

Prescribing Pattern of Drugs in Outdoor Patients with Type 2 Diabetes Mellitus in Relation to the Duration of Diabetes in a Tertiary Care Teaching Hospital – A Prospective Observational Study

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ABSTRACT

BACKGROUND

The current study was undertaken to evaluate the prescribing pattern of drugs in relation to the duration of diabetes in outdoor patients with type 2 diabetes mellitus in a tertiary care teaching hospital. There is scanty data on assessment of prescribing pattern of antidiabetic drugs in relation to the duration of diabetes especially from Indian population and no such study has been cited in our setup.

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DOI: 10.18410/jebmh/2021/49

How to Cite This Article:

Gupta H, Gupta S, Mahajan V, et al. Prescribing pattern of drugs in outdoor patients with type 2 diabetes mellitus in relation to the duration of diabetes in a tertiary care teaching hospital – a prospective observational study. *J Evid Based Med Healthc* 2021;8(05):256-260.
DOI: 10.18410/jebmh/2021/49

Submission 13-10-2020,
Peer Review 25-10-2020,
Acceptance 11-12-2020,
Published 01-02-2021.

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METHODS

This is a prospective observational study conducted in outdoor patients with type 2 diabetes mellitus for a period of 6 months. Our study sample included 155 patients whose prescriptions were analysed and detailed information such as demographic details, presenting complaints, past medical history of patients were recorded in their patient profile form after taking informed consent from those patients who fulfilled our study criteria.

RESULTS

Data of 155 patients was collected and analysed. The average age was 51.21 ± 9.73 with 92 % of patients being more than 40 years of age and most of the patients (50 %) have diabetes of duration < 5 years. The female to male ratio was 1.76. A Multidrug antidiabetic regimen (72 %) was more common than monotherapy (28 %). Commonly prescribed drugs were biguanides (metformin) (87 %) followed by sulfonylureas (SU) (45 %), dipeptidyl peptidase 4 inhibitor (DPP4i) (42 %), and insulin (14 %). Metformin was the most commonly used drug followed by glimepiride and teneligliptin. Drug combinations were more common than a single drug. Metformin + glimepiride was the most common drug combination followed by metformin + teneligliptin. Commonly prescribed drugs for comorbid conditions were telmisartan, levothyroxine and atorvastatin.

CONCLUSIONS

It was found that the prescribing pattern of drugs was mostly as per the recommendations of different guidelines. The study exhibited a significant increase in the utilization of two-drug combination therapies. Biguanides were the most commonly prescribed oral hypoglycaemic and metformin with glimepiride has been widely used. There was a proportionate rise in the use of insulin with an increase in the duration of diabetes. Brand names were commonly used compared to generic names, so we need to promote generic prescriptions.

KEYWORDS

Antidiabetic Drugs, Type 2 Diabetes Mellitus, Prescribing Pattern, Duration of Diabetes

BACKGROUND

Diabetes mellitus (DM) has emerged as an important clinical and public health problem worldwide. According to World Health Organization (WHO), about 422 million people worldwide have diabetes.¹ The International Diabetes Federation (IDF) which is a global diabetes community estimates that there were 72.9 million people with diabetes in India in 2017, which is projected to rise to 134.3 million by the year 2045.² Currently, many antidiabetic drugs are available, physicians can choose any drug depending on patient's profile and need.

Prescribing pattern of drugs may vary from physician to physician and from patient to patient. The study of prescribing pattern of drugs used for management of such common diseases is very important to ensure rational and cost-effective medical care. There is scanty data on assessment of prescribing pattern of antidiabetic drugs in relation to the duration of diabetes especially from Indian population and no such study has been cited in our setup. Keeping these facts in mind, this study was planned to evaluate the prescribing pattern of drugs in patients with type 2 diabetes in relation to duration of diabetes and to provide recommendations if any regarding prescriptions.

The current study was undertaken to evaluate the prescribing pattern of drugs in relation to duration of diabetes in outpatients with type 2 diabetes mellitus in a tertiary care teaching hospital.

METHODS

This prospective observational study was undertaken in outpatients with type 2 diabetes mellitus with age more than 18 years of both genders with or without concurrent illness over a period of 6 months in a tertiary care teaching hospital, (North India) Govt. Medical College Jammu after approval from institutional ethical committee vide no. IEC / 2019 / 725. Type 1 diabetes mellitus patients were excluded from the study. Our study sample included 155 patients whose prescriptions were analysed and detailed information such as demographic details, presenting complaints, past medical history of patients were recorded in their patient profile form after taking informed consent from those patients who fulfilled our study criteria. Sampling was done using random sampling technique. The enrolled patients were then divided according to duration of diabetes into 3 groups a) Diabetes duration < 5 years b) Diabetes duration 5 - 10 years c) Diabetes duration > 10 years. Each category was further divided into four subgroups according to the treatment received a) monotherapy b) two-drug therapy c) three-drug therapy d) four-drug therapy including insulin with other oral hypoglycemic drugs.

Each prescription was analysed for total number of drugs prescribed, average number of drugs per prescription, antidiabetic drugs prescribed and their number per prescription, drugs for other comorbidities and fixed dose combinations used. This data was analysed using descriptive methods. Statistical analysis was done using Microsoft excel software.

RESULTS

In this study, 155 prescriptions of outpatients of type 2 diabetes mellitus were collected and analysed. All the participants were divided into three different groups according to their duration of diabetes and drugs prescribed in each group were analysed. Average age was 51.21 ± 9.73 years with 92 % of patients more than 40 years of age. Female patients were more as compared to male patients. The female to male ratio was found to be 1.76:1. In this study about 50 % of all the patients have duration of diabetes < 5 years. (Table 1). Total number of antidiabetic drugs prescribed were 329. Average total number of drugs encountered per prescription were 3.01 and average number of antidiabetic drugs per prescription were 2.12. 4 % drugs were prescribed by generic name. (Figure 1)

Commonly prescribed group of antidiabetic drugs were biguanides (87 %) followed by sulfonylureas (SU) (46 %), dipeptidyl peptidase 4 inhibitor (DPP4i) (42 %) and insulin (14 %). Metformin (87 %) was the most commonly used drug followed by glimepiride (45 %) and teneligliptin (37 %). Results of present study suggest that pioglitazone use has decreased drastically. There was proportionate rise in the use of insulin with the increase in duration of diabetes. (Table 2, 3). Fixed dose combinations (FDCs) were more commonly prescribed than monotherapy. FDCs prescribed were 133 (67 %) among total prescriptions. FDCs prescribed were two drug combinations (95 %) and three drug combinations (4.5 %). Two drug combinations included metformin + teneligliptin (40.6 %), metformin + glimepiride (38.3 %), metformin + vildagliptin (6.7 %), metformin + sitagliptin (6.7 %). Three drug combinations included glimepiride + metformin + pioglitazone (1.5 %), metformin + glimepiride + voglibose (3 %). (Table 2)

Drugs prescribed for comorbid conditions were antihypertensives (most common along the duration of diabetes) followed by vitamins, levothyroxine, atorvastatin and proton pump inhibitors. Use of proton pump inhibitors also increased in patients having diabetes for 5 - 10 years.

FDCs Used for Comorbidities

Telmisartan 40 mg + amlodipine 5 mg, telmisartan 40 mg + chlorthalidone 12.5 mg, cilnidipine 10 mg + telmisartan 40 mg, aspirin 75 mg + atorvastatin 10 mg.

Out of 155 patients, maximum no. of patients (58) were prescribed with 2-drug therapy (37 %), while 49 (32 %) patients were prescribed with triple therapy, 42 (27 %) patients were prescribed with monotherapy and six patients (4 %) were prescribed with 4-drug therapy. Number of antidiabetic drugs per prescription increased with increase in the duration of diabetes. In patients with diabetes duration less than 5 years, 2 drugs were more frequently prescribed (40.26 %) as compared to patients with duration of diabetes 5 - 10 years in which 3 drugs were more commonly used (41.82 %) and in patients with duration of diabetes more than 10 years, there has been increase in the use of 4 drugs besides 2 drugs and 3 drugs. (Figure 2).

| Duration of Diabetes (Years) | Females | | Males | | Total | |
|------------------------------|------------------------|-----------------------|------------------------|-----------------------|------------------------|-----------------------|
| | Number of Patients (%) | Mean Age (Years) (SD) | Number of Patients (%) | Mean Age (Years) (SD) | Number of Patients (%) | Mean Age (Years) (SD) |
| < 5 | 52 (52.53) | 49.32 (9.11) | 25 (44.64) | 51.6 (11.40) | 77 (49.68) | 50.06 (9.90) |
| 05 - 10 | 33 (33.33) | 50.30 (9.37) | 22 (39.29) | 51.95 (7.96) | 55 (35.48) | 50.96 (8.79) |
| > 10 | 14 (14.14) | 52.28 (8.25) | 9 (16.07) | 60.88 (11.75) | 23 (14.84) | 55.65 (10.43) |
| Grand Total | 99 (100 %) | 50.07 (9.05) | 56 (100 %) | 53.23 (10.61) | 155 (100 %) | 51.21 (9.73) |

Table 1. Gender & Age Distribution of Patients in Subgroups along with Duration of Diabetes

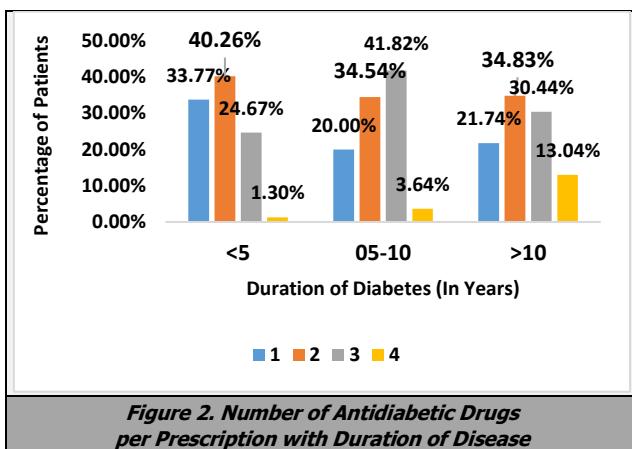


Figure 2. Number of Antidiabetic Drugs per Prescription with Duration of Disease

| Antidiabetic Drug Groups | Number of Patients along the Duration of Diabetes (in Years) | | | |
|-----------------------------|--|--------|------|-------|
| | < 5 | 5 - 10 | > 10 | Total |
| Biguanide | 76 | 43 | 16 | 135 |
| Sulfonylureas | 37 | 25 | 9 | 71 |
| DPP4 inhibitors | 28 | 34 | 10 | 72 |
| Alpha glucosidase inhibitor | 0 | 4 | 0 | 4 |
| Thiazolidinedione | 0 | 1 | 1 | 2 |
| Insulin | 3 | 10 | 10 | 23 |

Table 2. Antidiabetic Drug Groups Used by the Patients along with Duration of Diabetes and Frequency of Fixed Dose Combination Usage

| Fixed Dose Combinations (FDCs) | Frequency (no.) of FDCs Used with Duration of Diabetes (in years) | | | |
|--|---|-----------|-----------|------------|
| | < 5 | 5 - 10 | > 10 | Total |
| Glimepiride + metformin | 31 | 17 | 3 | 51 |
| Glimepiride + pioglitazone | 0 | 1 | 2 | 3 |
| Gliclazide + metformin | 1 | 0 | 0 | 1 |
| Teneliglitin + metformin | 26 | 18 | 10 | 54 |
| Vildagliptin + metformin | 1 | 7 | 1 | 9 |
| Sitagliptin + metformin | 3 | 5 | 1 | 9 |
| Glimepiride + metformin + pioglitazone | 1 | 0 | 1 | 2 |
| Voglibose + glimepiride + metformin | 0 | 4 | 0 | 4 |
| Total | 63 | 52 | 18 | 133 |

Table 4. Prescribing Pattern of Antidiabetic Drugs

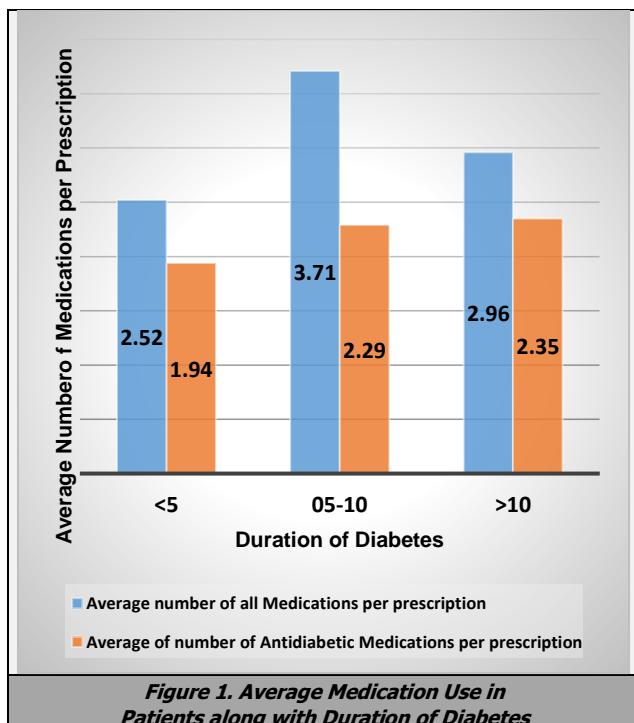


Figure 1. Average Medication Use in Patients along with Duration of Diabetes

| Drugs | No. of Encounters | Percentage of Encounters (%) |
|--------------|-------------------|------------------------------|
| Metformin | 135 | 87 |
| Glimepiride | 70 | 45 |
| Teneliglitin | 58 | 37 |
| Insulin | 23 | 15 |
| Sitagliptin | 7 | 4.5 |
| Vildagliptin | 7 | 4.5 |
| Voglibose | 4 | 2.5 |
| Pioglitazone | 2 | 1.2 |
| Gliclazide | 1 | 0.6 |

Table 3. Frequency of Fixed Dose Combination Usage

DISCUSSION

This study was done to assess the prescribing pattern of antidiabetic drugs in relation to the duration of diabetes mellitus. A total of 155 prescriptions of patients with type 2 diabetes mellitus were evaluated during the study period and it was observed that prevalence of diabetes was more in females (63.8 %) as compared to males (36.1 %). Studies conducted by Satpathy SV et al. and Yusefzadeh G et al. also showed that female had preponderance in the prevalence of diabetes, while studies conducted by Mohmmad M et al. and Joshi DB et al., was contradictory to our study which have reported a high proportion of diabetes in male patients.^{3,4,5,6} Average age in our study was 51.21 years with 92 % of patients above 40 years which was similar with study done by Upadhyay DK et al. and Kannan et al.^{7,8} Prevalence of diabetes mellitus increases with increase in the age as ageing causes increase in disturbance of carbohydrate metabolism due to associated decrease in insulin secretion in response to glucose load as well as increased insulin resistance in peripheral tissues and insulin sensitivity also decreases with increasing age and obesity.⁹

Duration of diabetes has a significant role in its management. Patients having diabetes for < 5 years can usually be managed with single drug therapy and increase number of drugs are required with increase in the duration of diabetes. In our study, average number of drugs per prescription was 2.12 drugs which is less as compared to study conducted by Upadhyay DK et al. (3.76 per prescription) and more as compared to that reported by Kannan et al. (1.4 per prescription).^{7,8}

Biguanide (87 %) remained the most preferred drug across the entire duration of diabetes in both monotherapy as well as in combination therapy in our study, DPP4i (42 %) seem to be fast catching up with SU (46 %) as a second-line treatment after metformin and use of insulin is increasing with the increase in the duration of diabetes. Out of all patients with diabetes duration 10 years or more, 43 % patients would require addition of insulin for glycaemic control.

This pattern of drug use is as per recommendation of recent guidelines for the management of diabetes mellitus which suggest that metformin should be started along with life style modifications at the time of diagnosis. Metformin is the most preferred 1st line drug as it is effective, inexpensive with low incidence of adverse effects. Metformin rarely produces hypoglycaemia when used as monotherapy. It has a favourable effect on lipids and glycated haemoglobin A1C, weight and cardiovascular mortality.^{2,10}

Sulfonylureas have evolved over the years and presently constitute an important pillar for the treatment of type 2 diabetes mellitus. In this study, among the sulfonylureas, glimepiride was the most commonly prescribed drugs. The major advantage of glimepiride over other sulfonylureas is its safety, higher efficacy and low hypoglycaemia potential. Glimepiride has several extrapancreatic and pleiotropic benefits, which include insulin-sensitizing properties and anti-inflammatory, antioxidative and angiogenic effects.¹¹

Dipeptidyl peptidase-4 (DPP-4) inhibitors are also commonly used as second-line therapy for the management of diabetes. In our study teneligliptin was the commonly used drug among this group. DPP-4i have a favourable safety profile and can be used without dose adjustments in older adults and in patients with mild renal impairment; they have a neutral effect on body weight and do not cause hypoglycaemia by themselves.^{12,13}

Singla R et al. reported metformin to be the most commonly used drug and the increase in the use of insulin with the increase in the duration of diabetes.¹⁴ Patel B et al., in their study reported the uses of metformin at 87.7 %, sulfonylureas at 68 %, and DPP4i at 10.5 % among 114 people from Ahmedabad, India.¹⁵ Another study conducted by Meta-Cases M et al. had shown metformin was the most common drug 68 %, followed by SU (25.6 %).¹⁶ Study by Ashutosh K et al. had shown that metformin was the most commonly prescribed drug (84 %), followed by sulfonylureas (glimepiride) (41 %) and DPP4 inhibitors [teneligliptin (20 %) and vildagliptin (18 %)]. Results of these studies are confirmatory with our study.¹⁷

Fixed dose combinations (FDCs) were more commonly used than monotherapy. Polypharmacy is a frequent problem in patients with type 2 diabetes mellitus patients having other comorbidities also. Fixed dose combinations have various advantages such as better patient compliance and economical while minimizing pill burden. There are disadvantages also like they discourage adjustment of doses according to patient's need. Numerous irrational fixed drug combinations are prescribed in India. The most important concern with irrational FDCs is that they expose patients to unnecessary risk of adverse drug reactions.^{18,19,20,21}

FDCs prescribed in our study were 133 (67 %) among total prescriptions. FDCs prescribed were either two drug combinations (95 %) or three drug combinations (4.5 %). Two drug combination included metformin + teneligliptin (40.6 %), metformin + glimepiride (38.3 %), metformin + vildagliptin (6.7 %), metformin + sitagliptin (6.7 %) and metformin + gliclazide (0.75 %). Three drug combination: glimepiride + metformin + pioglitazone 2 (1.5 %) and metformin + glimepiride + voglibose 4 (3 %). In this study, metformin + teneligliptin was the most common followed by metformin + glimepiride. In a study conducted by Venkateshwara Murthy N et al., metformin + glimepiride (6.85 %) was the most commonly prescribed regimen followed by metformin + glibenclamide (4.57 %).²²

Out of all these combination glimepiride + metformin + pioglitazone and metformin + gliclazide have been banned according to the list given by Ministry of Health and Family Welfare.²³ Pioglitazone use had been decreased mainly due to the risk of bladder carcinoma but few studies conducted in India showed no direct correlation between use of pioglitazone and bladder carcinoma.^{24,25,26} DeFronzo RA et al. conducted a study that concluded that pioglitazone can be a safer alternative in type 2 diabetes mellitus patients with cardiovascular disease as it helps to preserve beta cell function, also helps in treating metabolic syndrome and adverse effects can be avoided if used with caution. As per recent guidelines, pioglitazone can be used as an add therapy to first line drugs.²⁷ Comorbidity can increase the health care utilization and can increase pill burden and thus can increase the medical care costs for the patients. Hypertension was the commonest comorbidity in this study. Studies conducted by Venkateshwara Murthy N et al. and Agarwal R et al. showed similar results.^{18,22}

CONCLUSIONS

Our study concluded that there was a rational use of medications as the prescribing pattern was observed largely in compliance with Indian Council for Medical Research (ICMR) guidelines. Metformin was the most preferred antidiabetic drug across all the groups of diabetes. DPP4i seems to be fast catching up with sulfonylureas as second-line treatment after metformin. In sulfonylureas, glimepiride was the most commonly prescribed drug and in DPP4i teneligliptin was commonly used. With increase in the duration of diabetes, more patients need insulin for their glycaemic control. Metformin with glimepiride has been a widely used drug combination. There is need for promotion of generic prescribing to make the treatment more cost effective and rational.

Limitations

This is a short-term research study. The small sample size restricts the generalization of findings; therefore, similar studies should be conducted in larger sample to substantiate the finding. Further, we have not included indoor patients and we have not done prescription follow up.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.
 Financial or other competing interests: None.
 Disclosure forms provided by the authors are available with the full text of this article at jebmh.com.

REFERENCES

- [1] www.who.int/health-topics/diabetes. Last accessed on 5th April 2020.
- [2] ICMR Guidelines for Management of Type 2 Diabetes 2018. Last accessed on 15th Jan 2020.
- [3] Satpathy SV, Datta S, Upreti B. Utilization study of anti-diabetic agents in a teaching hospital of Sikkim and adherence to current standard treatment guidelines. *J Pharm Bioallied Sci* 2016;8(3):223-228.
- [4] Yusefzadeh G, Sepehri G, Goodarzi H, et al. Prescription pattern study in type 2 diabetes mellitus in diabetic out patients in private clinics in Kerman, Iran. *British Journal of Drugs & Medical Research* 2014;4(32):5144-5153.
- [5] Mahmood M, Reddy RC, Lahari SJR, et al. Prescription pattern analysis of anti-diabetic drugs in diabetes mellitus and associated comorbidities *Clin Invest* 2018;8(1).
- [6] Joshi DB, Lakhani JD, Siddhpuria RY, et al. A study on drug utilization pattern of metformin and its different formulations used in patients with type-2 diabetes mellitus in tertiary care teaching hospital. *J Integr Health Sci* 2018;6(1):22-26.
- [7] Upadhyay DK, Palaian S, Ravi Shankar P, et al. Prescribing pattern in diabetic outpatients in a tertiary care teaching hospital in Nepal. *J Clin Diagn Res* 2007;1(4):248-255.
- [8] Kannan, Arshad, Kumar S. A study on drug utilization of oral hypoglycemic agents in type-2 diabetic patients. *Asian J Pharm Clin Res* 2011;4(4):60-64.
- [9] Pankaj CK, Satendra SP, Dhananjay P, et al. A prospective study on drug utilization pattern of anti-diabetic drugs in a tertiary care teaching hospital of eastern Uttar Pradesh, India. *Int J Res in Med Sci* 2019;7(3):669-675.
- [10] American Diabetes Association. Pharmacological approaches to glycaemic treatment: Standards of Medical Care in Diabetes - 2018. *Diabetes Care* 2018;41(Suppl 1):S73-85.
- [11] Kundu PK, Moses A, Chawla R, et al. Extrapancreatic benefits and pleiotropic effects of glimepiride: value-added effects for therapeutic preference in type 2 Diabetes Mellitus. *J Association of Physicians of India* 2019;67(12):20-21.
- [12] Sesti G, Avogaro A, Belcastro S, et al. Ten years of experience with DPP-4 inhibitors for the treatment of type 2 diabetes mellitus. *Acta Diabetol* 2019;56(6):605-617.
- [13] Makrilakis K. The role of DPP-4 Inhibitors in the treatment algorithm of type 2 Diabetes Mellitus: when to select, what to expect? *Int J Environ Res Public Health* 2019;16(15):2720.
- [14] Singla R, Bindra J, Singla A, et al. Drug prescription patterns and cost analysis of diabetes therapy in India: audit of an endocrine practice. *Indian J Endocr Metab* 2019;23(1):40-45.
- [15] Patel B, Oza B, Patel KP, et al. Pattern of anti-diabetic drugs use in type-2 diabetic patients in a drugs outpatient clinic of a tertiary care teaching hospital. *Int J Basic Clin Pharmacol* 2013;2(4):485.
- [16] Mata-Cases M, Franch-Nadal J, Real J, et al. Glycaemic control and anti-diabetic treatment trends in primary care centres in patients with type 2 diabetes mellitus during 2007-2013 in Catalonia: a population-based study. *BMJ Open* 2016;6(10):e012463.
- [17] Ashutosh K, Ipseeta RM, Sandeep R. Assessment of prescription pattern of anti-diabetic drugs in the outpatient department of a tertiary care hospital. *Int J Clin Endocrinol Metab* 2017;3(1):1-7.
- [18] Agrawal R, Rath B, Saha K, et al. Drug utilization pattern of antidiabetic agents in a tertiary care hospital of western Odisha, India. *Int J Basic Clin Pharmacol* 2016;5(5):2222-2226.
- [19] WHO Expert Committee on Specifications for Pharmaceutical Preparations: thirty-ninth report. (WHO technical report series: 929), 2005.
- [20] Manjunatha CH, Rohith V, Maheshwari R, et al. Prescription pattern of fixed dose drug combinations in obstetrics and gynecology department of a tertiary care hospital in Puducherry, India: an observational study. *Int J Basic Clin Pharmacol* 2018;7(11):1-4.
- [21] Arya DS, Chowdhury S, Chawla R, et al. Clinical benefits of fixed dose combinations translated to improved patient compliance. *J Assoc Physicians India* 2019;67(12):58-64.
- [22] Venkateswaramurthy N, Md. Shajeem S, Sambathkumar R. Prescribing pattern of anti-diabetic drugs in type-2 diabetic patients. *Int J Pharm Sci Res* 2016;7(11):4550-4555.
- [23] [www.cdsco.nic.in>banneddrug](http://www.cdsco.nic.in/banneddrug). Last accessed on 15th Jan 2020.
- [24] Shukla R, Kalra S. Pioglitazone: Indian perspective. *Indian J Endocr Metab* 2011;15(4):294-297.
- [25] Balaji V. Efficacy and safety of pioglitazone in type 2 diabetes in the Indian patients: results of an observational study. *Indian J Endocrinol Metab* 2013;17(4):709-715.
- [26] Gupta S, Gupta K, Ravi R, et al. Pioglitazone and the risk of bladder cancer: an Indian retrospective cohort study. *Indian J Endocrinol Metab* 2015;19(5):639-643.
- [27] DeFronzo RA, Inzucchi S, Abdul-Ghani M, et al. Pioglitazone: the forgotten, cost-effective cardioprotective drug for type 2 diabetes. *Diab Vasc Dis Res* 2019;16(2):133-143.