

Second Time Medication adherence Scale:

Table 6: WHO Second Time Adherence Scale of the patients

Adherence scale	Number of patients(80)	Percentage(%)
High adherence	25	16.66%
Low adherence	15	10%
medium adherence	40	26.66%
No response	70	-----

Comparatively the adherence pattern among the patient population was improved after the first visit to the clinical pharmacy department and attended for patient counseling then, after the first

visit high adherence was improved. Out of 80 diabetic patients high adherence 25(16.66%), medium adherence 40(26.66%) and low adherence 15(10%).

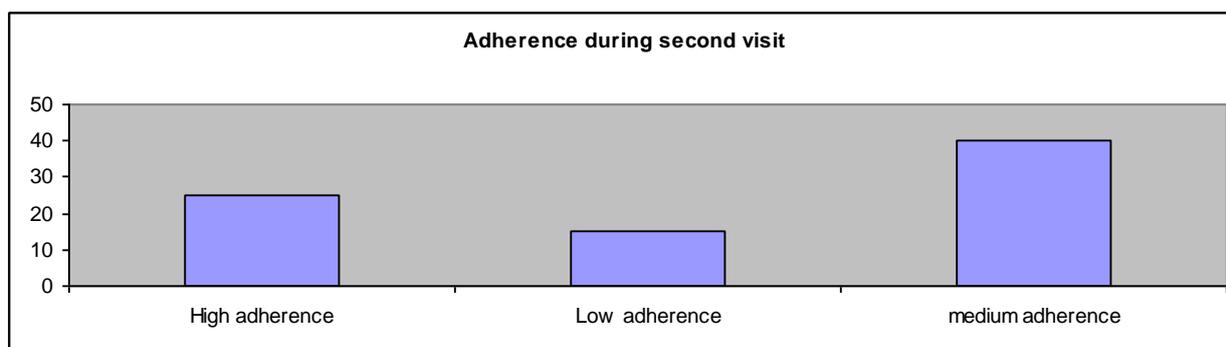


Figure 6: Second Time Medication adherence Scale

Third Time Medication Adherence Scale:

Table 7: WHO Third Time Adherence Scale of the patients

Adherence scale	Number of Patients(55)	Percentage(%)
High adherence	20	13.33%
Low adherence	10	6.66%
Medium adherence	25	16.66%
No response	95	-----

After the second visit to clinical pharmacy department, there is a significant increased in medication adherence among diabetic population

was found. Out of 55 patients high adherence was observed in n=20(13.33%), medium adherence n=25(16.66%), and low adherence n=10(6.66%).

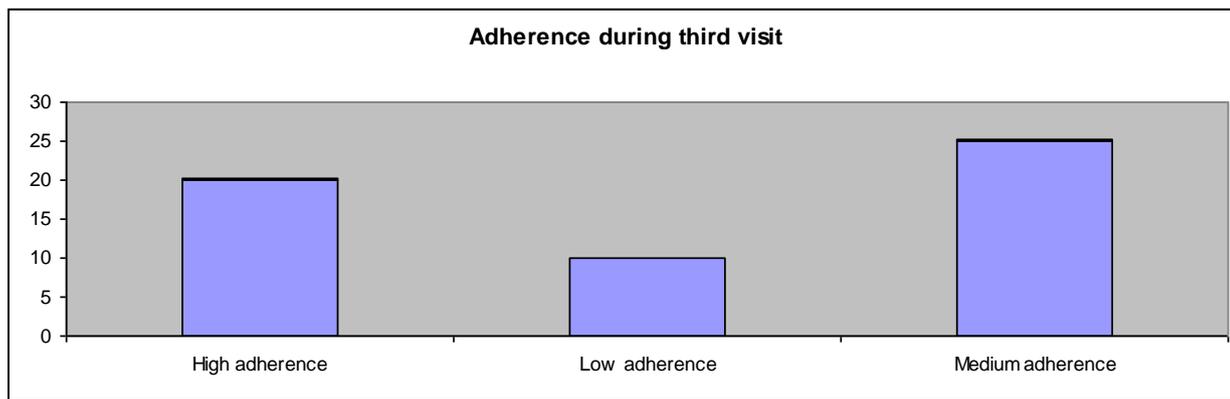


Figure 7: Third Time Medication Adherence Scale

Discussion

There have been variations in results obtained regarding adherence toward medication.²² In this study, adherence was observed only in a total 69% of the study population. The poor level of adherence in this work demonstrates the lack of attention T2DM patients are giving toward their health. An almost similar result determined through the pill count method was seen in patients with diabetes mellitus, asthma, and hypertension in Malaysia,^{6,23} which further substantiates the need for proper medication management. Based on previous work, patient characteristics related to nonadherence have been shown to vary. In general, race and sex have not been consistently associated with the level of patient adherence.^{14,23,24} On the other hand, level of education has been reported to affect adherence to medication.²⁴ In this study also, characteristics such as race, sex, duration of T2DM, body mass index, number of drugs taken, and educational level did not determine the level of adherence. The number of drugs taken by patients was dependent on the severity of T2DM and comorbidities. According to a US survey, 50% of

diabetic patients received more than seven medications in their prescription. This included antidiabetic drugs as well as other drugs to treat comorbidities.¹⁰ Thus, the drug regimen for patients with diabetes mellitus can become complex, and adherence may definitely be a challenge for patients.^{13,25} Studies have previously demonstrated that patients with more than two medications were more likely to be nonadherent, especially the elderly.⁶ However, there was no difference in the level of adherence in patients with a higher number of medications in this study group.

Many factors can directly or indirectly influence patient adherence. This study analyzed patient characteristics in determining adherence in T2DM. This study also indicates that, with the increase in age, the adherence to medication improved. Similar results were observed from a study among diabetic patients in a hospital in France, which showed that noncompliers were largely younger patients.¹³ It is possible that the younger patients were less aware of their disease and were thus more likely to be more nonadherent. This particular scenario observed in

this present study emphasizes the need for educating the younger generation. Another risk factor for nonadherence was the presence of comorbidities. T2DM patients with comorbidities generally have more drugs of different pharmacological classes such as hypertensive drugs, lipid-lowering agents, and antiplatelet drugs.

This complex treatment regimen could be a factor that contributes toward nonadherence. Previous studies that have shown reduced adherence in patients with comorbidities due to multiple medications^{10,11,14} support the current findings. A third factor determining adherence was medication knowledge. In this study, a very small percentage of patients (13.33%) reported a perfect medication knowledge score. The direct association between adherence and medication knowledge suggests that health care professionals are in the best position to disseminate appropriate information for better treatment outcome. Several studies have demonstrated poor understanding of medication knowledge among diabetic patients.²⁶ To that end, patient education on medication regimens is essential in order to improve adherence.

Limitations of the study

Some of the limitations of the study were the potential inaccuracies in the responses of the patients that are inherent in any self-reported questionnaire especially in chronic disease conditions. The study included patients who had diabetes mellitus for different lengths of time (a

few months to a number of years), and their perception and response to questions on adherence may differ. All the possible comorbidities (other than the three stated) were probably not captured during data collection. The study looked at a limited number of clinics in a specific district, and caution should be exercised in extrapolating the results.

Conclusion

This work provides an understanding of the extent of nonadherence in T2DM patients in tertiary health care clinics. Adherence to medications in T2DM patients remains unsatisfactory and, as a consequence, results in wastage of medications and less than optimal outcomes. The determinants of medication nonadherence were age, medication knowledge scores, and the presence of comorbidities. Although methods involved in adherence studies differ, the level of adherence identified in this study was similar to previous findings. Poor adherence among T2DM patients from tertiary health care clinics demonstrates the need to focus on this group of patients in order to improve treatment. Improving medication knowledge is shown as an important method in promoting adherence in T2DM patients. Particular focus is required for patients with comorbidities. Thus, this study provides a deeper understanding of adherence in T2DM patients and ways in which to overcome this setback.

Acknowledgement

It is a proud privileged honor for me to express my heartfelt thanks and gratefulness to all the persons who backed me directly or indirectly throughout the materialization of this project work at this magnitude. First and foremost, I place my heartfelt gratitude to my respected guide Professor, P,venkata sravani , Pharm D, Assistant professor Department of pharmacy practice . I take this opportunity with pride and enormous gratification to express my hearty thanks to B.Venkateswarlu, Pharmacy practice ,A. Sadanandam Pharm.D for their inspirational, impressive and innovative ideas as well as their constructive suggestions for the completion of my project.

References

1. Zanariah H, Chandran LR, Wan Mohamad WB, et al. *Prevalence of Diabetes Mellitus in Malaysia in 2006 – Results of the 3rd National Health and Morbidity Survey (NHMSIII)*. Kuala Lumpur, Malaysia: Clinical Research Centre; 2008.
2. Ooyub S, Ismail F, Daud N. Diabetes program in Malaysia – current and future. *NCD Malaysia*. 2004;3(2):6–12.
3. Simpson RW, Shaw JE, Zimmet PZ. The prevention of type 2 diabetes – lifestyle change or pharmacotherapy? A challenge for the 21st century. *Diabetes Res Clin Pract*. 2003;59(3):165–180.
4. Paes AH, Bakker A, Soe-Agnie CJ. Measurement of patient compliance. *Pharm World Sci*. 1998;20(2):73–77.
5. Haynes RB, Taylor DW, Sackett DL. *Adherence in Health Care*. Baltimore, MD: The Johns Hopkins University Press; 1979.
6. Aziz AM, Ibrahim MI. Medication noncompliance – a thriving problem. *Med J Malaysia*. 1999;54(2):192–199.
7. Vik SA, Maxwell CJ, Hogan DB, et al. *Determinants and Health Related Outcomes Associated With Nonadherence to Prescribed Drug Regimens: A Comparison of Rural and Urban Home Care Clients. Working Paper 03-02*. Edmonton, AB: Institute of Health Economics; 2003.
8. Haynes RB, Taylor DW, Sackett DL, Gibson ES, Bernholz CD, Mukherjee J. Can simple clinical measurements detect patient noncompliance? *Hypertension*. 1980;2(6):757–764.
9. Shalansky SJ, Levy AR, Ignaszewski AP. Self-reported Morisky score for identifying nonadherence with cardiovascular medications. *Ann Pharmacother*. 2004;38(9):1363–1368.
10. Rubin RR. Adherence to pharmacologic therapy in patients with type 2 diabetes mellitus. *Am J Med*. 2005;118 Suppl 5A:27S–34S.
11. Bartels D. Adherence to oral therapy for type 2 diabetes: opportunities for

- enhancing glycemic control. *J Am Acad Nurse Pract.* 2004; 16(1):8–16.
12. Leichter SB. Making outpatient care of diabetes more efficient: analyzing noncompliance. *Clin Diabetes.* 2005;23(4):187–190.
13. Bezie Y, Molina M, Hernandez N, Batista R, Niang S, Huet D. Therapeutic compliance: a prospective analysis of various factors involved in the adherence rate in type 2 diabetes. *Diabetes Metab.* 2006;32(6):611–616.
14. Osterberg L, Blaschke T. Adherence to medication. *N Engl J Med.* 2005;353(5):487–497.
15. Turner R, Cull C, Holman R. United Kingdom Prospective Diabetes Study 17: a 9-year update of a randomized, controlled trial on the effect of improved metabolic control on complications in non-insulin-dependent diabetes mellitus. *Ann Intern Med.* 1996;24(1 Pt 2): 136–145.
16. Krejcie RV, Morgan DW. Determining sample size for research activities. *Educational and Psychological Measurement.* 1970;30:607–610.
17. Morisky DE, Green LW, Levine DM. Concurrent and predictive validity of self-reported measure of medication adherence. *Med Care.* 1986;24(1):67–74.
18. Krousel-Wood M, Muntner P, Jannu A, Desalvo, Re RN. Reliability of a medication adherence measure in an outpatient setting. *Am J Med Sci.* 2005;330(3):128–133.
19. Södergård B, Halvarsson M, Tully P, et al. Adherence to treatment in Swedish HIV-infected patients. *J Clin Pharm Ther.* 2006; 31(6):605–616.
20. Hinton PR, Brownlow C, McMurray I, Cozens B. *SPSS Explained.* East Sussex, UK: Routledge Inc; 2004.
21. Rausch JR, Hood KK, Delamater A, et al. Changes in treatment adherence and glycemic control during the transition to adolescence in type 1 diabetes. *Diabetes Care.* 2012;35(6):1219–1224.
22. Cramer JA. A systematic review of adherence with medications for diabetes. *Diabetes Care.* 2004;27(5):1218–1224.
23. Misra R, Lagerb J. Ethnic and gender differences in psychosocial factors, glycemic control, and quality of life along adult type 2 diabetic patients. *J Diabetes Complications.* 2009;23(1):54–64.
24. Ramli A, Ahmad NS, Paraidathathu T. Medication adherence among hypertensive patients of primary health clinics in Malaysia. *Patient Prefer Adherence.* 2012;6:613–622.
25. Hankó B, Kázmér M, Kumil P, et al. Self-reported medication and lifestyle adherence in Hungarian patients with type 2 diabetes. *Pharm World Sci.* 2007;29(2):58–66.
26. Wan Bebalar WM. *Diabetes di Malaysia: Komplikasi dan Rawatan.* [*Diabetes in*

- Malaysia: Complications and Treatment.*] Pulau Pinang: Universiti Sains Malaysia; 2005. Malay.
27. The Expert Committee on the Diagnosis and Classification of Diabetes Mellitus: Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care* 20:1183–1197, 1997.
28. Pharmacotherapy – DIPIRO ; 6th edition; page no: 1333-1363
29. Clinical pharmacy and therapeutics – Roger Walker; 4th edition; page no:629-652
30. The Expert Committee on the Diagnosis and Classification of Diabetes Mellitus: Follow-up report on the diagnosis of diabetes mellitus. *Diabetes Care* 26:3160–3167, 2003.
31. Carpenter MW, Coustan DR: Criteria for screening tests for gestational diabetes. *Am J Obstet Gynecol* 144:768–773, 1982.
32. Seino Y, Nanjo K, Tajima N, Kadowaki T, Kashiwagi A, Araki E, Ito C, Inagaki N, Iwamoto Y, Kasuga M, Hanafusa T, Haneda M, Ueki K. Report of the committee on the classification and diagnostic criteria of diabetes mellitus. *J Jpn Diabetes Soc.* 2010; 53:450–67. (Japanese).
33. Kuzuya N, Abe M, Ueda H, Kuzuya K, Kuzuya T, Kosaka K, Goto Y, Shigeta Y, Baba S, Hirata Y, Horiuchi A, Yamada K, Wada M. Report of the committee on the diagnostic criteria of the oral glucose tolerance test for diabetes mellitus. *J Jpn Diabetes Soc.* 1970;13:1–7. (in Japanese)
34. So deeryard B, Halvarsson M, Tully MP, et al. Adherence to treatment in Swedish HIV-infected patients. *J Clin Pharm Ther.* 2006;31:605–616.
35. Norman SA, Marconi KM, Schezel GW, et al. Beliefs, social normative influences, and compliance with antihypertensive medication. *Am J Prev Med.* 1985;1:10–17.
36. Guillemin F, Bombardier C, Beaton D. Cross-cultural adaptation of health-related quality of life measures: literature review and proposed guidelines. *J Clin Epidemiol.* 1993;46:1417–1432.