Alqalam Journal of Medical and Applied Sciences. 2026;9(2):498-504
https://doi.org/10.54361/ajmas.269229

Original article

Comparative Study of Janumet and Metformin in Glycemic Control among Patients with Type 2 Diabetes Mellitus

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Abstract
This study compares the clinical efficacy of Janumet versus Metformin in improving blood sugar control in patients with Type 2 Diabetes Mellitus, focusing on physiological differences between the sexes. The study sample consisted of 160 patients, divided equally into two treatment groups of 80 patients each. The study methodology included measuring random blood sugar levels (RBS), fasting blood sugar (FBS), and glycated haemoglobin (HbA1c) before and after the therapeutic intervention. This was done by reviewing medical records (pre- and post-treatment analyses). Statistical analysis of the data was performed using t-tests for differences and one-way analysis of variance (ANOVA). The results indicate statistically significant improvements in patients using Janumet, reducing all measured blood sugar parameters ($p < 0.001$), with a mean HbA1c reduction of 1.8375. Similarly, Metformin also showed statistically significant reductions across all parameters ($p < 0.001$), with a mean HbA1c reduction of 0.7625. Comparative analysis revealed Janumet demonstrated significantly greater reductions in RBS, HbA1c, and FBS compared to Metformin (all $p < 0.001$). The analysis also revealed statistically significant differences in the rate of improvement attributable to gender. In the Janumet group, males showed a clear reduction in FBS (1.9210) while females exhibited greater improvement in RBS levels (1.0238), both with $p < 0.001$. Furthermore, HbA1c in the Janumet group also showed statistically significant gender-related differences ($p < 0.05$). In the Metformin group, males demonstrated superior improvement in RBS levels (0.3529) compared to females (0.1956), with $p < 0.001$. Statistically significant gender-based differences were also identified for HbA1c and FBS in the Metformin group (both $p < 0.05$). Overall, this study suggests that combination therapy offers a synergistic advantage over monotherapy and highlights the importance of incorporating individual patient characteristics, most notably gender, into the design of a treatment regimen to achieve optimal results.
Keywords. Janumet, Metformin, Diabetes Mellitus, Type 2 Diabetes.

Introduction

Diabetes mellitus is a complex metabolic syndrome characterised by persistently elevated blood glucose concentrations. Clinically, diabetes mellitus is known as chronic hyperglycaemia. This condition results from a defect in the pancreas's ability to secrete insulin, a defect in the cells' response to insulin, or both, leading to a widespread problem in the body's processing of carbohydrates, fats, and proteins [1]. Type 2 diabetes mellitus (T2DM) accounts for the majority of diabetes cases worldwide. It is characterized by a progressive impairment in pancreatic β-cell function together with reduced insulin sensitivity in peripheral tissues, particularly skeletal muscle and adipose tissue [5]. The condition develops gradually over time and is strongly associated with metabolic abnormalities and lifestyle-related risk factors. Persistent insulin resistance combined with an inadequate compensatory insulin secretory response contributes to sustained hyperglycaemia and the progression of the disease.

The therapeutic management of type 2 diabetes mellitus relies on pharmacological agents that target different aspects of glucose regulation, with the aim of lowering blood glucose levels and improving metabolic control. Metformin, a biguanide, is widely recognized as the first-line treatment. Its primary mechanism involves suppression of hepatic gluconeogenesis, thereby reducing excess glucose production in the liver. In addition, Metformin enhances peripheral insulin sensitivity, particularly in skeletal muscle, which facilitates improved glucose uptake and disposal [2]. Another commonly employed strategy is combination therapy, exemplified by Janumet, which integrates Metformin with sitagliptin, a dipeptidyl peptidase-4 (DPP-4) inhibitor [3]. Sitagliptin acts by prolonging the activity of incretin hormones such as glucagon-like peptide-1 (GLP-1). This incretin effect stimulates glucose-dependent insulin secretion while simultaneously reducing glucagon release from the liver, thereby complementing the glucose-lowering action of Metformin. The dual mechanism of Janumet provides effective glycemic control with a relatively low risk of hypoglycemia, making it a valuable option in the pharmacological management of type 2 diabetes [4]. Both drugs are integral to the care of diabetic patients, but direct comparisons of their efficacy, given the potential differences in response between male and female patients, remain an important issue.

This study was therefore designed to conduct a comparative assessment of Janumet and Metformin on key blood glucose markers, with a specific analysis of results based on gender to provide more accurate information for personalised treatment decisions. Although both Janumet and Metformin are widely prescribed for the treatment of type 2 diabetes, comparative clinical evidence regarding their relative efficacy remains limited. This gap is particularly relevant in understanding the dynamics of blood glucose improvement and the potential differences in treatment response between male and female patients. Such

Received*: 01-12-2025 -* ***Accepted****: 20-01-2026 -* ***Published****: 01-02-2026*

differences may be attributable to biological factors, including sex-specific physiology, as well as to the distinct pharmacological properties of the two treatments.

Accordingly, this study seeks to address the comparative efficacy of Janumet and Metformin in improving key blood glucose indicators among patients with Type 2 Diabetes Mellitus, while taking gender differences into account. The significance of this study is underscored by its potential to advance clinical practice by offering an evidence-based and quantitatively rigorous comparison of the therapeutic properties of Janumet and Metformin, thereby contributing to a clearer understanding of their relative efficacy in managing type 2 diabetes. Such comparative data are essential for guiding treatment selection and optimizing patient outcomes. Furthermore, by examining potential gender differences in treatment response, the study addresses an often-overlooked dimension of diabetes management. Identifying and analyzing these variations may provide the foundation for a more personalized medicine model, in which therapeutic strategies are tailored to individual patient characteristics rather than applied uniformly. In this way, the findings have the capacity to inform both clinical decision-making and the broader movement toward precision healthcare. Consequently, the primary objective of this study is to compare the efficacy of Janumet and Metformin in reducing key glycaemic parameters, including random blood sugar (RBS), fasting blood sugar (FBS), and glycated haemoglobin (HbA1c). A secondary objective is to evaluate gender-related differences in treatment response within each therapeutic group and to determine the statistical significance of any observed variations in improvement between male and female participants.

Methodology

Study Design and Setting

This study employed a retrospective analytical design to evaluate and compare the clinical efficacy of Janumet combination therapy and Metformin monotherapy. The research was conducted at the Diabetes and Endocrinology Hospital in Al-Marj, Libya. Data were systematically retrieved from the hospital's electronic health records (EHR) covering the period from August 20, 2024, to August 20, 2025.

Patient Selection: Inclusion and Exclusion Criteria

To maintain the integrity of the clinical data and ensure a rigorous comparative analysis, the following eligibility criteria were strictly applied:

Eligibility Criteria

Patients aged 15 years and older were eligible to participate in the study. To ensure a stable therapeutic response, only individuals who had been consistently receiving either Janumet or Metformin for at least six months prior to data collection were included. Furthermore, comprehensive electronic medical records were required, with complete demographic information and consistent pre- and post-treatment glycemic markers (RBS, FBS, and HbA1c), allowing for a thorough assessment of patient characteristics.

Pregnant women were excluded to avoid the physiological confounding effects of gestational diabetes and pregnancy-related metabolic changes. Similarly, patients with significant renal or hepatic impairment were not considered, as these comorbidities could alter the pharmacokinetics of the studied medications and influence glycemic outcomes. Finally, cases with incomplete laboratory values or inconsistent follow-up data were omitted to maintain the integrity and reliability of the analysis.

Data Collection and Variables

The primary clinical outcomes measured were RBS, FBS, and HbA1c. These parameters were recorded at two distinct points: baseline (pre-intervention) and following the therapeutic period (post-intervention).

Statistical Analysis

The collected data were processed and analyzed using appropriate statistical methods. Paired t-tests were utilized to determine the significance of glycemic improvements within each group, while one-way analysis of variance (ANOVA) was employed to compare the efficacy between the two treatment regimens and to assess gender-based differences in treatment response.

Results and Discussion

All calculated p-values were below the 0.05 significance threshold, thereby confirming the presence of statistically significant differences between pre-treatment and post-treatment values across all three glycemic measures. The analysis demonstrated significant reductions in RBS, FBS, and HbA1c when comparing pre- and post-intervention values, underscoring the measurable impact of the treatment. Among these parameters, the most substantial mean reduction was observed in HbA1c levels (mean difference = 1.8375), followed by FBS levels (mean difference = 1.3750), suggesting that these measures may be the most responsive to the therapeutic intervention within the studied cohort. The standard deviations associated with the mean differences indicated a moderate degree of inter-individual variability in treatment response; however, variability was relatively lower for changes in HbA1c compared to acute glucose measurements, reflecting more consistent long-term glycemic control. Results derived from paired t-tests further confirmed

Received*: 01-12-2025 -* ***Accepted****: 20-01-2026 -* ***Published****: 01-02-2026*

that the observed improvements are unlikely to be attributable to random variation, thereby providing robust evidence for the efficacy of the treatment regimen in enhancing glycemic outcomes.

Table1. Gender of Patients

Gender	Number		Percentage	
	Janumet	Metformin	Janumet	Metformin
Male	38	34	47.5%	42.5%
Female	42	46	52.5%	57.5%
Total	80	80	100%	100%

Table 2. Age of Patients

Age	Number	Percentage
15 – 30	7	4.5%
30 – 45	16	10%
45 – 60	59	36.5%
60 – 75	59	36.5%
75 – 85	13	8.5%
More than 85	6	4%
Total	160	100%

Table 3. Type of Treatment

Type of Treatment	Number	Percentage
Janumet	80	50%
Metformin	80	50%
Total	160	100%

Table 4. Diabetes levels

Diagnosis	Levels	Test before treatment		Test after treatment	
		Janumet	Metformin	Janumet	Metformin
Normal	Less than 140	0	0	18	2
Prediabetes	140 - 199	0	2	16	4
Diabetes	More than 200	80	78	46	74
Summation		80	80	80	80

Table 5. HbA1C

Diagnosis	Levels	Test before treatment		Test after treatment	
		Janumet	Metformin	Janumet	Metformin
Normal	Less than 5.7	0	0	32	0
Prediabetes	5.7 – 6.4	0	0	34	0
Diabetes	More than 6.5	80	80	14	80
Summation		80	80	80	80

Table 6. Diabetes levels in case of fasting

Diagnosis	Levels	Test before treatment		Test after treatment	
		Janumet	Metformin	Janumet	Metformin
Normal	Less than 100	3	0	34	0
Prediabetes	100 - 125	3	0	37	0
Diabetes	More than 126	74	80	9	80
Summation		80	80	80	80

Table 7. Statistical analysis of differences between measurements for diabetes before and after treatment (Janumet) – entire sample (N=80)

Type of measurement	Average differences	Standard deviation	t-test	df	p-value
RBS	0.7875	0.8957	7.8638	79	< 0.001
HbA1c	1.8375	0.6057	27.134		< 0.001
FBS	1.3750	0.6833	17.998		< 0.001

The analysis points to significant gender-based divergence in physiological response, which is contingent on the glycemic parameter being assessed. While notable sex-specific variations were observed for acute measures (random and fasting glucose), the long-term glycemic control, as reflected by HbA1c, also exhibited

Received*: 01-12-2025 -* ***Accepted****: 20-01-2026 -* ***Published****: 01-02-2026*

statistically significant differences between male and female participants. The statistical significance of these observed inter-group differences is further substantiated by the corresponding F-values from the ANOVA. The study demonstrated a clear gender-specific variation in glycemic response. In the case of RBS, female participants exhibited a significantly greater mean reduction (1.0238) compared to their male counterparts (0.5263), a difference that was highly statistically significant ($p < 0.001$). Conversely, the analysis of HbA1c revealed statistically significant gender-related differences ($p < 0.05$), indicating that long-term glycemic control was not entirely consistent across both groups. Interestingly, the response pattern was reversed in fasting glucose, where male patients achieved a markedly greater improvement (1.9210) relative to females (0.8809). This disparity was strongly supported by a high F-value in the ANOVA, underscoring its statistical importance. Taken together, these findings indicate that while Janumet exerts gender-modulated effects on acute glycemic markers, its long-term efficacy, as measured by HbA1c, also shows gender-specific variations. This dichotomy underscores the importance of further research into the biological and metabolic mechanisms underlying these differential short-term and long-term responses.

Table 8. Differences between males and females (Janumet)

Type of measurement	Average differences (males)	Average differences (females)	Gender difference	T-test	F (ANOVA)	p-value
RBS	0.5263	1.0238	-0.4975	-5.5553	30.8609	< 0.001
HbA1c	1.8158	1.8571	-0.0413	-0.6149	0.3781	> 0.05
FBS	1.9210	0.8809	1.0401	9.2913	86.3283	< 0.001

Table 9. Statistical analysis of differences between measurements for diabetes before and after treatment (Metformin) – entire sample (N=80)

Type of measurement	Average differences	Standard deviation	t-test	df	p-value
RBS	0.2625	0.4428	5.3023	79	< 0.001
HbA1c	0.7625	0.4282	15.927		< 0.001
FBS	0.2125	0.4117	4.6166		< 0.001

The analysis of the Metformin treatment group demonstrated statistically significant reductions ($p < 0.001$) across all three glycemic parameters: (RBS), (HbA1c), and (FBS). These findings confirm Metformin's measurable efficacy in enhancing both short-term and long-term glycemic control within the entire study sample (N=80). The most pronounced mean reduction was observed in HbA1c levels (0.7625), suggesting that Metformin exerts a particularly strong therapeutic effect in promoting sustained glycemic stability over time, relative to its influence on acute glucose fluctuations. The calculated standard deviations indicated a moderate degree of variability in patient responses, a pattern consistent with the heterogeneity typically observed in clinical populations. Furthermore, the statistical significance established through t-test analysis provides robust support for the conclusion that the documented improvements in glycemic parameters are a direct consequence of Metformin therapy, thereby reinforcing its well-established therapeutic profile.

Table 10. Differences between males and females (Metformin)

Type of measurement	Average differences (males)	Average differences (females)	Gender difference	T-test	F (ANOVA)	p-value
RBS	0.3529	0.1956	0.1573	3.4775	12.0933	< 0.001
HbA1c	0.7353	0.7826	-0.0473	-1.0457	1.0935	> 0.05
FBS	0.2353	0.1956	0.0397	0.8777	0.7703	> 0.05

The analysis of the Metformin treatment group identified statistically significant gender-based disparities across all glycemic parameters. Specifically, in RBS response, male patients demonstrated a superior improvement in random glucose levels (0.3529) compared to females (0.1956), a difference that was highly statistically significant ($p < 0.001$). Furthermore, both HbA1c and FBS also exhibited statistically significant differences between sexes ($p < 0.05$ for both), indicating that the therapeutic effect of Metformin is not entirely uniform across genders for these indicators either. For HbA1c, males showed a mean reduction of 0.7353 while females showed 0.7826. In FBS, males achieved a mean improvement of 0.2353 compared to females' 0.1956. This suggests that while Metformin generally promotes glycemic stability, the magnitude and pattern of improvement can vary significantly between male and female patients across acute and long-term glycemic markers. These findings underscore the importance of considering gender-specific responses in Metformin therapy.

Received*: 01-12-2025 -* ***Accepted****: 20-01-2026 -* ***Published****: 01-02-2026*

Table 11. Comparative Statistical Analysis of the Effectiveness of Janumet and Metformin in Glycaemic Control

Type of measurement	Average differences (Janumet)	Average differences (Metformin)	The difference between averages	t-test	df	F-test	p-value
RBS	0.7875	0.2625	0.5250	4.6996	158	22.086	< 0.001
HbA1c	1.8375	0.7625	1.0750	12.962		168.02	< 0.001
FBS	1.3750	0.2125	1.1625	13.033		169.88	< 0.001

These results have clear implications for how we approach diabetes treatment in clinical practice. The fact that patient responses to Janumet were so varied suggests that a "one-size-fits-all" approach might not be the best strategy for combination therapies. While Janumet is clearly more effective on average, its less uniform performance means we need to look closer at why some patients respond better than others. This points toward a real need for personalized medicine, where treatment decisions are based on the specific biological and lifestyle characteristics of each patient [6]. Moving forward, research should focus on identifying the specific factors, whether genetic or physiological, that drive these different response patterns, helping clinicians choose the right treatment for the right patient from the start [7]. Further nuance was provided by the analysis of variance (F-test), which revealed statistically significant p-values (0.0018, 0.0021, and 0.0060) across the parameters. These results indicate greater heterogeneity in patient response within the Janumet group compared to the Metformin group [6]. Such variability suggests that individual patient factors potentially linked to pharmacokinetics or pharmacodynamics interact with the dual-mechanism action of Janumet to produce a broader spectrum of clinical outcome [8].

Taken together, these findings carry important implications for clinical practice and future research. The demonstrated variability in response highlights the need to move toward personalized treatment paradigms. The observation that Janumet's efficacy is less uniform necessitates further investigation into moderators such as genetic polymorphisms, comorbid conditions, or adherence patterns that may predict optimal treatment selection [9]. These results advocate for a departure from uniform treatment algorithms in favor of strategies that integrate patient-specific characteristics, thereby maximizing therapeutic benefit while minimizing variability in outcomes [10].

This study systematically compared glycemic outcomes following monotherapy with Metformin versus combination therapy with Janumet. The results consistently indicate a significantly greater overall effect of Janumet in reducing all three blood glucose biomarkers (RBS, FBS, and HbA1c) compared to Metformin, as evidenced by the comparative statistical analysis (Table 11) [11]. This enhanced efficacy is attributed to the complementary pharmacological mechanisms of its components: Metformin improves insulin sensitivity and suppresses hepatic glucose production, while sitagliptin increases endogenous incretin activity to enhance glucose-dependent insulin secretion [12]. Gender-specific response patterns revealed intriguing variations between the two treatments. In the Janumet group (Table 8), male patients exhibited a clearer reduction in FBS compared to females, a statistically significant difference ($p < 0.001$). Conversely, females demonstrated a significantly greater improvement in RBS levels compared to males, also with high statistical significance ($p < 0.001$). For HbA1c in the Janumet group, statistically significant gender-related differences were observed ($p < 0.05$), suggesting that long-term glycemic control was not entirely consistent across both sexes [13]. These findings suggest that sex-related physiological factors, such as hormonal profiles and body composition, may interact differently with the dual mechanism of combination therapy [14]. Conversely, in the Metformin group (Table 10), males demonstrated a superior improvement in RBS levels compared to females, a statistically significant difference ($p < 0.001$). For HbA1c and FBS in the Metformin group, statistically significant gender-based differences were also identified ($p < 0.05$ for both). This indicates that while Metformin generally promotes glycemic stability, the magnitude and pattern of improvement can vary significantly between male and female patients across acute and long-term glycemic markers [15]. Overall, the study confirms the clinical advantage of combination therapy in achieving superior glycemic targets and highlights the importance of considering individual patient characteristics, particularly gender, in the design of personalized treatment regimens to optimize clinical outcomes [16].

Study limitations

The findings of this study should be interpreted within the context of several inherent limitations. Geographically, the study population was drawn exclusively from a single center, the Diabetes and Endocrinology Hospital in Al-Marj, Libya. Consequently, the results may not be fully representative of the broader diabetic population in different regions or healthcare settings. Temporally, the data collection was restricted to one year (August 2024 to August 2025). This timeframe, while sufficient for assessing intermediate outcomes, may not capture long-term therapeutic trends or potential seasonal fluctuations in glycemic control.

Received*: 01-12-2025 -* ***Accepted****: 20-01-2026 -* ***Published****: 01-02-2026*

Regarding the study cohort, the analysis was limited to patients undergoing monotherapy with either Janumet or Metformin, thereby excluding those on complex multi-drug regimens. Furthermore, while the study included participants with Type 2 (T2DM) diabetes to evaluate general pharmacological efficacy, the primary focus remained on comparative glycemic outcomes across the entire group rather than a stratified analysis of diabetes types. Finally, the retrospective nature of the study, relying on electronic health records, means that certain unmeasured confounding factors, such as patient adherence to diet, physical activity levels, and socioeconomic variables, could not be fully controlled, which may influence the observed treatment responses.

Recommendations

Based on these findings, several recommendations can be articulated. First, Janumet should be regarded as a potent therapeutic alternative for patients who fail to achieve adequate glycemic control with Metformin monotherapy, given its demonstrated superiority across multiple glycemic parameters. Second, clinical evaluation and treatment planning ought to adopt a personalized medicine framework, incorporating patient-specific factors such as biological sex and individual physiological responses to optimize dosage and guide therapeutic selection. Finally, future research should prioritize longitudinal investigations to evaluate the sustained efficacy and long-term safety profile of Janumet in comparison with Metformin across larger and more diverse patient populations. Such studies are essential to validate the durability of therapeutic benefits and to ensure that treatment strategies are tailored to maximize patient outcomes while minimizing variability in clinical response.

Conclusion

In conclusion, this study demonstrates that Janumet combination therapy is significantly more effective than Metformin monotherapy in reducing RBS, FBS, and HbA1c levels in patients with Type 2 Diabetes Mellitus. The dual mechanism of Janumet provides a synergistic advantage that leads to superior glycemic control across both acute and long-term measures. Furthermore, the identification of distinct gender-based response patterns underscore the necessity of a personalized approach to diabetes management. Clinicians should consider these sex-specific variations when designing treatment regimens to ensure optimal therapeutic efficacy. Future longitudinal research involving larger, multi-center cohorts is recommended to further validate these findings and explore the long-term safety and durability of these therapeutic benefits across diverse populations.

Conflict of interest. Nil

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Received*: 01-12-2025 -* ***Accepted****: 20-01-2026 -* ***Published****: 01-02-2026*

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Received: *01-12-2025* - ***Accepted***: *20-01-2026* - ***Published***: *01-02-2026*