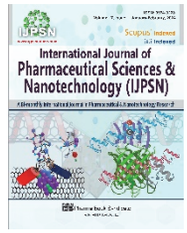
International Journal of
Pharmaceutical Sciences and Nanotechnology (IJPSN)
http://www.ijpsnonline.com



RESEARCH ARTICLE

Pharmacoeconomic Evaluation and Effect of Insulin Glargine and Insulin Detemir in Patients with Type 1 Diabetes Mellitus: A Comparative Analysis

Satish Gunda[1]| Dr. V. Jayashree[2]*

[1]Research Scholar, Vels Institute of Science Technology and Advanced Studies, Pallavaram, Chennai - 600117.

[2]Associate Professor, Department of Pharmacology, School of Pharmaceutical Sciences, VISTAS

***Correspondence author:** Dr. V. Jayashree, Department of Pharmacology, School of Pharmaceutical Sciences, Vel's Institute of Science, Technology and Advances Studies (VISTAS), Pallavaram, Chennai, Tamil Nadu.

Email: mailtovjayashree@gmail.com

How to cite this article: Gunda Satish and Jayashree Dr. V., Pharmacoeconomic Evaluation and Effect of Insulin Glargine and Insulin Detemir in Patients with Type 1 Diabetes Mellitus: A Comparative Analysis, International Journal of Pharmaceutical Sciences and Nanotechnology. 2025, 18(3):8052-8057.

MSID: 6911

https://doi.org/10.37285/ijpsn.2025.18.3.4

ABSTRACT

Background: Type 1 diabetes mellitus (T1DM) is a chronic metabolic disorder with rising global prevalence, imposing significant health and economic burdens. Key treatments for T1DM include long-acting insulin analogs like insulin glargine and insulin detemir. However, comparative pharmacoeconomic analyses of these medications remain limited.

Objectives: This research evaluated the cost-effectiveness, glycemic control, and safety profiles of insulin glargine and insulin detemir in individuals with type 1 diabetes mellitus (T1DM).

Methods: A prospective observational study involving 353 adult patients with T1DM was carried out over 1.5 years at a tertiary care hospital in South India. Data were collected on demographics, glycemic control (HbA1c levels), incidence of hypoglycemia, and treatment costs.Statistical analyses, including descriptive statistics and the incremental cost-effectiveness ratio (ICER), were conducted using SPSS version 24.

Results: Participants had a mean age of 46.1 ± 10.8 years, with 69.97% being male. HbA1c reduction was comparable between treatments (Glargine: -1.64%, Detemir: -1.57%). Severe hypoglycemia rates were similar, with 0.69 and 0.61 episodes per 100 person-years for Glargine and Detemir, respectively. Glargine and Detemir had about the same number of total hypoglycemia cases, with 90.94 episodes for every 100 people each year. However, Insulin glargine demonstrated a notable cost advantage, with an annual treatment cost of INR 18,197.58 compared to INR 26,314.07 for Detemir. ICER of INR 8,116.49 per annum.The reduced cost of Glargine was attributed to lower daily dose requirements and a lower per-unit cost.

Conclusion: Both Insulin glargine and Insulin detemir are effective and safe for managing T1DM. However, Insulin glargine is more cost-effective, making it a preferable option, especially in resource-limited healthcare settings. These findings highlight the importance of integrating clinical outcomes and cost considerations in diabetes management strategies. To assess long-term effects and wider population applications, further study is required.

Keywords:
Pharmacoeconomics, Diabetes Mellitus, Insulin Glargine, Insulin Detemir, Type 1 Diabetes Mellitus (T1DM)

Introduction

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by persistently high blood sugar levels due to impairments in insulin secretion, action, or both. Long-acting insulin analogues, for example, insulin detemir (IDet), and insulin glargine (IGlar) are among the many available therapeutic alternatives that have greatly improved the control of T1DM (Type 1 Diabetes Mellitus). By providing basal glucose management, these insulins lower the chance of hypoglycemia and improve patient adherence and quality of life[1,2]. A pharmacoeconomic evaluation of Insulin glargine and Insulin detemir is crucial to determine their cost-effectiveness and impact on healthcare resources, especially in managing T1DM[3].DM affects over 537 million adults worldwide as of 2021, including an assumed increase to 783 million by 2045[4]. The highest rates are observed in the Middle East and North Africa, though prevalence varies across different regions[5]. Obesity, sedentary lifestyles, and urbanisation are the main causes of the rising incidence of type 2 diabetes (T2DM)[6]. DM is related to numerous comorbidities, for example, nephropathy, cardiovascular disease, neuropathy, and retinopathy. These issues not only shorten life expectancy but also dramatically increase medical expenses[7].

Current DM therapies aim to achieve glycemic control, mitigate complications, and improve quality of life[8]. Pharmacological alternatives include SGLT2 inhibitors, DPP-4 inhibitors, sulfonylureas, insulin, metformin, and GLP-1 receptor agonists. Their effectiveness varies, necessitating individualised treatment plans[9,10]. Novel approaches like tripeptide, a dual agonist of the GLP-1 and GIP receptors, have demonstrated encouraging results in weight loss and glycemic management[11]. Additionally, advances in continuous glucose monitoring and digital health solutions enhance disease management[12].

Treatment goals include:1) Maintaining HbA1c levels below 7%.2) Preventing microvascular and macrovascular complications 3) Improving quality of life. DM management evolves, from lifestyle interventions at diagnosis to advanced pharmacotherapy and combination treatments as the disease progresses[13]. Chronic DM can lead to disability due to complications such as neuropathy, amputations, and visual impairment, significantly affecting patients' daily lives.

Because of both direct medical expenses and indirect costs like lost productivity and early mortality, diabetes mellitus places a significant financial burden on society. In 2021, global DM-related healthcare expenditure reached $966 billion, marking a 316% increase over the past 15 years. Costs vary widely, influenced by treatment regimens and the presence of complications. Systematic Reviews (SR) and Meta-Analyses (MA) provide robust proof of the cost-effectiveness of interventions, highlighting the value of newer therapies in improving outcomes while controlling costs. Despite advancements, newer therapies face limitations, including high costs, limited accessibility, and potential side effects like gastrointestinal discomfort or hypoglycemia[14].

The pharmacoeconomic perspective of DM underscores the importance of balancing clinical efficacy with cost considerations. Though equal access is still a major obstacle, innovative medicines can develop patient outcomes and lessen the financial burden. With its enhanced glycemic control and decreased risk of hypoglycemia, IGlar and insulin detemir are prime examples of long-acting insulin therapy improvements that greatly aid in the overall control of T1DM. The rationale for comparing Insulin glargine (IGlar) and Insulin detemir (IDet) in the context of the South Indian population for their Regional Lifestyle and Dietary Patterns, Prevalence of Diabetes, Cost and Accessibility. This study seeks to assess the pharmacoeconomic aspects of insulin glargine and insulin detemir to identify the more cost-effective option and its impact on healthcare resource utilization in managing Type 1 Diabetes Mellitus (T1DM).

Methodology

A tertiary care hospital in South India served as the study's site. A prospective, observational, pharmacoeconomic research design was adopted to evaluate the research goals. The research was performed over 1.5 years, ensuring comprehensive data collection and analysis. Ethical approval Reg. No: ECR/1049/INST/AP/2018/RR-21, IEC Ref No. IEC/2021/078GM/SAH. A patient-tracking log form, which recorded participant registration while guaranteeing anonymity and compliance with confidentiality guidelines, was used to preserve participant confidentially throughout the study.

A total of 353 population data was collected. The study included participants who met the following inclusion criteria: Adults who signed an informed consent form and were at least eighteen years old were diagnosed with T1DM, had been on human insulin therapy for at least 12 months before providing informed consent, and had at least one documented HbA1C reading in their patient chart within the preceding 12 months. Conversely, patients were excluded if they had T2DM, gestational diabetes, chronic pancreatitis, or latent autoimmune diabetes in adulthood. Patients who were unwilling to participate in the study were excluded.

After completing data collection, statistical analysis was performed using SPSS version 24. All gathered data and endpoint factors were compiled using descriptive statistics. The number of individuals, mean, minimum value, median, SD (standard deviation), along maximum values were all included in the analysis for continuous variables. The ICER, the prime outcome calculation, was computed by analyzing the cost per QALY (quality-adjusted life-year) obtained, considering the incidence of hypoglycemia and HbA1c levels.

Abbreviations: T1DM: Type 1 Diabetes Mellitus; **IDet:** Insulin detemir; **IGlar:** Insulin glargine; **ICER:** Incremental cost-effectiveness ratio; **QALY:** Quality-adjusted life-year

Results

Table 1 presents the sociodemographic characteristics of the study participants (n = 353). The participants' mean age was 46.1 ± 10.8 years, along with the majority being male (69.97%) compared to female (30.03%).

Table 1. Baseline demographics of study participants (n = 353).

Sociodemographics (N=353)		**Number (n)**	**Percentage (%)**
Age (Mean±SD)		46.1±10.8	
Gender			
	Male	247.00	69.97
	Female	106.00	30.03
Marital status			
	Married	322.00	91.22
	Separated	2.00	0.57
	Single	16.00	4.53
	Widowed	13.00	3.68
Religion			
	Hindu	272.00	77.05
	Muslim	50.00	14.16
	Christian	31.00	8.78
Education			
	Illiterate	134.00	37.96
	Primary School	63.00	17.85
	Secondary School	36.00	10.20
	High School	76.00	21.53
	Graduate	38.00	10.76
	Post Graduate	6.00	1.70
Area of residence			
	Urban	145.00	41.08
	Rural	208.00	58.92
Total family income			
	<5 Lakhs	206.00	58.36
	5-7.5 Lakhs	66.00	18.70
	7.5-10 Lakhs	60.00	17.00
	>10 Lakhs	21.00	5.95
Duration of diabetes	10.1±5.4		
Years since the initiation of Insulin	10.0±5.5		

Risk factors	Baseline value	Value after treatment	Incremental difference
HbA1C level (%)	7.7±0.6	6.9±0.4	0.8±0.4
Systolic Blood Pressure (mmHg)	132.2±18.6	124.3±9.5	21.5±9.2
Diastolic Blood Pressure (mmHg)	86.0±9.4	81.6±3.8	11.8±5.7
Proportion of smokers (%)	181	51.27	
Proportion of alcoholics (%)	73	20.68	

In terms of marital status, 91.22% of participants were married, while smaller proportions were widowed (3.68%), single (4.53%), or separated (0.57%). Regarding religion, the majority identified as Hindu (77.05%), followed by Muslim (14.16%) and Christian (8.78%).

Educational background varied across the cohort, with 37.96% being illiterate, while others had completed primary school (17.85%), secondary school (10.20%), high school (21.53%), or higher education such as graduation (10.76%) or postgraduation (1.70%).

Participants predominantly resided in rural areas (58.92%) compared to urban areas (41.08%). Family income distribution revealed that 58.36% had a total income of less than 5 lakhs per year, while 18.70% reported incomes between 5-7.5 lakhs, 17.00% between 7.5-10 lakhs, and 5.95% above 10 lakhs annually.

The individuals had been on insulin therapy for an average of 10.0 ± 5.5 years, and diabetes' mean duration was 10.1 ± 5.4 years. These baseline characteristics provide a detailed profile of the study cohort, aiding in interpreting treatment outcomes and ensuring the relevance of the findings to similar populations.

Table 2 highlights the current market prices of various insulin preparations available in India, emphasizing cost variations among different brands and formulations. For example, the long-acting insulin analogue Glargine is available in several forms, such as Optisulin® cartridges, priced at INR 610 per unit, and the originator brand Lantus®, which is significantly more expensive at INR 2136 for a 10 ml vial. Other Lantus® products, such as the SoloStar pen (INR 760 per unit) and OptiClik cartridge (INR 640 per unit), showcase a range of pricing strategies depending on the delivery mechanism and packaging. These variations are crucial for analyzing cost-effectiveness and patient accessibility. Additionally, pharmaco-economic formulas aid in evaluating drug utilization and optimizing healthcare expenditures.

In Table-3 we compared the annual treatment costs of two long-acting insulin analogues, IGlar, as well as IDet in, a group of 353 study participants. The costs are broken down into three categories: insulin, test strips, and lancets.

Table 2. Current prices of different insulin preparations in India.

Current prices of different insulin preparations in India		Per unit cost (INR)
Detemir,long-acting insulin analogue (originator)	Levemir® 100iμ/ml, disposable Flexpen (5×3ml)	1450.00
Glargine, long-acting insulin analogue (originator)	Lantus® 100iμ/ml, vial (1×10ml)	2136.00
	Lantus for OptiClik 100 unit/ml Solution 3ml Cartridge	640.00
	Lantus SoloStar 100unit/ml Solution 1 Box = Five 3ml Syringes	760.00
Glargine, a long-acting insulin analogue	Optisulin® 100iμ/ml cartridges (5×3ml); pens	610.00

Table 3. Annual Cost Comparison of Insulin Detemir and Insulin Glargine.

Category	Insulin Detemir (₹)	Insulin Glargine (₹)	Difference (₹)	Difference (%)
Insulin	21,385.07	13,621.58	7,763.49	36.32%
Test Strips*	3,792	3,520	272	7.17%
Lancets**	1,137	1,056	81	7.12%
Total	26,314.07	18,197.58	8,116.49	30.84%

The annual expenditure on insulin is significantly higher for IDet (INR 21,385.07) compared to IGlar (INR 13,621.58), resulting in a cost difference of INR 7,763.49. Similarly, the cost of test strips is slightly higher for IDet (INR 3,792) than IGlar (INR 3,520), with a difference of INR 272. The expense for lancets also shows a marginal difference of INR 81, with IDet costing INR 1,137 and IGlar INR 1,056.

Overall, the total annual cost of treatment is INR 26,314.07 for IDet and INR 18,197.58 for Insulin glargine, showing a substantial ICER of INR 8,116.49. These findings underscore the economic advantage of IGlar over insulin Detemir in this cohort.

Discussion

The comparative analyses in Tables 4aa and 5b shed light on the treatment efficacy, adverse events, and cost-effectiveness of IDet and IGlar, two widely used long-acting insulin analogues. These findings are instrumental in guiding clinical decision-making and optimizing diabetes management strategies.

Efficacy Comparison

The data in Table 4a reveal a comparable reduction in HbA1c levels for both insulins. At six months, Glargine demonstrated a mean HbA1c reduction of -1.64% (95% CI: -3.70 to -0.42), while Detemir displayed a slightly lower reduction of -1.57% (95 per cent CI: -1.40 to -1.74). The weighted mean difference of 0.07% (95% CI: -0.10 to 0.24) indicates a negligible clinical difference in glycemic control between the two treatments. These results align with previous meta-analyses, which suggest comparable efficacy of glargine and detemir in achieving target HbA1c levels[15,16].

Safety and Hypoglycemia Rates

Table 4a shows comparable rates of severe hypoglycemia between Glargine and Detemir, with Glargine experiencing 0.69 episodes per 100 person-years and Detemir slightly lower at 0.61 episodes. Glargine and Detemir showed comparable rates of overall hypoglycemic events, with both recording 90.94 episodes per 100 person-years and a rate ratio of 1.00 (95% CI: 0.90–1.11). This parity in hypoglycemia rates aligns with findings from the TITAN and Cochrane reviews, emphasizing that both insulins are generally safe for clinical use[17,18].

Table 4b provides additional detail on the breakdown of hypoglycemic events. While Glargine was associated with a higher percentage of mild hypoglycemia (26.19% vs. 16.76%), Detemir exhibited a greater incidence of moderate hypoglycemia (16.22% vs. 5.95%). Severe hypoglycemia rates were comparable, differing by only 0.32%. These differences may reflect variations in pharmacokinetics and dosing regimens, which should be considered in clinical practice[19].

Table 4a. Comparative Analyses of Treatment efficacy and adverse events.

Description of efficacy and adverse event	Insulin	Mean (95% CI)	Reference
HbA1C reduction at 6 months (%)	Glargine	-1.64 (-3.70 - 0.42)	TITAN
			CADTH
	Detemir	-1.57 (-1.40- -1.74)	Calculation[a]
Weighted Mean difference in HbA 1C reduction (%)		0.07 (-0.10- 0.24)	Cochrane
Rate of severe hypoglycaemia (times / 100 persons – year)	Glargine	0.69 (0.43-1.13)	TITAN
	Detemir	0.61 (0.41-0.90)	Calculation[b]
The rate ratio of severe hypoglycaemia (IDet v/s IGlar)		0.88 (0.59, 1.30)	Cochrane
Rate of hypoglycaemia (times / 100 persons – year)	Glargine	90.94 (65.73-116.15)	TITAN
	Detemir	90.94 (81.85-100.94)	Calculation[c]
Rate ratio of hypoglycaemia (IDet v/s IGlar)	Detemir	1.00 (0.90, 1.11)	Cochrane

Table 4b. Comparative Analyses of Treatment efficacy and cost-effectiveness.

Description	Detemir (Mean±SD)	Glargine (Mean±SD)	Incremental difference
Baseline HbA1C (%)	7.74 ± 0.56	7.68 ± 0.56	
HbA1C (%) value after treatment	6.88 ± 0.42	6.89 ± 0.41	
Incremental difference of HbA1C (%)	0.86 ± 0.46	0.79 ± 0.42	
Percentage of hypoglycaemc events (Mild) (%)	16.76	26.19	-9.43
Percentage of hypoglycaemc events (Moderate) (%)	16.22	5.95	10.26
Percentage of hypoglycaemc events (Severe) (%)	8.65	8.33	0.32
Average dose of drug consumed per month (in mL)	12.29 ± 4.65	5.31 ± 1.86	
Insulin per day cost (INR)	59.4 ± 22.45	37.84 ± 13.26	
Insulin per month cost (INR)	1782.09 ± 673.61	1135.13 ± 397.94	
Insulin annual cost (INR)	21385.07 ± 8083.29	13621.58 ± 4775.58	
Total Annual Costs	26314.07	18197.58	8116.49

Cost-Effectiveness

Table 4b underscores the significant cost advantage of Glargine over Detemir. While the baseline HbA1c levels and post-treatment values were nearly identical for both insulins, the average monthly and annual costs were markedly higher for Detemir (INR 21,385.07±8,083.29 vs. INR 13,621.58±4,775.58). The incremental cost difference of INR 8,116.49 annually Favors Glargine, particularly for resource-limited settings. This cost disparity can be attributed to differences in average daily consumption (12.29±4.65 mL for Detemir vs. 5.31±1.86 mL for Glargine), highlighting the greater dose efficiency of Glargine.

Additionally, Glargine's lower daily insulin cost (INR 37.84±13.26 vs. INR 59.4±22.45 for Detemir) reinforces its cost-effectiveness. These findings align with earlier studies demonstrating that Glargine offers comparable glycemic control at a lower cost, improving affordability and accessibility for patients with diabetes.

Clinical and Policy Implications

The comparative analysis offers key insights for policymakers and clinicians, underscoring the need to balance clinical efficacy with economic considerations in diabetes management. Given the cost-effectiveness of Glargine, healthcare systems in developing countries could integrate it into national diabetes management programs to improve accessibility and adherence.

These findings can also inform clinical practice guidelines by encouraging personalized treatment approaches that factor in both clinical efficacy and economic feasibility. Additionally, patient-specific considerations such as dosing preferences, tolerability, and lifestyle should guide insulin selection. The slightly lower rates of moderate hypoglycemia with Glargine may benefit patients at higher risk, while Detemir's pharmacokinetic profile might be preferable in specific clinical scenarios.

Clinical Implications and Recommendations

The comparative analysis highlights important considerations for selecting insulin analogues. Both Glargine and Detemir achieve similar glycemic control with comparable safety profiles, but Glargine's cost-effectiveness provides a significant advantage. Glargine is a more sustainable option for managing diabetes for healthcare systems and policymakers in low socioeconomic countries.

However, patient-specific factors such as dosing preferences, tolerability, and lifestyle should also guide insulin selection. The slightly lower rates of moderate hypoglycemia with Glargine may benefit patients at higher risk of such events, while Detemir's pharmacokinetic profile may be preferable in specific clinical scenarios.

Conclusion

This comparative analysis indicates that both IGlar and IDet are effective and safe for managing blood sugar levels. However, Glargine's lower cost makes it a more viable option for patients and healthcare systems, particularly in settings where financial constraints play a crucial role. These findings emphasize the importance of considering clinical effectiveness, safety, and cost-efficiency when making treatment decisions for diabetes care.

Further studies should investigate long-term outcomes in real-world settings, focusing on patient adherence and overall quality of life. Additionally, tailoring treatment plans based on individual factors such as coexisting conditions, lifestyle, and insulin resistance could support more personalized and effective diabetes management.

Acknowledgement

The authors express their gratitude to every research participant for their willing involvement and for contributing vital data. The authors would like to express their appreciation for the helpful assistance provided by the management and staff of the pharmacy departments at Vikas College of Pharmaceutical Sciences (VCPS), Suryapet, Telangana, and Vel's Institute of Science, Technology, and Advances Studies (VISTAS), Pallavaram, Chennai, Tamil Nadu.

Financial support and sponsorship

No funds, grants, or other support were received. The authors have no relevant financial or non-financial interests to disclose.

Conflict of Interest

All authors declared no conflict of interest.

References

1. Rosenstock J, Nino A, Soffer J, Erskine L, Acusta A, Dole J, Carr MC, Mallory J, Home P. Impact of a weekly glucagon-like peptide 1 receptor agonist, albiglutide, on glycemic control and on reducing prandial insulin use in type 2 diabetes inadequately controlled on multiple insulin therapy: a randomized trial. Diabetes Care. 2020 Oct 1;43(10):2509-18. https://doi.org/10.2337/dc19-2316
2. Aschner P. Insulin therapy in type 2 diabetes. American journal of therapeutics. 2020 Jan1; 27(1): e7990. *27(1): pe79e90,January/February2020. | DOI: 10.1097/MJT.0000000000001088*
3. Smith KJ, Deschênes SS, Schmitz N. Investigating the longitudinal association between diabetes and anxiety: a systematic review and meta-analysis. Diabetic Medicine. 2018 Jun;35(6):677-93. https://doi.org/10.1111/dme.13606
4. American Diabetes Association. Economic costs of diabetes in the U.S. in 2021. *Diabetes Care.* 2021; 44(4): 917–28. https://doi.org/10.2337/dc21-S001
5. Zhao Q, Peng C. The Global Burden of Disease Attributable to High Fasting Plasma Glucose in 204 Countries and Territories, 1990–2021: A Systematic Analysis of the Global Burden of Disease Study 2021. Cheng, The Global Burden of Disease Attributable to High Fasting Plasma Glucose in.; 204: 1990-2021 https://ssrn.com/abstract=5038431
6. Karter AJ, Warton EM, Lipska KJ, Ralston JD, Moffet HH, Jackson GG, Huang ES, Miller DR. Development and validation of a tool to identify patients with type 2 diabetes at high risk of hypoglycemia-related emergency department or hospital use. JAMA Internal Medicine. 2017Oct1;177(10):1461-70. doi:10.1001/jamainternmed.2017.3844
7. Fowler MJ. Microvascular and macrovascular complications of diabetes. *Clinical Diabetes.* 2008; 26(2): 77–82. http://clinical.diabetesjournals.org.
8. Borner T, De Jonghe BC, Hayes MR. The antiemetic actions of GIP receptor agonism. American Journal of Physiology-Endocrinology and Metabolism. 2024 Apr 1;326(4):E528-36. https://doi.org/10.1152/ajpendo.00330.2023
9. Nathan DM, Buse JB, 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 of the American Diabetes Association and the European Association for the Study of Diabetes. Diabetes care. 2009 Jan 1; 32(1):193-203. https://doi.org/10.2337/dc08-9025
10. American Diabetes Association. Standards of medical care in diabetes—2021. *Diabetes Care.* 2021;44(Suppl 1): S1–S232. https://doi.org/10.2337/dc11-S011
11. Frías JP, Davies MJ, Rosenstock J, Pérez Manghi FC, Fernández Landó L, Bergman BK, Liu B, Cui X, Brown K. Tirzepatide versus semaglutide once weekly in patients with type 2 diabetes. New England Journal of Medicine. 2021 Aug 5;385(6):503-15. DOI: 10.1056/NEJMoa2107519
12. Kounatidis D, Vallianou NG, Tsilingiris D, Christodoulatos GS, Geladari E, Stratigou T, Karampela I, Dalamaga M. Therapeutic potential of GLP-2 analogs in gastrointestinal disorders: current knowledge, nutritional aspects, and future perspectives. Current Nutrition Reports. 2022 Dec;11(4):618-42. DOI: https://doi.org/10.1007/s13668-022-00433-0
13. Davies MJ, D'Alessio DA, Fradkin J, Kernan WN, Mathieu C, Mingrone G, Rossing P, Tsapas A, Wexler DJ, Buse JB. Management of hyperglycemia in type 2 diabetes, 2018. A consensus report by the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). Diabetes care. 2018 Oct 5;41(12):2669. doi: 10.2337/dci18-0033
14. Evert AB, Dennison M, Gardner CD, Garvey WT, Lau KH, MacLeod J, Mitri J, Pereira RF, Rawlings K, Robinson S, Saslow L. Nutrition therapy for adults with diabetes or prediabetes: a consensus report. Diabetes care. 2019 May;42(5):731. doi: 10.2337/dci19-0014
15. Home P, El Naggar N, Khamseh M, Gonzalez-Galvez G, Shen C, Chakkarwar P, Wenying Y. An observational non-interventional study of people with diabetes beginning or changed to insulin analogue therapy in non-Western countries: the A1chieve study. Diabetes research and clinical practice. 2011 Dec 1;94(3):352-63. https://doi.org/10.1016/j.diabres.2011.10.021
16. Monami M, Marchionni N, Mannucci E. Long-acting insulin analogues vs NPH human insulin in type 2 diabetes: A meta-analysis. *Diabetes Obes Metab.* 2009;11(4):372–8. https://doi.org/10.1111/j.1463-1326.2008.00976.x
17. Horvath K, Jeitler K, Berghold A, Ebrahim SH, Gratzer TW, Plank J, Kaiser T, Pieber TR, Siebenhofer A. Long-acting insulin analogues versus NPH insulin (human isophane insulin) for type 2 diabetes mellitus. Cochrane database of systematic reviews. 2007(2).Huang ES, et al. Trends in diabetes care. *Ann Intern Med.* 2017;166(6):400–8. https://doi.org/10.1002/14651858.CD005613.pub3
18. Philis-Tsimikas A, Charpentier G, Clauson P, Ravn GM, Roberts VL. Comparison of insulin detemir and insulin glargine in the treatment of type 1 and type 2 diabetes: A meta-analysis.*DiabetesTher.*2013;4(2):373–84. https://www.tandfonline.com/doi/citedby/10.2147/vhrm.s2159?scroll=top&needAccess=true
19. Owens DR, Matfin G, Monnier L. Basal insulin analogues in the management of diabetes mellitus: what progress have we made. Diabetes/metabolism research and reviews. 2014 Feb;30(2):104-19. https://doi.org/10.1002/dmrr.2469