

**Original Research**

## **Efficacy And Safety of Glimpride in Type 2 Diabetes Patients in Eastern Libya**

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### **ABSTRACT:**

Glimepiride is a drug used in the treatment of type 2 diabetes and can be combined with metformin, another anti-hyperglycemic agent, for patients with difficulty controlling their blood sugar levels. Study Timeframe: This study was conducted during 2023–2024. The study consisted of two parts, the first of which includes the theoretical computer framework, which dealt with the advanced study of some information related to the subject of the study, and the second is the procedural aspect or computer construction, in which the study group used a study form to fill in the data, and then it was statistically analyzed and its results were commented on. The spatial boundaries were represented in the outpatient clinics of the National Center for Diabetes and Endocrinology, eastern Libya (Al-marj – Benghazi – Al-Abyar). The sample consisted of 150 patients with type 2 diabetes (56 males – 94 females), aged between 32–90 years, selected based on initial hemoglobin and fasting plasma glucose measurements. Most received Glimepiride in combination with Metformin.



The study concluded that Glimepiride is safe with no observed side effects and improved blood sugar control in patients, as well as hemoglobin and fasting plasma glucose levels.

**KEYWORDS:** Glimepiride, Type 2 diabetes, T2DM Treatment, Diabetes Treatment.

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## INTRODUCTION

One of the most common metabolic disorders worldwide is type 2 diabetes mellitus (T2DM). It arises when insulin is either insufficiently produced by pancreatic beta cells or the body does not respond properly to insulin. The release, amount, and action of insulin must precisely meet the metabolic demands. Therefore, the molecular mechanisms involved in insulin synthesis, release, and response in tissues must be tightly regulated.

Defects in any of these processes may lead to metabolic imbalance, resulting in type 2 diabetes, which typically develops in adults and becomes more prevalent with age. About one-third of adults over 65 years old suffer from impaired glucose tolerance. Glucose levels in the plasma of elderly individuals rise higher after meals compared to younger adults, especially after meals rich in carbohydrates, and it takes longer for glucose levels to return to normal.

This is attributed to increased accumulation of visceral and abdominal fat, along with a reduction in muscle mass. Over 90% of adults with diabetes suffer from type 2 diabetes. T2DM Has become more common among children as childhood obesity has reached epidemic levels(NDIC, 2014).

Signs and Symptoms include frequent urination, excessive thirst, persistent hunger even after eating, fatigue, blurred vision, recurrent infections or slow-healing wounds, weight loss, tingling or numbness in hands or feet (NDIC, 2014).

Diabetes is known as a lifelong companion as it is a chronic disease with no definitive cure. However, there are several classes of medications to lower blood sugar levels in type 2 diabetes. Each class works differently to reduce blood sugar levels (S Judy – NDIC & ACA & CDC).

### Mechanism of Action:

- Stimulating the pancreas to produce and secrete more insulin.
- Reducing the liver's ability to produce and release sugar.
- Inhibiting the breakdown of carbohydrates in the intestines by blocking enzyme action, slowing down the absorption of carbohydrates by cells.
- Improving cell sensitivity to insulin.
- Limiting the kidneys' ability to reabsorb sugar, leading to increased sugar excretion in urine.
- Slowing down the process of food movement through the stomach.
- Each class of drugs contains one or more medications, with some taken orally and others as injections.

The drug "Glimepiride" belongs to the second generation of sulfonylureas used to control type 2 diabetes (T2DM) and improve blood sugar control. Sulfonylureas are one of the most widely used insulin secretagogues to lower blood glucose levels.

Their main effect is thought to be effective when residual pancreatic beta cells are present, as they stimulate the release of insulin from beta cells. They are also believed to exert extra-pancreatic effects, such as increasing peripheral glucose uptake via insulin (North Dakota, 2022).

## MATERIALS AND METHODS

The efficacy and safety of glimepiride in regulating blood sugar levels in type 2 diabetes patients have been demonstrated, making it one of the safest, most effective, and widely used drugs in the sulfonylurea class. This study involved 150 patients from three different cities in eastern Libya, aged 32 to 90 years, who were administered glimepiride at doses ranging from 1 to 6 milligrams. Additionally, the majority of patients received glimepiride in combination with metformin at doses of 500, 850, and 1000 milligrams. The effectiveness of glimepiride in conjunction with metformin was observed in reducing HbA1c levels and fasting blood sugar in patients, with minor side effects reported.

### *Data Collection Tool*

the questionnaire was used to collect the data in the place of study.

### *Statistical operations*

Unclassified data was handled and classified; frequencies and percentage were calculated as well as the arithmetic averages of some data. Illustrative statistical charts have also been included, both SPSS and Kchart were used.

## RESULTS AND DISCUSSION

The efficacy and safety of glimepiride in regulating blood sugar levels in type 2 diabetes patients have been demonstrated, making it one of the safest, most effective, and widely used drugs in the sulfonylurea class.

This study involved 150 patients from three different cities in eastern Libya, aged 32 to 90 years. Patients were administered glimepiride at doses ranging from 1 to 6 milligrams.

Additionally, the majority of patients received glimepiride in combination with metformin at doses of 500, 850, and 1000 milligrams. The

effectiveness of glimepiride in conjunction with metformin was observed in reducing HbA1c levels and fasting blood sugar in patients, with minor side effects reported.

**Table:(1).** The Sex of Patient of with Type 2 Diabetes

Sex	Number	Percentage
Males	56	37.33%
Females	94	62.67%
<b>Total</b>	<b>150</b>	<b>100%</b>

In the first table, 150 patients were enrolled in this study, with 56 male patients accounting for 37.33%, and 94 female patients accounting for 62.67%.

**Table:(2).** The Age of Patient with Type 2 Diabetes

Age	Number	Percentage
30 - 40 years	5	3.33%
41 - 50 years	33	22%
51 - 60 years	55	36.67%
61 - 70 years	40	26.67%
More than 70 years	17	11.33%
<b>Total</b>	<b>150</b>	<b>100%</b>

In the second table, which illustrates the age group of patients who took glimepiride (Amaryl), the highest percentage was for the age group of 51 to 60 years, with 55 patients, accounting for 36.67%. Next was the age group of 61 to 70 years, with 40 patients, accounting for 26.67%.

Then the age group of 41 to 50 years, with 33 patients, accounting for 22%. Followed by the age group of 70 and above, with 17 patients, accounting for 11.33%. The smallest percentage was for the age group of 30 to 40

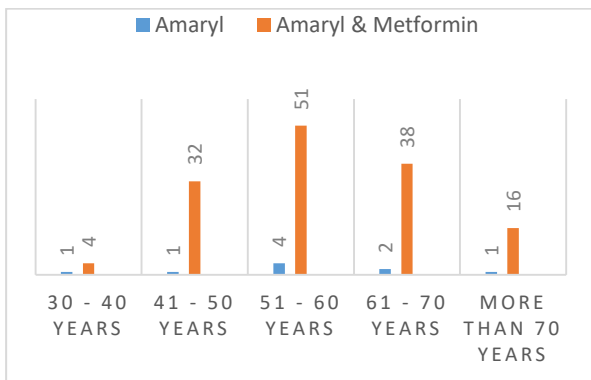
years, with only 5 patients, accounting for 3.33%.

**Type of Treatment (By General)**

**Table:(3).** The Type of Treatment of all Patients with Type 2 Diabetes.

Treatment	Number	Percentage
Amaryl [1,2,3,4,5,6mg]	9	6%
Amaryl [1,2,3,4,5,6mg] & metformin [500,850,1000mg]	141	94%
<b>Total</b>	<b>150</b>	<b>100%</b>

The third table indicates that the number of patients who received glimepiride alone without metformin was 9 patients, accounting for 6%. The number of patients who received glimepiride in combination with metformin was 141 patients, accounting for 94%. This shows an increase in the number of patients who take (amaryle) and (metformin) together, and this is consistent with a study (Manuel et al: 2004), (Manuel et al : 2009) and also a study (M Jasik et al: 2000) that proved a good high when used with some.



**Figure.1:**The Type of Treatment of all Patient with Type 2 Diabetes.

Figure (1) shows: The participation of the eye members according to the variables and the type of treatment, where the court determines

the patients who take Amaril with Metformin, and this is what the required color shows.

**Table:(4).** Distribution of Patients with Type 2 Diabetes in Eastern Libya.

City	Number	Percentage
Al-Marj	60	40%
Benghazi	70	46.67%
Al-Abyar	20	13.33%
<b>Total</b>	<b>150</b>	<b>100%</b>

The fourth table shows that the study was conducted on 150 patients from three different cities in Eastern Libya, with the distribution of patients as follows: 60 patients from Al-Marj city, accounting for 40%; 70 patients from Benghazi city, accounting for 46.67%; and 20 patients from Al-Abyar city, accounting for 13.33%.

**Age (30 - 40 years)**

**Table:(5).**Treatment (By Age 30 - 40 Years)

Treatment	Dose	Number	%	Side effects
Amaryl	3mg	1	0.67%	No
Amaryl & Metformin	2mg 850m g 2mg 1000 mg 4mg 1000 mg	2 1 1	2.67% 0.67%	No
<b>Total</b>		<b>5</b>	<b>3.34%</b>	

The fifth table indicates that there is only one patient receiving glimepiride without metformin at a dose of 2 milligrams in the age group of 30 to 40 years, accounting for 0.67% of the total of 150 patients. Four patients received glimepiride with metformin at doses of 2 and 4 milligrams of glimepiride and doses

of 850 and 1000 milligrams of metformin, constituting 2.67% of the total 150 patients, with no observed side effects in this group.

**Table:(6).** Sugar Levels by (Age 30-40)

Diagnosis	Levels	Test sugar before treatment	Test sugar after treatment
Uninfected	68 - 125		3
Exposed to injury	126 - 151		
Injured	152 - 354	4	2
Infected with Inability in control at its levels	More than 355	1	
<b>Total</b>		5	5

**Table:(7).** HbA1C Levels:( Age 30 - 40 years)

Diagnosis	Levels	HbA1C before treatment	HbA1C after treatment
Uninfected	4 - 5		
Exposed to injury	6		
Injured	7 - 11	3	5
Infected with Inability in control at its levels	More than 11	2	
<b>Total</b>		5	5

In six and seven tables, for the age group of 30 to 40, it was the least affected age group, with only 5 patients. Four of them were classified as diabetic before treatment, and one was diagnosed with uncontrolled diabetes. After receiving glimepiride, blood glucose levels normalized for three individuals, while two remained diabetic. Regarding HbA1c levels, three patients were classified as diabetic, and

two were classified as having uncontrolled diabetes before treatment. After receiving glimepiride, HbA1c levels decreased for all patients in this group, leading to their classification as diabetes.

**Age (41 - 50 years)**

**Table:(8).** Treatment (Age 41 - 50 years).

Treatment	Number	%	Side effect	
			Yes	No
Amaryl	1	0.67%	-	1
Amaryl & Metformin	32	21.33%	2	30
<b>Total</b>	33	22%		

The eight table indicates that there is one patient who received glimepiride without metformin in the age group (41-50), representing 0.67%. Additionally, 32 individuals received glimepiride with metformin, constituting 21.33% of the total 150 patients. It is noted that two individuals experienced side effects.

**Table:(9).** The doses of Amaryl Used in Treatment by (Age 30-40)

Amaryl	4mg	1	0.67%
Amaryl & Metformin	1mg 850mg	2	1.33%
	1mg 1000mg		
	2mg 500mg	12	8%
	2mg 850mg		
	2mg 1000mg		
	3mg 500mg	5	3.33%
	3mg 850mg		
	3mg 1000mg		
	4mg 500mg	11	7.33%
	4mg 850mg		
	4mg 1000mg		
	5mg 850mg	1	0.67%
	6mg 850mg	1	0.67%
<b>Total</b>		33	22%

The nine table indicates that there is one patient who received glimepiride without

metformin in the age group (41 -50 )years at a dose of 4 milligram, while the remaining 32 patients received glimepiride at doses of 1, 2, 3, 4, 5, or 6 milligrams along with metformin at doses of 500, 850, and 1000 milligrams.

**Table:(10).** Sugar Levels (Age 41 -50 years)

Diagnosis	Levels	Test sugar before treatment	Test sugar after treatment
Uninfected	68 - 125		10
Exposed to injury	126 – 151	1	15
Injured	152 – 354	21	8
Infected with Inability in control at its levels	More than 355	11	
<b>Total</b>		33	33

**Table:(11).**HbA1C Levels:( Age 41 -50 years)

Diagnosis	Levels	HbA1C before treatment	HbA1C after treatment
Uninfected	4 - 5		1
Exposed to injury	6		4
Injured	7 - 11	23	28
Infected with Inability in control at its levels	More than 11	10	
<b>Total</b>		33	33

In tenth and eleventh table for the age group (40-50), we had one individual classified as susceptible before treatment, 21 individuals classified as diabetic, and 11 individuals classified as having uncontrolled diabetes. After receiving glimepiride, the blood sugar levels decreased for 10 individuals to the non-

diabetic category, 15 individuals to the susceptible category, and 8 individuals to the diabetic category. Regarding HbA1c levels, we notice a decrease in the majority of diabetic individuals, moving them to the diabetic category, while 4 individuals moved to the susceptible category, and one individual moved to the non-diabetic category.

*Age (51 - 60 years)*

**Table:(12).**Treatment (By age 51 - 60 years).

Treatment	Number	Percentage	Side Effects
Amaryl	4	2.67%	No
Amaryl & Metformin	51	34%	No
<b>Total</b>	55	36.67%	

The twelve table for the age group (51 to 60 years .shows that 4 individuals received glimepiride without metformin, accounting for 2.67%. Additionally, 51 individuals received glimepiride in combination with metformin, accounting for 36.67% , with no observed side effect.

**Table:(13).**The Doses of Drug used in Treatment (Age 51-60)

Amaryl	3mg	1	2.67%
	4mg	2	
	5mg	1	
Amaryl & Metformin	1mg	500mg	3
	1mg	850mg	4
	1mg	1000mg	1
	2mg	500mg	10
	2mg	850mg	3
	2mg	1000mg	1
	3mg	500mg	5
	3mg	850mg	2
	3mg	1000mg	3
	4mg	500mg	11
	4mg	850mg	7
	4mg	1000mg	1
<b>Total</b>		55	36.67%

The thirteenth table shows that there are four patients who received glimepiride without metformin in the age group of 51 to 60 at doses of 3, 4, and 5 milligrams, while the remaining 51 patients received glimepiride at doses of 1, 2, 3, and 4 milligrams along with metformin at doses of 500, 850, and 1000 milligrams.

infected category, 14 individuals to the infected category, and 21 individuals to the affected category. Regarding HbA1c, the table indicates a decrease in glucose level for 43 individuals to the infected category, 9 individuals to the infected with uncontrolled levels category, and 3 individuals to the non-infected category.

**Table:(14).** Sugar levels:( Age 51 - 60 years).

Diagnosis	Levels	Test sugar before treatment	Test sugar after treatment
Uninfected	68 - 125	1	20
Exposed to injury	126 – 151	2	14
Injured	152 – 354	39	21
Infected with Inability in control at its levels	More than 355	13	
<b>Total</b>		55	55

**Table:(15).**HbA1C levels:(By age 51 - 60 years)

Diagnosis	Levels	HbA1C before treatment	HbA1C after treatment
Uninfected	4 - 5		3
Exposed to injury	6	3	9
Injured	7 - 11	34	43
Infected with Inability in control at its levels	> 11	18	
<b>Total</b>		55	55

In Tables (14, 15) for the age group (51-60), which had the highest number of affected individuals, three individuals were classified as predisposed to infection, 39 individuals were classified as infected before treatment, and 13 individuals were infected with uncontrolled levels. After receiving glimepiride, the glucose level decreased in 20 individuals to the non-

**Age (61-70 years)**

**Table:(16).** Treatment (Age 61-70 years).

Treatment	Number	Percentage	Side Effect
Amaryl	2	1.33%	No
Amaryl & Metformin summation	38	25.34%	No
	40	26.67%	

In Table sixteen, the number of patients receiving glimepiride in the age group (61-70), 40 patients. Among them, two patients receive Amaryl without metformin, accounting for 1.33% of the total, while the remaining thirty-eight receive glimepiride with metformin, constituting 25.34% of the total 150 patients, with no reported side effects. These rates are consistent with the findings of a study (M Jasik et al: 2000) and (K E Draeger et al: 1996) that demonstrated high effectiveness in controlling diabetes rates in patients who suffer from type 2 diabetes and who belong to the age groups (over 60 years).

**Table:(17).**The Doses of Amaryl (age 61-70).

(Amaryl	1mg	2	1.33 %
Amaryl & Metformin	1mg	850mg	1 0.67%
	2mg	500mg	9 8.67%
	2mg	850mg	4
	3mg	500mg	8 9.33%
	3mg	850mg	2
	3mg	1000mg	4
	4mg	500mg	4 5.34%
	4mg	850mg	2
	4mg	1000mg	2
	5mg	850mg	2 1.33%
<b>Total</b>			40 26.67%

Seventeenth Table indicates that the two patients receiving glimepiride without metformin in the age group of 61 to 70 were taking a dosage of 1 milligram of glimepiride. Meanwhile, the remaining 38 patients received glimepiride with metformin in dosages ranging from 1 to 5 milligrams of glimepiride, accompanied by metformin dosages of 500, 850, and 1000 milligrams. The table also shows that the dose (500) for merformin treatment is the most frequent compared to the rest of the doses, and this is consistent with a study (M Jasik et al: 2000).

**Table:(18).** Sugar levels:(By age 61 - 70 years)

Diagnosis	Levels	T- sugar before treatment	T- sugar after treatment
Uninfected	68 - 125		15
Exposed to injury	126 - 151	1	10
Injured	152 - 354	30	15
Infected with Inability in control at its levels	> 355	9	
Summation		40	40

**Table:(19).** HbA1C levels: (By age 61 - 70 years)

Diagnosis	Levels	HbA1C before treatment	HbA1C after treatment
Uninfected	4 - 5		3
Exposed to injury	6		7
Injured	7 - 11	30	28
Infected with Inability in control at its levels	More than 11	10	2
Summation		40	40

In Tables (18, 19) for the age group 61 to 70, which included 40 patients, table 17 clarified

the fasting blood sugar levels among patients before treatment. One patient was classified as susceptible to infection, 30 were classified as diabetic, and 9 were classified as diabetic with uncontrolled sugar levels , After receiving glimepiride, the fasting blood sugar levels decreased. 15 patients were classified as non-diabetic, 10 as susceptible to infection, and 15 as diabetic .In HbA1c levels before receiving glimepiride, 30 of them were classified as diabetic and 10 as diabetic with uncontrolled sugar levels. After receiving glimepiride, HbA1c levels decreased, where 3 patients were classified as non-diabetic, 7 patients as susceptible to infection, 28 patients as diabetic, and 2 patients as diabetic with uncontrolled sugar levels.

**Age (more than 70 years)**

**Table:(20).**Treatment (By age more than 70 years)

Treatment	Number	Percentage	Side effect
Amaryl	1	0.67%	No
Amaryl & Metformin	16	10.67%	No
<b>Total</b>	17	11.34%	

The 20 table illustrates that the number of patients receiving glimepiride in the age group of 70 years or older was seventeen patients. Only one patient receives glimepiride without combination with metformin, representing 0.67% of the total.

16 patients receive glimepiride with metformin, accounting for 10.67% of the total 150 patients, with no reported side effects.

This is consistent with studies (K E Draeger et al : 1996) and studies (M Jasik et al: 2000) that indicate that type 2 diabetes patients in older age groups take it together to obtain better results.

**Table:(21).**The Doses of Drug Used in Treatment (age more than 70)

<b>Amaryl</b>	<b>2mg</b>		<b>1</b>	<b>0.67%</b>
Amaryl & Metformin	1mg	500mg	3	2%
	2mg	500mg	2	4.67%
	2mg	850mg	3	
	2mg	1000mg	2	
	3mg	500mg	1	2%
	3mg	1000mg	2	
	4mg	850mg	2	2%
	4mg	1000mg	1	
<b>Total</b>			17	11.34%

Table 21 illustrates that the patient receiving glimepiride without combination with metformin in the age group of 70 years or older was receiving glimepiride at a dose of 2 milligrams. The remaining sixteen patients received glimepiride at doses of 1, 2, 3, 4 milligrams, along with metformin at doses of 500, 850, and 1000 milligram. The table also shows that the doses (850 , 1000) for metformin have the highest frequency, and this varies with study (M Jasik et al: 2000).

**Table:(22).**Sugar Levels (Age more than 70 years)

<b>Diagnosis</b>	<b>Levels</b>	<b>Test sugar before treatment</b>	<b>Test sugar after treatment</b>
Uninfected	68 - 125		6
Exposed to injury	126 – 151		4
Injured	152 – 354	12	7
Infected with	More than	5	
Inability in control at its levels	355		
<b>Total</b>		17	17

**Table:(23).** HbA1C Levels (Age more than 70 years).

<b>Diagnosis</b>	<b>Levels</b>	<b>HbA1C before treatment</b>	<b>HbA1C after treatment</b>
Uninfected	4 - 5		1
Exposed to injury	6	1	7
Injured	7 - 11	11	9
Infected with	More than	5	
Inability in control at its levels	11		
<b>Total</b>		17	17

Table 22 and 23 illustrate the fasting blood sugar and HbA1c levels among individuals aged 70 and above. Before receiving glimepiride, the fasting blood sugar levels were recorded for 12 diabetic patients, with 5 categorized as uncontrolled. After receiving glimepiride, blood sugar levels decreased in 6 non-diabetic individuals, 4 at risk of diabetes, and 7 diabetic patients. Prior to glimepiride, HbA1c levels were documented for 1 patient at risk of diabetes, 11 diabetic patients, and 5 with uncontrolled diabetes. Following glimepiride, HbA1c levels decreased in 1 non-diabetic individual, 7 at risk of diabetes, and 9 diabetic patients.

### CONCLUSION

A Study on the drug glimepiride and its efficacy and safety on type 2 diabetes patients from cities In East Libya (Al Marj, Alabyar, Benghazi). The total number of patients was 150 And the target ages for patients was between 32-90 years. Through the study We found that the effectiveness of Amaryl is greater in age groups under 60 years, and it is less effective in older age groups, with very minor side effects observed.

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**المخلص**

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جليمبيريد هو دواء يستخدم في علاج مرض السكري من النوع 2 ويمكن دمجه مع الميتفورمين، وهو عامل آخر مضاد لفرط سكر الدم، للمرضى الذين يعانون من صعوبة في التحكم في مستويات السكر في الدم. الإطار الزمني للدراسة: أجريت هذه الدراسة خلال الفترة 2023-2024. تكونت الدراسة من جزئين، الأول يتضمن الإطار النظري، الذي تناول الدراسة المتقدمة لبعض المعلومات المتعلقة بموضوع الدراسة، والثاني الجانب الإجرائي أو البناء الحاسوبي، والذي تناولت فيه مجموعة الدراسة واستخدمت استمارة الدراسة لملء البيانات، ومن ثم تم تحليلها إحصائياً والتعليق على نتائجها. وتمثلت الحدود المكانية في العيادات الخارجية للمركز الوطني للسكري والغدد الصماء شرق ليبيا (المرج - بنغازي - الأبيار). تألفت العينة من 150 مريضاً مصاباً بداء السكري من النوع 2 (56 ذكراً - 94 أنثى)، تتراوح أعمارهم بين 32-90 عاماً، تم اختيارهم بناءً على قياسات الهيموجلوبين الأولية وقياس الجلوكوز في بلازما الصيام. تلقى معظمهم جليمبيريد بالاشتراك مع الميتفورمين. اثبتت الدراسة إلى أن جليمبيريد آمن وليس له أي آثار جانبية ملحوظة، كما أنه يحسن التحكم في نسبة السكر في الدم لدى المرضى، وكذلك مستويات الهيموجلوبين والجلوكوز في البلازما أثناء الصيام.

**الكلمات المفتاحية:** جليمبيريد، مرض السكري من النوع 2، علاج مرض السكري .