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Review Article

Navigating Diabetes Mellitus: Advancing Forward

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Diabetes Mellitus (DM) is a group of metabolic diseases characterized by an elevated blood glucose level – resulting from defects in insulin secretion, in insulin action or both. Diabetes Mellitus is not a pathogenic entity but a group of etiologically different metabolic defects that share the phenotype of hyperglycemia. Several distinct types of DM exist and are caused by complex interaction of genetic factors and life style choices. The metabolic dysregulation associated with DM causes secondary pathophysiologic changes in multiple organ systems that impose a tremendous burden on the individual with diabetes and on the health care system. Intensive diabetes management has set the goal of improvement of glycemic control, which reduces complications associated with the diseases. A strict control of blood glucose levels (Ideally HbA1c< 7% mean plasma glucose level, < 150 mg/dl) delays the onset and progression of diabetic neuropathy, nephropathy, retinopathy, and reduction in cardiovascular risk. Sulfonylureas (Glebenclemide, Gliclazide, Glemiperide, and tolbutamide), Biguandies (Metformin, Phenformin) are effectively used in controlling elevated blood glucose levels in oral antidiabetic therapy. . Sitagliptin is a once-daily, orally active, potent and highly selective dipeptidyl peptidase-4 (DPP-4) inhibitor approved in many countries for the treatment of patients with type- 2 diabetes. Sitagliptin was the first DPP-4 inhibitor that was approved for the management of type 2 diabetes in 2007. Sitagliptin is being used as monotherapy (100 or 200 mg OD) or as an add-on to ongoing oral antidiabetic agents (OAD) in patients with type 2 diabetes with significant reduction in glycaemic levels within a few weeks. In this review, we will briefly study the different therapeutic options available for the management of Diabetes Mellitus.

Keywords: Diabetes mellitus, Insulin, Sulfonylureas, Biguanides, Sitagliptin.

Introduction

Diabetes Mellitus (DM) comprises a cluster of metabolic disorders characterized by elevated blood glucose levels, stemming from deficiencies in insulin secretion, insulin action, or a combination of both [1-5]. Rather than constituting a singular pathogenic entity, DM encompasses various etiological metabolic defects that share the common feature of hyperglycemia. Different types of DM arise from complex interactions involving genetic factors and lifestyle choices, contributing to hyperglycemia through reduced insulin secretion, decreased glucose utilization, and increased glucose production [5-10].The metabolic dysregulation associated with DM leads to secondary pathophysiological changes across multiple organ systems, placing a significant burden on individuals with diabetes and on healthcare systems. In the United States, DM stands as the primary cause of end-stage renal disease, non-traumatic lower extremity amputations, and adult blindness. With a rising global incidence, DM is projected to remain a leading cause of morbidity and mortality in the foreseeable future [10-15]. Approximately 20% of the current global diabetic population resides in the South-East Asian region, and it is anticipated that the number of individuals with diabetes in this region will triple by 2025, escalating from an estimated 30 million

to 80 million. Consequently, South-East Asian countries are expected to face substantial challenges and bear the maximum global burden of the disease in the initial decades of the 21st century [15-20]. An examination of age-specific prevalence rates consistently reveals an increase in diabetes prevalence with advancing age. In the South-East Asian region, the proportion of individuals aged 30 years and above rose from 37.2% in 1995 to 41.9% in 2005, corresponding to an increase in the proportion of diabetics in older age groups. Unfavorable modifications in lifestyle and dietary habits associated with urbanization are considered pivotal factors in diabetes development. Diabetes prevalence is approximately twice as high in urban areas compared to rural populations. The percentage of diabetic cases residing in urban areas is projected to increase from 5.4% in 1995 to 7.3% by 2025. Recent population-based surveys in Bangladesh, India, and Indonesia indicate a considerable rise in the prevalence of the disease in both urban and rural populations compared to earlier results [20-25].

Classification of Diabetes Mellitus:

Diabetes Mellitus is categorized based on the underlying pathogenic processes that result in hyperglycemia, with the two primary classifications being Type 1 and Type 2 DM [25].

Type 1 diabetes: Predominantly occurring in childhood, Type 1 diabetes constitutes approximately 10 to 20% of diagnosed diabetes cases. This form of diabetes is characterized by a near-total deficiency of insulin due to the destruction of pancreatic beta cells. The causes of beta cell destruction may involve autoimmunity, viral infections, or drug-related factors [26-29].

Type 2 diabetes: Representing a heterogeneous group of disorders, Type 2 diabetes involves varying degrees of insulin resistance, impaired insulin secretion, and heightened glucose production. Common phenotypic hyperglycemia in Type 2 DM arises from distinct genetic and metabolic defects affecting insulin action and/or secretion. The onset of Type 2 DM is often preceded by a phase of abnormal glucose homeostasis categorized as impaired fasting glucose (IFG) or impaired glucose tolerance (IGT) [30-35].

Other types of diabetes mellitus:

1. **Gestational Diabetes Mellitus:** This form manifests as glucose intolerance during pregnancy. Insulin resistance linked to the metabolic changes in late pregnancy increases insulin requirements and may result in impaired glucose tolerance.
2. **Maturity Onset Diabetes of the Young (MODY):** MODY is a subtype of DM characterized by autosomal dominant inheritance, an early onset of hyperglycemia, and impairment in insulin secretion [36-40].

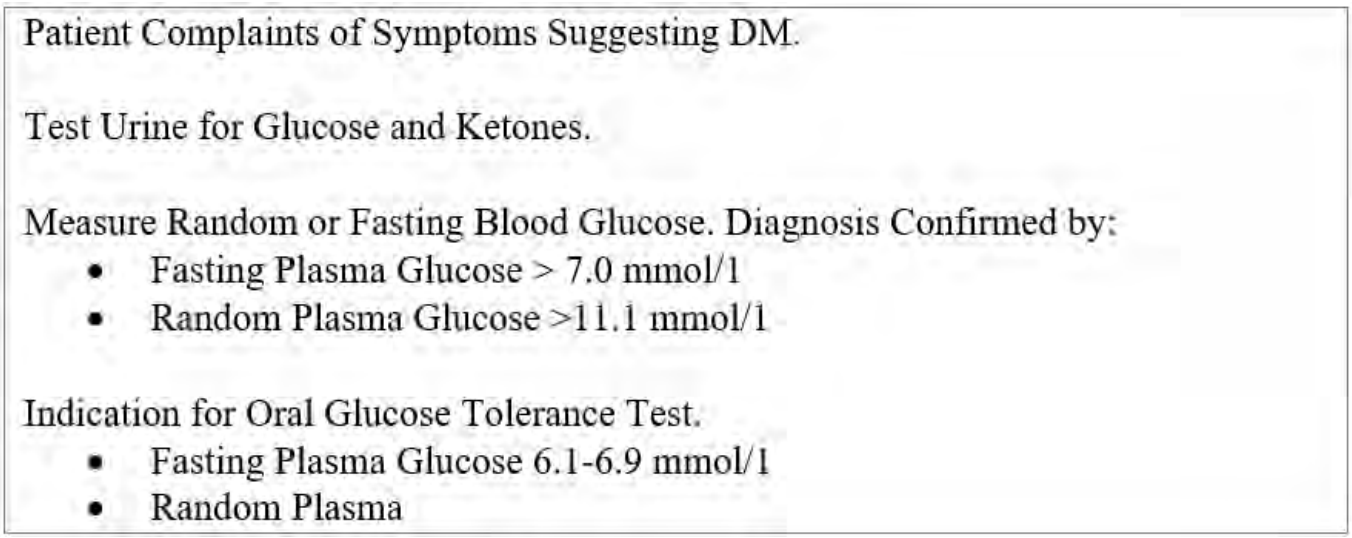

Figure 1. ***Diagnosis of DM [40-45]***

Diabetes	Plasma Glucose	Whole Blood
	Venous (Capillary) (mmol/1)	Glucose Venous (Capillary) (mmol/1)
Fasting	>7.0	>6.1
2 Hours after Glucose Load.	>11.1 (>12.2)	>10.0 (>11.1)
Impaired Glucose Tolerance		
Fasting	<7.0	<6.1
2 Hours after Glucose Load.	7.8-11.0 (8.9-12.1)	6.7-9.9 (7.8-11.0)

Table 1. ***Oral Glucose Tolerance Test: WHO Diagnostic Criteria [46-49]***

Management of Diabetes Mellitus

Once diabetes mellitus (DM) is diagnosed, the treatment objective is to regulate blood glucose levels and prevent complications. Depending on the type of DM, this can involve regular physical exercise, a carefully controlled diet, and medication. Individuals with Type 1 DM typically require insulin injections, often administered two to four times daily, as their bodies do not produce insulin [49-55]. The required insulin amount varies among individuals and can be influenced by factors such as physical activity levels, diet, and the presence of other health conditions. People with Type 1 DM must monitor their glucose levels multiple times a day to maintain control. For those with Type 2 DM, treatment initially involves diet control, exercise, and weight reduction, although over time, these measures may become insufficient. Individuals with Type 2 DM often collaborate with nutritionists to develop a diet plan regulating blood sugar levels, particularly after meals [55-60].

A recommended meal typically contains low fat (30% or less of total calories), moderate protein (10 to 20% of total calories), and a variety of carbohydrates from sources like beans, vegetables, and grains. Regular exercise, even in short durations, aids in glucose absorption by body cells. Diet control and exercise may also contribute to weight reduction, partially mitigating the body's insulin utilization challenges [60-65]. Intensive diabetes management aims to enhance glycemic control, reducing complications associated with the disease. Strict control of blood glucose levels (preferably HbA1c < 7%, mean plasma glucose < 150 mg/dl) delays the onset and progression of diabetic complications like neuropathy, nephropathy, retinopathy, and lowers cardiovascular risk [12]. Various medications, including sulfonylureas (such as Glebenclemide, Gliclazide, Glemiperide, and tolbutamide) and biguanides (like Metformin and Phenformin), effectively control elevated blood glucose levels in oral antidiabetic therapy.

Sulfonylureas stimulate pancreatic beta-cells to produce insulin, enhance cellular glucose uptake, and reduce liver glucose production. They bind to the sulfonylurea receptor on pancreatic B-cells, blocking ATP-sensitive potassium channels, leading to decreased potassium efflux and β cell depolarization. The subsequent opening of voltage-dependent calcium channels causes calmodulin activation, resulting in insulin exocytosis from granules [65-70]. However, sulfonylureas can lead to weight gain and hypoglycemia [76].

Metformin and phenformin, both biguanides, are utilized in oral diabetic therapy. Metformin significantly improves glycemic control and lipid profiles, primarily by inhibiting gluconeogenesis [77-81]. Acarbose effectively controls postprandial blood glucose levels [82-83]. The global burden of diabetes is increasing due to rising incidence and prevalence, particularly of type-2 diabetes, driven by factors like aging populations, obesity, physical inactivity, and increased longevity of patients with diabetes. Type 2 DM management is complex, involving various pharmacological agents. It is a significant risk factor for microvascular and macrovascular complications,

emphasizing the need for glycemic control. Available antidiabetic agents target different mechanisms to improve blood glucose levels, but each has its tolerability and safety concerns. Monotherapy may be insufficient for long-term glycemic control, necessitating combination therapies. Sitagliptin, a dipeptidyl peptidase-4 (DPP-4) inhibitor, is used for type 2 diabetes management, enhancing incretin hormones' gluco-regulatory effects [90-105].

Conclusion

Despite the array of available options, modern medicine has encountered limited success in combating Diabetes Mellitus. While the condition cannot be completely cured, effective management is achievable through the judicious use of available therapeutic interventions. Despite lifelong efforts by investigators and scientists, a definitive cure or eradication medicine remains elusive. The current drugs and medications are capable of controlling the disease, yet a comprehensive cure remains absent. The understanding of the "GENOME" offers a glimmer of hope for prevention, but extensive work remains, especially given its significant hereditary component. Consequently, Diabetes Mellitus stands as a condition that necessitates enduring management. Ongoing advancements in genetic studies, particularly in genome coding, may emerge as potential solutions in the future. Otherwise, the upcoming generation may continue to grapple with the persistence of the disease in the community.

References

1. Blair M. Diabetes Mellitus Review. Urol Nurs. 2016 Jan-Feb; 36(1):27-36.
2. Lihite RJ, Lahkar M, Das S, Hazarika D, Kotni M, Maqbool M, Phukan S. A study on adverse drug reactions in a tertiary care hospital of Northeast India. Alexandria journal of medicine. 2017 Jul 11;53(2):151-6.
3. Ribeiro C, de Alencar Mota CS, Voltarelli FA, de Araújo MB, Botezelli JD, et al. Effects of Moderate Intensity Physical Training in Neonatal Alloxan- Administered Rats. J Diabetes Metab. 2010; 1:107.
4. Zehravi M, Maqbool M, Ara I. Polycystic ovary syndrome and infertility: an update. International journal of adolescent medicine and health. 2021 Jul 22;34(2):1-9.
5. da Silva SB, Costa JP, Pintado ME, Ferreira DC, Sarmento B. Antioxidants in the Prevention and Treatment of Diabetic Retinopathy – A Review. J Diabetes Metab. 2010; 1:111.
6. Zehravi M, Maqbool M, Ara I. Correlation between obesity, gestational diabetes mellitus, and pregnancy outcomes: an overview. International Journal of Adolescent Medicine and Health. 2021 Jun 18;33(6):339-45.
7. American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care. 2014;37 Suppl 1:S81–S90.
8. Maqbool M, Bekele F, Fekadu G. Treatment strategies against triple-negative breast cancer: an updated review. Breast Cancer: Targets and Therapy. 2022 Jan 11:15-24.
9. Craig ME, Hattersley A, Donaghue KC. Definition, epidemiology and classification of diabetes in children and adolescents. Pediatr Diabetes. 2009;10 Suppl 12:3–12.
10. Rasool S, Maqbool M. An overview about Hedychium spicatum: a review. Journal of Drug Delivery and Therapeutics. 2019 Feb 15;9(1-s):476-80.
11. Galtier F. Definition, epidemiology, risk factors. Diabetes Metab. 2010;36:628–651.
12. Zehravi M, Maqbool M, Ara I. Depression and anxiety in women with polycystic ovarian syndrome: a literature survey. International Journal of Adolescent Medicine and Health. 2021 Aug 23;33(6):367-73.
13. M.N. Piero, G.M. Nzaro, J.M. Njagi. Diabetes mellitus – a devastating metabolic disorder. Asian Journal of Biomedical and Pharmaceutical Sciences; 04 (40); 2014 ,1-7.
14. Maqbool M, Gani I, Dar MA. Anti-diabetic effects of some medicinal plants in experimental animals: a review. Asian Journal of Pharmaceutical Research and Development. 2019 Feb 15;7(1):66-9.
15. Deshmukh, C.D. and Jain, A. Int. J. Pure App. Biosci. 3 (3): 224-230 (2015)

16. Zehravi M, Maqbool M, Ara I. Polycystic ovary syndrome and reproductive health of women: a curious association. International journal of adolescent medicine and health. 2021 Apr 21;33(6):333-7.
17. Pittas AG (2009) Diabetes Mellitus, Diagnosis and Pathophysiology. Tufts University; 2005-2009.
18. Mohd M, Maqbool M, Dar MA, Mushtaq I. Polycystic ovary syndrome, a modern epidemic: an overview. Journal of Drug Delivery and Therapeutics. 2019 May 15;9(3):641-4.
19. Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Diabetes Care. 1997; 20: 1183-97.
20. Maqbool M, Fekadu G, Jiang X, Bekele F, Tolossa T, Turi E, Fetensa G, Fanta K. An up to date on clinical prospects and management of osteoarthritis. Annals of Medicine and Surgery. 2021 Dec 1;72:103077.
21. World Health Organization Definition and diagnosis of diabetes mellitus and intermediate hyperglycemia : Report of a WHO/IDF consultation. Geneva: WHO; 2006.
22. Majeed A, Bashir R, Farooq S, Maqbool M. Preparation, characterization and applications of nanoemulsions: An insight. Journal of Drug Delivery and Therapeutics. 2019 Mar 15;9(2):520-7.
23. American Diabetes Association. Position Statement. Diagnosis and classification of diabetes mellitus. Diabetes Care. 2009; 32: S62-S67.
24. Zehravi M, Maqbool M, Ara I. Healthy lifestyle and dietary approaches to treating polycystic ovary syndrome: a review. Open Health. 2022 May 2;3(1):60-5.
25. Kumar PJ, Clark M (2002) Textbook of Clinical Medicine. Pub: Saunders, London, UK. 1099-1121.
26. Maqbool R, Maqbool M, Zehravi M, Ara I. Menstrual distress in females of reproductive age: a literature review. International journal of adolescent medicine and health. 2021 Jul 22;34(2):11-7.
27. Baynes HW (2015) Classification, Pathophysiology, Diagnosis and Management of Diabetes Mellitus. J Diabetes Metab 6: 541.
28. Malik JA, Maqbool M. COVID-19: An overview of current scenario. □□□. 2020 Aug;10(3):17-24.
29. International Diabetes Federation. IDF Diabetes Atlas. 6th ed. Brussels, Belgium: International Diabetes Federation; 2013.
30. Maqbool M, Rasool S, Dar MA, Bashir R, Khan M. Hepatotoxicity and Hepatoprotective agents: A Mini review. PharmaTutor. 2019 Sep 1;7(9):34-40.
31. Akram T Kharroubi and Hisham M Darwish Diabetes mellitus: The epidemic of the century World J Diabetes. 2015 Jun 25; 6(6): 850–867.
32. Ara I, Maqbool M, Fekadu G, Hajam TA, Dar MA. Pharmaceutical significance of Nigella sativa L., a wonder herb. Journal of Applied Pharmaceutical Sciences and Research. 2020;3(4):04-13.
33. Bastaki, S., Review Diabetes mellitus and its treatment, Int J Diabetes & Metabolism, 13: 111-134 (2005)
34. Maqbool M, Nasir N, Mustafa S. Polycystic in ovarian syndrome and its various treatment strategies. INDO AMERICAN JOURNAL OF PHARMACEUTICAL SCIENCES. 2018 Sep 1;5(9):8470-8.
35. Harris MI. Epidemiological correlates of NIDDM in Hispanics, whites, and blacks in the U.S. population. Diabetes care. 1991;14(7):639.
36. Maqbool M, Zehravi M, Maqbool R, Ara I. Study of adverse drug reactions in pulmonary medicine department of a Tertiary care hospital, Srinagar, Jammu & Kashmir, India. CELLMED. 2021;11(2):8-1.
37. Pories WJ, Swanson MS, MacDonald KG. Who would have thought it? An operation proves to be the most effective therapy for adult-onset diabetes mellitus. Annals of Surgery. Sep 1995;222(3):339-352.
38. Ara I, Maqbool M, Bukhari B, Ara N, Hajam TA. Present status, standardization and safety issues with herbal drugs. International Journal of Research in Pharmaceutical Sciences and Technology. 2020 May 18;1(3):95-101.

39. Sjostrom L, Lindroos AK, Peltonen M, et al. Lifestyle, Diabetes, and Cardiovascular Risk Factors 10 Years after Bariatric Surgery. New England Journal of Medicine. 2004;351(26):2683-2693.
40. Maqbool M, Fekadu G, Dugassa D, Bekele F, Turi E, Simegnew D. The pattern of substance abuse in the psychiatry department of a tertiary care of Srinagar hospital, Jammu and Kashmir, India. Archives of Neuroscience. 2020 Oct 31;7(4).
41. Nathan DM, Buse JB, Davidson MB, et al. Management of hyperglycaemia in type 2 diabetes: a consensus algorithm for the initiation and adjustment of therapy. A consensus statement from the American Diabetes Association and the European Association for the Study of Diabetes. Diabetologia. Aug 2006;49(8):1711-1721.
42. Maqbool M, Dar AM, Rasool S, Khan M. Curious case of drug resistant malaria and artemisinin compounds in the modern era. Journal of Applied Pharmaceutical Sciences and Research. 2019 Jul 8:1-4.
43. Impact of Intensive Lifestyle and Metformin Therapy on Cardiovascular Disease Risk Factors in the Diabetes Prevention Program. Diabetes Care. April 1, 2005 2005;28(4):888-894.
44. Ara I, Maqbool M, Gani I. Reproductive Health of Women: implications and attributes. International Journal of Current Research in Physiology and Pharmacology. 2022 Nov 28:8-18.
45. Hadden DR, Montgomery DAD, Skelly RJ, et al. Maturity Onset Diabetes Mellitus: Response To Intensive Dietary Management. The British Medical Journal. 08/021975;3(5978):276-278.
46. Zehravi M, Maqbool R, Maqbool M, Ara I. To Identify Patterns of Drug Usage among Patients Who Seek Care in Psychiatry Outpatient Department of a Tertiary Care Hospital in Srinagar, Jammu and Kashmir, India. Journal of Pharmaceutical Research International. 2021 Jun 10;33(31A):135-40.
47. Krentz AJ, Bailey CJ. Oral antidiabetic agents: current role in type 2 diabetes mellitus.Drugs. 2005;65(3):385-411.
48. Fekadu G, Bekele F, Bekele K, Hanbisa S, Belay G, Maqbool M. Drug use evaluation of beta-blockers in medical wards of Nedjo general hospital, Western Ethiopia. Cardiovascular Therapeutics. 2020 Jun 1;2020.
49. Bailey CJ, Turner RC. Metformin. New England Journal of Medicine. 1996;334:574-579.
50. Maqbool M, Javed S, Bajwa AA. Assessment OF pain management IN postoperative cases using different scales and questionnaires. INDO AMERICAN JOURNAL OF PHARMACEUTICAL SCIENCES. 2019 Jan 1;6(1):983-7.
51. Foye WO, Lemke TL, Williams DA. Foye's Principles of Medicinal Chemistry. Sixth ed:Wolters Kluwer; 2008.
52. Ara I, Maqbool M, Zehravi M. Psychic consequences of infertility on couples: A short commentary. Open Health. 2022 Jan 1;3(1):114-9.
53. Souhami RL, Moxham J. Textbook of medicine. Third ed. London: Churchill Liingstone; 1997.
54. Maqbool M, Dugassa D, Fekadu G. Adverse drug reactions of antiepileptic drugs in the neurology department of a tertiary care hospital, Srinagar, Jammu & Kashmir, India. Archives of Neuroscience. 2021 Apr 30;8(2).
55. Lalau JD. Lactic acidosis induced by metformin: incidence, management and prevention.Drug Safety. Sep 1 2010;33(9):727-740.
56. Bashir R, Maqbool M, Ara I, Zehravi M. An In sight into Novel Drug Delivery System: In Situ Gels. CELLMED. 2021;11(1):6-1.
57. Zangeneh F, Kudva YC, Basu A. Insulin sensitizers. Mayo Clin Proc. 2003;78:471-479.
58. Zehravi M, Maqbool M, Ara I. Teenage menstrual dysfunction: an overview. International Journal of Adolescent Medicine and Health. 2022 Sep 19;35(1):15-9.
59. Rendell M. The Role of Sulphonylureas in the Management of Type 2 Diabetes Mellitus. Drugs. 2004;64(12):1339-1358.
60. Dar MA, Maqbool M, Rasool S. Pharmaceutical wastes and their disposal practice in routine. Int J Inf Comput Sci. 2019 Apr;6:76-92.
61. Rasool S, Maqbool M, Joshi Y. Drug utilization studies among ENT patients in various

clinical settings: A comprehensive review. Journal of Drug Delivery and Therapeutics. 2019 Feb 15;9(1-s):481-5.
62. Krentz AJ, Bailey CJ, Melander A. Thiazolidinediones for type 2 diabetes. British Medical Journal. 2000;321:252-253.
63. Ara I, Zehravi M, Maqbool M, Gani I. A review of recent developments and future challenges in the implementation of universal health coverage policy framework in some countries. Journal of Pharmaceutical Research & Reports. SRC/JPRSR-131. DOI: doi. org/10.47363/JPRSR/2022 (3). 2022;127.
64. Day C. Thiazolidinediones: a new class of antidiabetic drugs. Diabetic Medicine. 1999;16:1-14. 70.
65. Maqbool M, Dar MA, Rasool S, Gani I, Khan M. Substance use disorder and availability of treatment options: an overview. Journal of research in health science. 2019;1:4-10.
66. Yki-Jarvinen H. Thiazolidinedions. New England Journal of Medicine. 2004;351:1106- 1118.
67. Maqbool M, Shabbir W, Aamir S. Adverse events of blood transfusion and blood safety in clinical practice. Indo American Journal Of Pharmaceutical Sciences. 2018 Aug 1;5(8):8254-9.
68. Nesto RW, Bell D, Bonow RO, et al. Thiazolidinedione use, fluid retention, and congestive heart failure: a consensus statement from the American Heart Association and the American Diabetes Association. Circulation. 2003;108:2941-2948.
69. Maqbool M, Naeem A, Aamer S. Diabetes mellitus and its various management strategies in practice. Indo American Journal of Pharmaceutical Sciences. 2018 Aug 1;5(8):8163-+.
70. Nathan DM BJ, Davidson MB, Ferrannini E, Holman RR, Sherwin R, Zinman B. Medical management of hyperglycemia in type 2 diabetes: a consensus algorithm for the initiation and adjustment of therapy: a consensus statement from the American Diabetes Association and the European Association for the Study of Diabetes. Diabetes Care.2008;31(12):1-11.
71. Maqbool M, Tariq S, Amjad S. Prescribing practices in pediatrics and drug utilization studies promoting pediatric health. Indo American Journal of Pharmaceutical Sciences. 2018 Aug 1;5(8):8070-6.
72. Van de Laar FA, Lucassen PL, Akkermans RP. Alpha-glucosidase inhibitors for type 2 diabetes mellitus. Cochrane Database Syst Rev CD003639. 2005.
73. Maqbool M, Ikram U, Anwar A. Adverse drug reaction monitoring and occurrence in drugs used in pulmonary disorders. Indo American Journal Of Pharmaceutical Sciences. 2018 Aug 1;5(8):8060-5.
74. Kristensen JS, Frandsen KB, Bayer T, Muller PG. Compared with repaglinide, sulfonylurea treatment in type 2 diabetes is associated with a 2.5 fold increase in symptomatic hypoglycemia with blood glucose levels <45 mg/dl. Diabetes 2000; 49 (Suppl 1):A131 (Abstract).
75. Maqbool R, Maqbool M, Zehravi M, Ara I. Acute neurological conditions during pregnancy and their management: a review. International Journal of Adolescent Medicine and Health. 2021 Aug 23;33(6):357-66.
76. Kendall DM, Riddle MC, Rosenstock J, et al. Effects of exenatide (exendin-4) on glycemic control and weight over 30 weeks in patients with type 2 diabetes treated with metformin and a sulfonylurea. Diabetes Care. 2005;28:1083–1091.
77. Maqbool M, Zehravi M, Maqbool R, Ara I. An overview about treatment of gestational diabetes mellitus: A short communication. CELLMED. 2021;11(3):12-.
78. DeFronzo R, Ratner RE, Han J, et al. Effects of exenatide on glycemic control and weight over 30 weeks in metformin-treated patients with type 2 diabetes. Diabetes Care.2005;28:1092–1100.
79. Fekadu G, Gamachu B, Mengie T, Maqbool M. Knowledge, attitude of health care professional's towards clinical pharmacy services in Nedjo General Hospital, Western Ethiopia. International Journal. 2019 Jul;5(7):172.
80. Buse JB, Henry RR, Han J, et al. Exenatide-113 Clinical Study Group (2004) Effects of exenatide on glycemic control over 30 weeks in sulfonylurea-treated patients with type 2 diabetes. Diabetes Care. 2004;27:2628–2635.
81. Maqbool M. Evaluation of drug utilization pattern in the pediatric department of a Tertiary

Care Hospital in Srinagar, Jammu & Kashmir, India. Journal of Applied Pharmaceutical Sciences and Research. 2019:6-9.
82. Scott R, Wu M, Sanchez M, Stein P. Efficacy and tolerability of the dipeptidyl peptidase4 inhibitor sitagliptin as monotherapy over 12 weeks in patients with type 2 diabetes. International Journal of Clinical Practice. 2007;61:171–180.
83. Maqbool M, Gani I. Utilization of statins in reducing comorbidities of diabetes mellitus: A systematic review. Journal of Pharmacy Practice and Community Medicine. 2018;4(4).
84. Raz I, Hanefeld M, Xu L, et al. Efficacy and safety of the dipeptidyl peptidase-4 inhibitor sitagliptin as monotherapy in patients with type 2 diabetes mellitus. Diabetologia.2006;49:2564–2571.
85. Maqbool M, Ara I, Gani I. The Story of Polycystic Ovarian Syndrome: A Challenging Disorder with Numerous Consequences for Females of Reproductive Age. International Journal of Current Research in Physiology and Pharmacology. 2022 Nov 28:19-31.
86. Aschner P, Kipnes MS, Lunceford JK. Effect of the dipeptidyl peptidase-4 inhibitor sitagliptin as monotherapy on glycemic control in patients with type 2 diabetes. Diabetes Care. 2006;29:2632–2637.
87. Maqbool M, Zehravi M. Neuroprotective role of polyphenols in treatment of neurological disorders: A review. Interventional Pain Medicine and Neuromodulation. 2021 Dec 31;1(1).
88. Miller, Onje ELS, Taylor J. DPP-IV inhibitors: A review of sitagliptin, vildagliptin, alogliptin, and saxagliptin. Formulary. April 2008;43(4).
89. Maqbool M, Arshad B, Liaquat S. Psychotropic drug utilisation pattern can be useful in monitoring treatment regimens for mental disorders in psychiatric settings. INDO AMERICAN JOURNAL OF PHARMACEUTICAL SCIENCES. 2018 Aug 1;5(8):7717-21.
90. Schmitz O, Brock B, Rungby J. Amylin agonists: a novel approach in the treatment of diabetes. Diabetes Care. 2004;53 (Suppl 3):S233–S238.
91. Zehravi M, Maqbool M, Ara I. Unfolding the mystery of premenstrual syndrome (PMS): an overview. International Journal of Adolescent Medicine and Health. 2022 Sep 19;35(1):9-13.
92. Hollander PA, Levy P, Fineman MS, et al. Pramlintide as an adjunct to insulin therapy improves long-term glycemic and weight control in patients with type 2 diabetes. Diabetes Care. 2003;26:784–790.
93. Zehravi M, Maqbool M, Ara I. An overview about safety surveillance of adverse drug reactions and pharmacovigilance in India. The Indian Journal of Nutrition and Dietetics. 2021 Jul:408-18.
94. Ryan GJ, Jobe LJ, Martin R. Pramlintide in the treatment of type 1 and type 2 diabetes mellitus. Clinical Therapeutics. 2005;27:1500-1512.
95. Ara I, Kalam MA, Maqbool M, Zehravi M. Phytochemical Standardization and Anti-Anxiety (Izterab-e-Nafsani) study of Aftimoon Hindi (Cuscuta reflexa Roxb.) on An Animal Model. CELLMED. 2021;11(3):14-.
96. Thayer A. Insulin. Chemical Engineering News. Vol 83; 2005:74-75.
97. Maqbool M, Khan M. Hypertension and Pregnancy: an important issue. PharmaTutor. 2019 Aug 1;7(8):71-8.
98. Briscoe VJ, Davis SN. Hypoglycemia in Type 1 and Type 2 Diabetes:Physiology, Pathophysiology, and Management. Clinical Diabetes. 2006;24(3):115-121.
99. Ara I, Maqbool M, Gani I. Neuroprotective Activity of Herbal Medicinal Products: A Review. International Journal of Current Research in Physiology and Pharmacology. 2022 Dec 23:1-0.
100. Zammitt NN, Frier BM. Hypoglycemia in Type 2 Diabetes: Pathophysiology, frequency, and effects of different treatment modalities. Diabetes Care. December 2005;28(12):2948-2961.
101. Dar MA, Maqbool M, Javed S. Assessing Health-Related Quality Of Life (Qol) In Rheumatoid Arthritis. INDO AMERICAN JOURNAL OF PHARMACEUTICAL SCIENCES. 2019 Jan 1;6(1):988-94.
102. Dar MA, Maqbool M, Gani I, Ara I. Menstruation hygiene and related issues in adolescent girls: A brief commentary. International Journal of Current Research in Physiology and Pharmacology. 2023 Feb 11:1-5.
103. Ara I, Maqbool M. The curious case of Neuropathic Pain and its management: an overview.

Open Health. 2022 Oct 17;3(1):145-54.
104. Zehravi M, Maqbool M, Ara I. An Update on Pain Control in Conservative Dentistry and Endodontics: A Review. The Indian Journal of Nutrition and Dietetics. 2022 Jan:114-25.
105. Ara I, Maqbool M, Zehravi M, Gani I. Herbs Boosting Immunity in Covid-19: An Overview. Adv J Chem B. 2020;3(3):289-94.