ORIGINAL ARTICLE

Medical adherence among Type 2 Diabetes Mellitus patients at Tertiary Care Teaching Hospital of Nepal

Raut B1, Poudel N[2] ,Thapa D[3]

[1].Department of Pharmacology, Kathmandu Medical College and Teaching Hospital (KMCTH), Duwakot, Bhaktapur, Nepal. [2]. Department of Medicine, Kathmandu Medical College and Teaching Hospital (KMCTH), Sinamangal, kathmandu, Nepal. [3].Department of Pharmacology, Devdaha Medical College and Teaching Hospital, Rupandehi, Devdaha

Abstract

Background: Diabetes is a chronic, metabolic disease characterized by elevated levels of blood glucose. The most common is type 2 diabetes mellitus which occurs when the body becomes resistant to insulin or doesn't make enough insulin. It is ranked among the 10th leading cause of mortality globally. Proper medication adherence is critical component to control further complications of disease and to obtain higher therapeutic benefit.**Method:** It is a hospital based prospective cross sectional study involving 122 patients based on non probability sampling conducted in the tertiary care Teaching hospital. Patients who have been diagnosed with type 2 diabetes mellitus and taking anti-diabetic medicine at least 6 months prior were enrolled. A structured anonymous questionnaire was divided into three parts for data collection. A multivariate binary logistic regression model was applied to identify and compared the variables predictors of medication adherence. **Results:** In this study 122 patients diagnosed with type 2 diabetes mellitus taking anti-diabetic medications were enrolled. On the basis of Likert score (29%) had adherence and (71%) had non adherence to medication. (59%) of them had used oral hypoglycemic agent (25.4%) had used insulin only and (17%) had used both. Medication adherence was significantly correlated to the age (r= -0.18, 95% CI= -0.35 to -0.002, p=0.048), sex (r= -0.36, 95% CI= -0.51 to -0.20, p<0.001), education (r= -0.21, 95% CI= 0.04 to 0.38, p=0.018) and occupation (r= 0.24, 95% CI= 0.06 to 0.40, p=0.009) of the participant. Medication adherence was significantly correlated with availability of medicines locally (r= -0.22, 95% CI= -0.38 to -0.45, p=0.014), societal awareness (r= -0.22, 95% CI= -0.38 to -0.04, p=0.016) and confidence with symptoms related to the disease (r= -0.25, 95% CI= -0.41 to -0.07, p=0.006).**Conclusion:**Medication adherence was found to be lower among the Nepalese population at the tertiary care hospital. Counseling services and awareness program could be effective for the treatment and prevention of complications of diabetes

Key Words : Diabetes mellitus, Medical adherence, Therapeutic benefit.

Introduction

Diabetes is a chronic, metabolic disease characterized by elevated levels of blood glucose (or blood sugar), which leads over time to serious damage to the heart, blood vessels, eyes, kidneys and nerves.[1]The most common is type 2 diabetes, usually in adults, which occurs when the body becomes resistant to insulin or doesn't make enough insulin.[1]

The burden of diabetes mellitus (DM) has increased globally.[2] It is ranked among the 10th leading causes of mortality together with cardiovascular disease (CVD), respiratory disease, and cancer.[3] Decrease in nutrition quality, lack of exercise, obesity and increase in sedentary behaviors are some important modifiable risk factors for type 2 Diabetes.[2,3]It has become a serious challenge to the health system in developing countries due to

Correspondence Author

Dr Binod Raut, Associate Professor, Kathmandu Medical College and Teaching Hospital (KMCTH), Duwakot, Bhaktapur, Nepal. E-mail: binod14raut@gmail.comPhone:+9779840050194

Journal of Diabetes and Endocrinology Association of Nepal

ORIGINAL ARTICLE

complications associated with the disease, cost of disease treatment, lack of human and financial resources, and lack of awareness about the disease at the population level and among patient.[4]

Glycemic control is crucial for treatment of disease along with prevention of microvascular and macrovascular complications associated with it.[5] In order to achieved this, lifestyle modification and proper use of anti-diabetic medications are important steps.[6]

Proper medication adherence is critical component of metabolic control among adults with diabetes to obtain higher therapeutic benefit.[7]WHO has defined Healthcare adherence as "The extent to which an individual behavior (in terms of medications intake, adopting healthy diets, or performing lifestyle modifications) concurs with medical or health advice".[8] In chronic disease like Diabetes, non-adherence to the medications will have negative impact on the health outcome.[7]Poor adherence is associated with inadequate glycemic control, increased morbidity and mortality.[9,10]Factors influencing medication adherence includes lack of information, complexity of regimen, concomitant disease, perceptions of benefit, side effects, medication cost, and emotion of well being.[6,11]

There are limited studies has undergone regarding adherence and medication taking behavior among Diabetic patients. Hence, this study aims to identify medication adherence and factors determining non-adherence in patients with type 2 Diabetes Mellitus.

Material and Methods

This cross-sectional study was conducted among type 2 diabetes mellitus patients attending in tertiary care teaching hospital. The study was carried out from April 2023 to Sept 2023 for period of six months after taking ethical clearance from institutional review committee. The inclusion criteria were adults aged 18 years or above on antidiabetic medication for at least six months. A 122 sample size was calculated based on the presumption of prevalence of diabetes medication adherence .the desired sample size was enrolled using convenient sampling methodology. Written informed consent was taken before enrolling in the study. A structured anonymous questionnaire were used based on existing literatures.[12,13,14]

The data collection tool was divided into three parts first part included about socio-demographic characteristics such as age, sex, residence, educational status, working status, marital status, yearly income, associated other diseases and types of medicine used. The second part was composed of questions related to medication adherence. It consists of eight questions related to forgot taking medicine, stop taking medicine on own without consulting doctors, forgot to take during travel, took medicine yesterday, when felt better stop taking medicine ownself,overwhelmed in taking medicine daily and how difficult was it to remember to take medicine with either "yes" or "no" for questions 1 to 7 and Item 8 had a 5-point Likert answer scale. We have marked answer "no" as 1 and each "yes" answer is marked as 0 apart from item 5, in which each "yes" answer is marked as 1 and each "no" answer is marked as 0. For Item 8, the code (0–4) has to be standardized by dividing the result by 4 to calculate a summated score. Total scores on this part of the questionnaire range from 0 to 8, with scores of 8 reflecting high adherence, <6 reflecting low adherence.

The third part was about assessment of illness perception. Assessment of illness perception was done using the B-IPQ, a validated tool that estimates eight different characteristics of illness perception: consequences, timeline,

ORIGINAL ARTICLE

personal control, treatment control, identity, concerns, understanding, societal awareness, availability of doctor for follow ups and for counseling and emotional representation.14 The B-IPQ tool assesses all the stated aspects of illness perception using an 11-point Likert scale. A higher score indicates a more threatening view of the illness, while a lower score indicates a benign view. Patients who scored ≤12 were labelled non adherent and those who scored >13 were labelled to have good medication adherence.

Data were analyzed using SPSS program, version 20. Mean and standard deviation were calculated for quantitative data. Qualitative data were presented as number and percent. A multivariate binary logistic regression model was applied to identify the independent predictors of medication adherence (High adherence vs low adherence). The basis for the adherence categories would be "High medication adherence is associated with the higher odds of better use of medication and less disease outcome". In the logistic regression model (enter method), the above-mentioned binary outcome variables were compared with the potential predictor as included in the data collection form. All covariates in the analysis were included and made the category with respect to each variable as the reference category. We obtained the odds ratio (OR) and confidence interval (CI) of OR of each variable as the final results from logistic regression after adjusting with other independent variables. An adjusted OR of more than one that did not include a null value (0) in the confidence interval was considered a significant predictor. Furthermore, we applied Spearsman's test, Chi square test to find the correlation between overall B-IPQ score and medication adherence values. A P value ≤ 0.001 was set as a statistically significant value.

Results

A total of 122 Type 2 diabetes mellitus patients were participated in the study in which (53.3%) were from the age group between 51 to 80 years while (46.7%) were from the age group 30 to 50 years. There were 66 (54.1%) were female and 56 (45.9%) were male.

Majority of the patient (68.9%) were married, (50%) of the patients' average income per year was Rs 1 lakh per anum. More than (61.5%) of the patients were from urban or city areas whereas (38.5%) of the patients were from village area. Similarly (43.4%) of the patients have got primary education and ((9%) were illiterate. (36.1%) of the patients were private employee and (27%) of them are unemployed. More than (60%) of them were associated other diseases along with type 2 diabetes mellitus. On the basis of use of medicine (59%) of them had used oral hypoglycemic agent whereas (25.4%) had used insulin only and (17%) had used both oral as well as insulin combination.

ORIGINAL ARTICLE

Demographic characteristics of the participants: Table 1

1.1Age

	Frequency	Percent
30-50	57	46.7
51-80	65	53.3
Total	122	100.0

1.2Sex

	Frequency	Percent
Male	56	45.9
Female	66	54.1
Total	122	100.0

1.3Residence

	Frequency	Percent
1.City	75	61.5
2 .Village	47	38.5
Total	122	100.0

1.4Education

	Frequency	Percent
1. formal education	23	18.9
2. Primary/secondary	53	43.4
3. Bachelors /Masters	35	28.7
4. Uneducated	11	9.0
Total	122	100.0

1.5Occupation

	Frequency	Percent
1. Government employee	30	24.6
2. Private employee	44	36.1
3. Unemployed	33	27.0
4. Retired	15	12.3
Total	122	100.0

1.6 Marital status

	Frequency	Percent
1. Married	84	68.9
2. Divorced/widow	31	25.4
3. Single	7	5.7
Total	122	100.0

1.7 Income

	Frequency	Percent
1. Less than 1 lakh per annum	60	49.2
2. More than 1 lakh per annum	62	50.8
Total	122	100.0

1.8 OtherDiseases

	Frequency	Percent
1. Other disease	73	59.8
2. Only diabetes	49	40.2
Total	122	100.0

1.9 Types of medicine used

	Frequency	Percent
1. Oral hypoglycaemic agent	72	59.1
2. Insulin	31	25.4
3. Oral +insulin	19	15.5
Total	122	100.0

Patients were grouped into non adherent and adherent to medication based on the sum of scores reported on various factors. Patients who scored ≤12 were labelled non adherent and those who scored >13 were labelled to have good medication adherence.
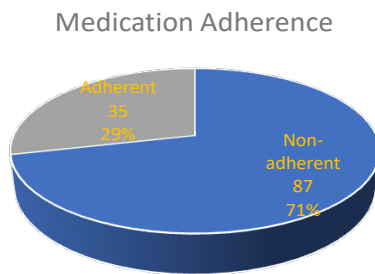
ORIGINAL ARTICLE

	Frequency	Percent
Non adherent	87	71.3
Adherent	35	28.7
Total	122	100.0

Figure: 1 medication adherence

Medication Adherence

The disease perception Likert scale for each factor ranged from 0 to 10. Scores were grouped into 3 categories (0-3, 4-6 and 7-10) during Chi-square test of independence to determine the effect of disease perception on medication adherence.

Table: 2 Effect of Demographic factors on medication adherence

Independent variable	Chi-square value (df)	p-value
Sex	15.92 (1)	<0.001*
Age	2.14 (1)	0.14
Residence	0.04 (1)	0.84
Education	10.47 (3)	0.015*
Occupation	9.63 (3)	0.022*
Marital	27.08 (2)	<0.001*
Income	0.24 (1)	0.63
Other disease	19.96 (1)	<0.001*
Medicine used type	0.74 (2)	0.69

*indicate statistically significant results.

Patients were more likely to forget taking medication if they were females, poorly educated, unemployed, married and had any other disease/s additional to DM.

Table: 3 Effect of disease perception on medication adherence

Independent variable	Chi-square value (df)	p-value
Illness affect	0.39 (1)	0.53
Illness last	9.02 (2)	0.01*
Control illness	15.31 (2)	<0.001*
Treatment help	0.45 (2)	0.80
Feel symptoms	15.17 (2)	<0.001*
Worried	5.12 (2)	0.08
Family support	3.05 (2)	0.22
Medicines availability	5.98 (1)	0.014*
Doctors availability	1.75 (1)	0.19
Society awareness	5.75 (1)	0.017*

*indicate statistically significant results.

Perceptions on longevity of the illness, control over the treatment, feeling about symptoms, availability of medicines locally and the societal awareness on the disease had a significant effect on medication adherence.

Correlation between medication adherence and demographic factors

Medication adherence was significantly correlated to the age (r= -0.18, 95% CI= -0.35 to -0.002, p=0.048), sex (r= -0.36, 95% CI= -0.51 to -0.20, p<0.001), education (r= -0.21, 95% CI= 0.04 to 0.38, p=0.018) and occupation (r= 0.24, 95% CI= 0.06 to 0.40, p=0.009) of the participant.

There was no correlation of medication adherence with place of residence(r= -0.02, 95% CI= -0.20 to 0.16, p=0.84), income status (r= 0.04, 95% CI= -0.14 to 0.22, p=0.63) and type of drug the participant was using(r= -0.04, 95% CI= -0.22 to 0.14, p=0.63).

ORIGINAL ARTICLE

Correlation between medication adherence and disease perception

Medication adherence was significantly correlated with availability of medicines locally (r= -0.22, 95% CI= -0.38 to -0.45, p=0.014), societal awareness (r= -0.22, 95% CI= -0.38 to -0.04, p=0.016) and confidence with symptoms related to the disease (r= -0.25, 95% CI= -0.41 to -0.07, p=0.006). The correlation between medication adherence and doctors' availability, effect of disease on daily life, longevity of the disease, feeling of control with the disease, effect of treatment to cure disease, concern on the disease and the family support on treatment were not statistically significant.

Discussion

The present study found that more than 50% patients were from age group 51-80 years in which female are more compare to male whereas in similar study done in Iran had found more male patient compare to female with Type 2 diabetes mellitus.15 Majority of the patient were married and 50% of the patient have Rs 1 lakh as average income per annum in which 61% of them were from urban area similar study done in India had also found more number of patients from urban area which is due to lack of awareness about the disease.16 Majority of the patient uses oral hypoglycemic agent to control the blood glucose level similar study done in Ethiopia had also found more than 60% of patient using oral hypoglycemic agent which more convenient and available easily and can be taken through oral route which is painless and effective.[17]

The present study found that (28.7%) of patients with Type 2 Diabetes Mellitus were adherent to the medications prescribed by doctors. Similar study done by AlQarni et al in Alkhobar city, reported slightly higher proportion (35.8%)

of the patient were found to be adherent to medications.15A study from a tertiary care hospital in New Delhi using the Morisky scale reported that 32.5% were found to have high adherence, while 34.5% and 33% had moderate and low adherence, respectively.16 This wide variation of prevalence figures reported across different studies might be due to the diverse study populations, study timing, and the varied scales used for measuring adherence.

In our study it was found that (71.3%) of the patients were non adherent to the medication in similar study by Murwanashyaka et al 17 also reported higher percentage of participant with non adherent these large discrepancy might have been attributed due to differences in study setting tools used to assess medication adherence, availability of appropriate medication, proper follow ups and counseling regarding disease condition. The reported mean rate of non-adherence in developed countries is only 50% whereas the rate is higher in developing countries which signified our study as it was done in developing country.18

In our study it was found that the medication adherence was significantly correlated to the age (r= -0.18, 95% CI= -0.35 to -0.002, p=0.048), sex (r= -0.36, 95% CI= -0.51 to -0.20, p<0.001), education (r= -0.21, 95% CI= 0.04 to 0.38, p=0.018) and occupation (r= 0.24, 95% CI= 0.06 to 0.40, p=0.009) of the participant. In contrast, an Iranian study found that a significantly higher proportion of males (86.6% vs. 80.3%, p = 0.036) exhibited non-adherence to diabetes medications compared to females. Meanwhile, a study in the USA by Kirkman et al. reported better medication adherence among males (AOR = 1.14, 95% CI = 1.12–1.16, p < 0.001).19, However, a study by Chepulis et al. in New Zealand, focusing on Metformin adherence among T2DM patients,

Journal of Diabetes and Endocrinology Association of Nepal

ORIGINAL ARTICLE

found no significant association between sex and medication adherence. These variations across studies from different regions may be attributed to differing study settings and socio-cultural factors20.There was no correlation of medication adherence with place of residence(r= -0.02, 95% CI= -0.20 to 0.16, p=0.84), income status (r= 0.04, 95% CI= -0.14 to 0.22, p=0.63) and type of drug the participant was using(r= -0.04, 95% CI= -0.22 to 0.14, p=0.63) was found in our study.

Medication adherence was significantly correlated with availability of medicines locally (r= -0.22, 95% CI= -0.38 to -0.45, p=0.014), societal awareness (r= -0.22, 95% CI= -0.38 to -0.04, p=0.016) and confidence with symptoms related to the disease (r= -0.25, 95% CI= -0.41 to -0.07, p=0.006), similar other study also illustrated that gaining more knowledge related to diabetes could decrease negative illness perception and increase the odds of medication adherence among patients with type 2 diabetes mellitus21.There was significant medical adherence was found in relation to availability of medicine and societal awareness which clarify that knowledge and awareness in relation to disease is important factor to reduce the further complications of diseases. The correlation between medication adherence and doctors' availability, effect of disease on daily life, longevity of the disease, feeling of control with the disease, effect of treatment to cure disease, concern on the disease and the family support on treatment were not statistically significant.

In our study it was found that the patients were more likely to forget taking medication who are females, poorly educated, unemployed, married and had any other additional diseases , similar studies done in Nepal had showed

lower education lead to more non adherence to treatment.22 another study done in Ethiopia had showed that adherence was high in those who had high educational status.23It signifies that better education leads to better medication adherence. Educated people understand detail information about the disease process and its consequences.

In our studyunemployed were likely to forget taking medication because of their lack of job and socioeconomic burden whereas in similar study done in France showed that employed patients are more likely to forget to take medicine due to busy in their work schedule.24 Similar in relation to additional disease due to use of more number of medicine for different diseases they often forget to take all medicine. One of the other reasons for non-adherence to treatment was having other chronic conditions in addition to diabetes. In addition, the problem of accepting the "disease", which may lead to resistance against treatment and difficult physical and psychological experiences, in many cases prevent diabetic patients from taking their medications properly. The side effects of certain diabetes medications result in disgust toward medications, increase the likelihood of medication discontinuation, and change the pattern of medication intake. These findings are in line with those of the study by Sweileh, in which the experience of medication side effects and the simultaneous use of several medications led to non-adherence to treatment.25

Type-2 diabetes not only leads to physical and hormonal problems in the patients, but may also become a social issue, because the patient has interactions with other people and is engaged in daily life activities. Therefore, the conditions and challenges of everyday life, influence

ORIGINAL ARTICLE   OPEN ACCESS

diabetic patients' interactions with their illness and the treatment process. The findings of our study are in line with those of other studies on mental problems and psychological health.26.27 In addition, stressful life events and depression28,29and their implications affect adherence to treatment in patients with type-2 diabetes. Other studies have suggested that the more stressful events experienced by the patient, the higher the chance of non-adherence to treatment, and that depression and stress can lead to reduced adherence to treatment.30 While caring for these patients, their roles in everyday life should be adequately examined, and any interference in the treatment adherence should be resolved through careful planning to find a balance between these two. Family participation and the support they can provide for the patients, especially when they experience psychological problems are also of high importance.

Conclusion:

The present cross-sectional study found low medication adherence by patients with type2 diabetes mellitus. Patients were more likely to forget taking medication if they were females, poorly educated, unemployed, married and had any other diseases additional to diabetes mellitus. There was significant association found between medication adherence with age, sex, education and occupation. It had significant correlation with perceptions on longevity of the illness, control over the treatment, feeling about symptoms, availability of medicines locally and the societal awareness and confidence with symptoms related to the disease. Patients with formal education were more likely to adhere to their medication regimen compared to those without formal education. Furthermore, enhancing diabetes counseling services across the country could raise awareness among patients and their families about diabetes

management, including medication adherence. Providing diabetes counseling in both hospital and community settings would be beneficial for patients. These results highlight the importance of patient education and awareness regarding medication adherence in managing diabetes.

Recommendations:

For the betterimprovement of medical adherence on type 2 diabetes mellitus patients, healthcare providers should engage in open communication, educating patients on the importance of their medications and the potential consequences of non-adherence. Simplifying the medication regimen, such as using combination pills or reducing the number of daily doses, can also enhance adherence. Proper counseling and awareness program regarding diabetes mellitus can help in effective management and prevention of complication. Behavioral strategies, like motivational interviewing, can be effective in addressing patients' beliefs and attitudes towards their treatment. Involving family members or caregivers can provide additional support and encouragement. Regular follow-up appointments and monitoring can help identify adherence issues early and provide opportunities for intervention. Financial barriers should also be addressed by discussing cost-effective alternatives or assisting patients in finding financial aid programs.

Journal of Diabetes and Endocrinology Association of Nepal

ORIGINAL ARTICLE

Conflict of interest: No any conflict of interest
Financial Support: All the authors have declared that no any financial support was provided for conducting this study.

References

1. Diabetes. Key facts. 16 September 2022 [website] (https://www.who.int/news-room/fact-sheets/detail/diabetes, accessed on 12 Feb 2023).

2. Shrestha N, Karki K, Poudyal A, et al. Prevalence of diabetes mellitus and associated risk factors in Nepal: findings from a nationwide population based survey. BMJ Open 2022;12: e060750.

3. Pradeepa R, Mohan V. Epidemiology of type 2 diabetes in India. Indian J Ophthalmol. 2021 Nov;69(11):2932-8.

4. Pandey AR, Aryal KK, Shrestha N, Sharma D, Maskey J, Dhimal M. Burden of Diabetes Mellitus in Nepal: An Analysis of Global Burden of Disease Study 2019. J Diabetes Res. 2022 Dec 20;2022:4701796.

5. Kennedy-Martin T, Boye KS, Peng X. Cost of medication adherence and persistence in type 2 diabetes mellitus: a literature review. Patient Prefer Adherence. 2017 Jun 30;11:1103-17.

6. Ahmad NS, Ramli A, Islahudin F, Paraidathathu T. Medication adherence in patients with type 2 diabetes mellitus treated at primary health clinics in Malaysia. Patient Prefer Adherence. 2013 Jun 17;7:525-30.

7. Baghikar S, Benitez A, Fernandez Piñeros P, Gao Y, Baig AA. Factors Impacting Adherence to Diabetes Medication Among Urban, Low Income Mexican-Americans with Diabetes. J Immigr Minor Health. 2019 Dec;21(6):1334-41.

8. Thirunavukkarasu A, Naser Abdullah Alshahrani A, Mazen Abdel-Salam D, et al. Medication Adherence Among Hypertensive Patients Attending Different Primary Health Centers in Abha, Saudi Arabia: A Cross-Sectional Study. Patient Prefer Adherence. 2022 Oct 19; 16:2835-44.

9. Ahmad A, Khan MU, Aslani P. A Qualitative Study on Medication Taking Behaviour Among People With Diabetes in Australia. Front Pharmacol. 2021 Sep 20;12:693748.

10. Patel S, Abreu M, Tumyan A, et al. Effect of medication adherence on clinical outcomes in type 2 diabetes: analysis of the SIMPLE study. BMJ Open Diab Res Care 2019;7:e000761.

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. Thirunavukkarasu A, Naser Abdullah Alshahrani A, Mazen Abdel-Salam D, et al. Medication Adherence Among Hypertensive Patients Attending Different Primary Health Centers in Abha, Saudi Arabia: A Cross-Sectional Study. Patient Prefer Adherence. 2022 Oct 19; 16:2835-44.

13. Lam WY, Fresco P. Medication adherence measures: an overview. Biomed Res Int. 2015; 2015:217047.

14. Broadbent E, Petrie KJ, Main J, Weinman J. The brief illness perception questionnaire. J Psychosom Res. 2006;60(6):631–7.

15. AlQarni, K.; AlQarni, E.A.; Naqvi, A.A.; AlShayban, D.M.; Ghori, S.A.; Haseeb, A.; Raafat, M.; Jamshed, S. Assessment of Medication Adherence in Saudi Patients With Type II Diabetes Mellitus in Khobar City, Saudi Arabia. Front. Pharm. 2019, 10, 1306. [CrossRef]

16. Acharya AS, Gupta E, Prakash A, Singhal

ORIGINAL ARTICLE

N. Self-reported adherence to medication among patients with type II diabetes mellitus attending a tertiary care hospital of Delhi. J Assoc Physicians India 2019;67:26–9

17. Murwanashyaka, J.d.D.; Ndagijimana, A.; Biracyaza, E.; Sunday, F.X.; Umugwaneza, M. Non-adherence to medication and associated factors among type 2 diabetes patients at Clinique MedicaleFraternite, Rwanda: A cross-sectional study. BMC Endocr. Disord. 2022, 22, 219. [CrossRef]

18. Manan, M.M.; Husin, A.R.; Alkhoshaiban, A.S.; Al-Worafi, Y.M.A.; Ming, L.C. Interplay between Oral Hypoglycemic Medication Adherence and Quality of Life among Elderly Type 2 Diabetes Mellitus Patients. J. Clin. Diagn. Res. 2014, 8, JC05. Available online: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4316278/ (accessed on 15 May 2022). [CrossRef]

19. Kirkman, M.S.; Rowan-Martin, M.T.; Levin, R.; Fonseca, V.A.; Schmittdiel, J.A.; Herman, W.H.; Aubert, R.E. Determinants of Adherence to Diabetes Medications: Findings From a Large Pharmacy Claims Database. Diabetes Care 2015, 38, 604–609. [CrossRef]

20. Chepulis, L.; Mayo, C.; Morison, B.; Keenan, R.; Lao, C.; Paul, R.; Lawrenson, R. Metformin adherence in patients with type 2 diabetes and its association with glycated haemoglobin levels. J. Prim. Health Care 2020, 12, 318–326. [CrossRef]

21. Alyami, M.; Serlachius, A.; Mokhtar, I.; Broadbent, E. Illness Perceptions, HbA1c, and Adherence in Type 2 Diabetes In Saudi Arabia. Patient Prefer Adherence 2019, 13, 1839–1850. [CrossRef]

22. Kafle, N.K.; Poudel, R.R.; Shrestha, S.M. Noncompliance to diet and medication among patients with type 2 diabetes mellitus in selected hospitals of Kathmandu, Nepal. J. Soc. Health Diabetes 2018, 6, 90–95. [CrossRef]

23. Abebaw, M.; Messele, A.; Hailu, M.; Zewdu, F. Adherence and Associated Factors towards Antidiabetic Medication among Type II Diabetic Patients on Follow-Up at University of Gondar Hospital, Northwest Ethiopia. Adv. Nurs. 2016, 2016, 8579157. [CrossRef]

24. Tiv, M.; Viel, J.F.; Mauny, F.; Eschwege, E.; Weill, A.; Fournier, C.; Fagot-Campagna, A.; Penfornis, A. Medication adherence in type 2 diabetes: The ENTRED study 2007, a French population-based study. PLoS ONE 2012, 7, e32412. [CrossRef] [PubMed]

25. Arifulla M, Lisha Jenny J, Sreedharan J, Muttappallymyalil J, Basha SA. Patients' adherence to anti-diabetic medications in a hospital at Ajman, UAE. Malaysian J Med Sci. 2014;21(1):44.

26. Poursharifi H, Babapour J Memory, health locus of control and adherence in type II diabetic patients in Iran-Tabriz. Procedia-Social Behav Sci. 2011;30:2621–2624. doi:10.1016/j.sbspro.2011.10.513

27. Kreyenbuhl J, Leith J, Medoff DR, et al. A comparison of adherence to hypoglycemic medications between type 2 diabetes patients with and without serious mental illness. Psychiatry Res. 2011;188(1):109–114. doi:10.1016/j.psychres.2011.03.013

28. Osborn CY, Egede LE. The relationship between depressive symptoms and medication nonadherence in type 2 diabetes: the role of social support. Gen Hosp Psychiatry. 2012;34(3):249–253. doi:10.1016/j.genhosppsych.2012.01.015

29. Walders-Abramson N, Venditti EM,

Journal of Diabetes and Endocrinology Association of Nepal

ORIGINAL ARTICLE

Ievers-Landis CE, et al. Relationships among stressful life events and physiological markers, treatment adherence, and psychosocial functioning among youth with type 2 diabetes. J Pediatr. 2014;165(3):504–508. doi:10.1016/j. jpeds.2014.05.020

30. Zhang J, Xu C-p, Wu H-x, et al. Comparative study of the influence of diabetes distress and depression on treatment adherence in Chinese patients with type 2 diabetes: a cross-sectional survey in the People's Republic of China. Neuropsychiatr Dis Treat. 2013;9:1289