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Original Research Article

Comparative and Combined Impact of Metformin and Lifestyle Intervention (Yoga and Walking) on Metabolic Parameters in Patients with Type 2 Diabetes Mellitus

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Abstract:

Background: Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder characterized by hyperglycemia, insulin resistance, and altered lipid metabolism. Metformin remains the first-line pharmacological therapy, while lifestyle interventions such as yoga and walking have shown promising metabolic benefits.

Objective: To evaluate and compare the effects of metformin alone, lifestyle intervention alone (yoga and walking), and their combined approach on metabolic parameters in patients with T2DM.

Methods: A comparative interventional study was conducted on patients diagnosed with T2DM. Participants were divided into three groups: metformin-only group, lifestyle intervention group (yoga and walking), and combined therapy group. Metabolic parameters including fasting blood glucose (FBG), HbA1c, body mass index (BMI), and lipid profile were assessed at baseline and after the intervention period.

Results: The combined intervention group demonstrated greater improvement in glycemic control and lipid parameters compared to metformin or lifestyle intervention alone. Significant reductions were observed in HbA1c, fasting glucose, BMI, and triglyceride levels.

Conclusion: The combined use of metformin with yoga and walking provides superior metabolic benefits in T2DM management compared to either therapy alone, emphasizing the importance of integrating lifestyle modification with pharmacotherapy.

Keywords: Type 2 diabetes mellitus, Metformin, Yoga, Walking, Lifestyle intervention, Metabolic parameters.

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Introduction

Diabetes mellitus is one of the major problems in the field of the twenty-first century due to its constantly growing prevalence rate, chronicity and development of severe complications [1]. The name diabetes mellitus is based on the Greek diagnosis diabetes, meaning pass through, and the Latin word mellitus, meaning sweet, referring to the old description in ancient medical literature of excessive urination with urine that is sweet tasting. According to the historical account, diabetes was well described as a clinical entity ever since the medical literature in the Egyptian and Indian world in 1500 BC, where it was linked to excessive thirst, polyuria and weight loss. The basic insight into insulin deficiency and insulin resistance as the underlying process of the disease has been achieved over the centuries as a result of physiological and biochemical progresses [2].

Diabetes mellitus has become a worldwide threat in the current times, and this has been fuelled by dramatic demographic, socioeconomic and lifestyle changes. The International Diabetes Federation (IDF) estimates that there were about 537 million adults with diabetes in the world by 2021 which is expected to increase to 643 million by 2030 and 783 million by 2045, assuming the trends remain the same. Most of this growth is a product of Type 2 Diabetes Mellitus (T2DM) which is over 90% in all cases of diabetes in the world as a whole. Low and middle income nations face the greatest burden of diabetes in which swift urbanization, shift in the diet, and physical inactivity have established an environment that promotes the occurrence of metabolic conditions [3].

Diabetes distribution has significant regional disparities in the world. South East Asian, Western

Pacific as well as Middle Eastern countries are recording the highest growth in diabetes prevalence. India and especially has become one of the epicentres of the diabetes pandemic and has been dubbed as the diabetes capital of the world. Recent predictions indicate over 77 million adults in India live now with diabetes and a large percentage pass as prediabetic [4]. The genetic susceptibility along with the environmental variables including sedentary lifestyle, high-carbohydrate diets, psychosocial stress and the growing prevalence of obesity have increased the prevalence.

In addition to high prevalence, diabetes mellitus has a heavy burden on human beings economically as well as at the family level and in health care. Direct medical expenses comprise the hospitalization, medication, diagnostic, and complication management expenses, whereas indirect costs are the productivity, disability, and early mortality costs [5]. Diabetes is not a communicable disease, but it is the chronic one that requires lifetime management hence it is among the costliest non-communicable diseases to treat. Out of pocket payments in the care of diabetes in most developing countries has been a significant contributor to the financial distress and poor life quality.

The type of diabetes mellitus is also linked to high morbidity and mortality rates because it causes long term complications. These complications have an impact on various organ systems and they involve cardiovascular disease, kidney failure, blindness and amputations of the limbs. Epidemiological research findings always support the fact that patients with diabetes are two to four times more susceptible to cardiovascular disease than their non-diabetic counterparts [6]. Consequently, diabetes not only has a metabolic disorder, but is also one of the primary causes of cardiovascular morbidity and mortality across the world.

Increased prevalence of diabetes in the world has made international institutions like the World Health Organization (WHO) and UN acknowledge diabetes as a key non communicable disease that needs concerted measures to prevent and manage. In 2011, the United Nations Political Declaration on Non-Communicable Diseases mentioned diabetes as a significant challenge to sustainable development and requested more thorough interventions in the form of public health interventions to mitigate the factors recognized as modifiable risk factors including unhealthy diet, lack of physical activity, and obesity [7].

Type 2 diabetes mellitus (T2DM) is one of the most prevalent metabolic disorders worldwide and is associated with long-term complications such as cardiovascular disease, nephropathy, neuropathy, and retinopathy. India has emerged as a global hub for diabetes due to rapid urbanization, sedentary lifestyle, obesity, and genetic predisposition.

Metformin is widely recommended as the first-line oral antidiabetic agent due to its efficacy in reducing hepatic glucose production and improving insulin sensitivity. However, pharmacotherapy alone is often insufficient to achieve long-term glycemic targets.

Lifestyle interventions, including regular physical activity and mind-body practices such as yoga, have gained importance as complementary therapies. Walking improves glucose uptake in skeletal muscles, whereas yoga contributes to stress reduction, improved autonomic balance, and better metabolic regulation.

Therefore, the present study aims to compare and evaluate the combined impact of metformin and lifestyle intervention (yoga and walking) on key metabolic parameters in T2DM patients.

Materials and Methods

The present study was held in Department of Biochemistry working in association with Department of Medicine of a tertiary care hospital Indore.

Study Design: A comparative interventional study was conducted in patients diagnosed with T2DM.

Study Population: Patients aged between 30–65 years with confirmed type 2 diabetes mellitus were included.

Inclusion Criteria

- Diagnosed cases of T2DM
- Stable metformin therapy
- Willingness to participate in lifestyle intervention

Exclusion Criteria

- Type 1 diabetes mellitus
- Severe cardiovascular disease
- Pregnancy
- Patients on insulin therapy

Grouping

Participants were divided into three groups:

- Group A: Metformin only
- Group B: Lifestyle intervention (Yoga + Walking)
- Group C: Combined Metformin + Lifestyle intervention

Lifestyle Intervention Protocol

- Yoga: 30–45 minutes/day, 5 days/week
- Walking: 30 minutes/day, 5 days/week

Parameters Assessed

- Fasting Blood Glucose (FBG)
- HbA1c
- Body Mass Index (BMI)

Statistical Analysis: Data were analyzed using appropriate statistical tests (paired t-test, ANOVA). A p-value <0.05 was considered statistically significant.

Result:

Table 1: Distribution of participants as per their Age

S. No.	Age Group	Frequency	Percent
1	30 -39 Years	47	31.3
2	40 -49 Years	58	38.7
3	49 -60 Years	45	30.0
Total		150	100.0

The mean age of the participants is 44.62 ± 8.762 years (30-60 years).

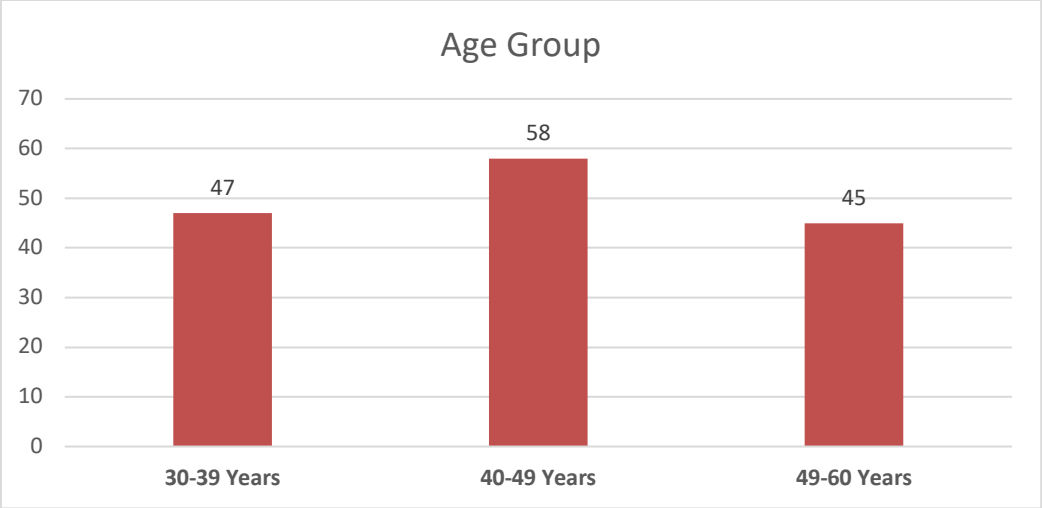


Figure 1: Age Group

Table 2: Distribution of participants as per their Gender

S.NO.	Gender	Frequency	Percent
1	Female	72	48.0
2	Male	78	52.0
Total		150	100.0

In our study, 72 (48%) participants were female while 78 (52%) were male.

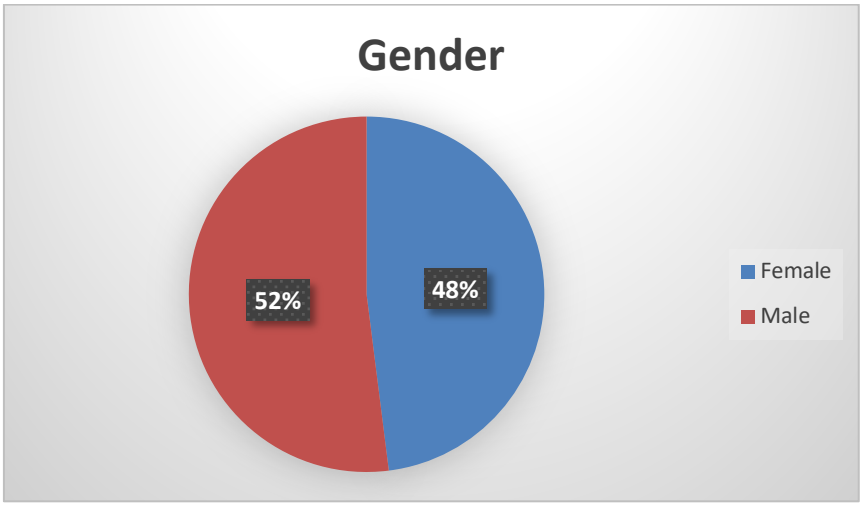
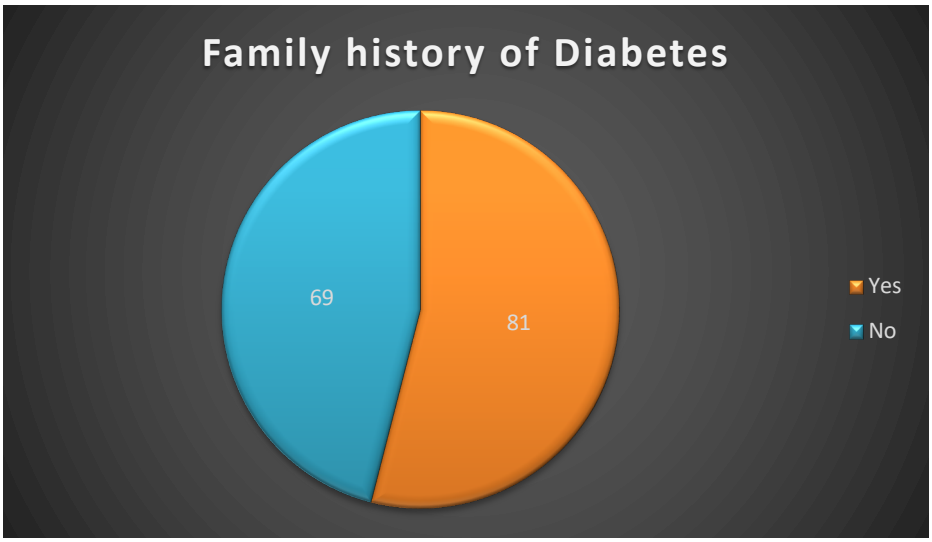


Figure 2: Gender

Table 3: Distribution of participants based on family history of diabetes:

S. No.	Family history of diabetes	Frequency	Percent
1	Yes	81	54.0
2	No	69	46.0
Total		150	100.0

54% i.e. 81 participants have positive family history of diabetes and 46% i.e. 69 don't have any family history of diabetes.



Effect on Glycemic Control:

- Before intervention, the mean fasting blood sugar level of the participants was 169.93 ± 17.625 mg/dl. All three groups showed baseline comparability (F=2.479, p=0.087).
- At 24 weeks, the mean fasting RBS level of the participants was 140.08 ± 13.455 mg/dl. A statistically significant difference was present, which advocate strong impact of the intervention on fasting blood sugar level. (F=37.123, p<0.001).
- There was no statistically significant difference in post prandial blood sugar (PPBS) levels among the three groups at baseline (F= 1.106, p = 0.334) and mean was 229.39 ± 20.726 mg/dl.
- At the end of the study, there was major drop in mean post prandial blood sugar level and it reaches at 189.63 ± 19.504 mg/dl. A statistically significant difference was observed between the groups (F = 64.337, p < 0.001), indicating a significant effect of the interventions on post prandial blood sugar level.
- Mean HbA1c was 8.741 ± 0.7293 and baseline HbA1c levels were comparable among the three groups and no statistically significant difference observed (F= 0.644, p = 0.527).
- At 24 weeks, a statistically highly significant difference was found between the groups (F = 71.700, p < 0.001), and mean HbA1c level drops to 5.729 ± 0.641 showing a substantial improvement in long term glycemic control following intervention among the participants.
- Initially the mean fasting insulin level was 22.271 ± 4.264 µIU/ ml. and all 03 groups were comparable (F = 0.782, p = 0.459). Though fasting insulin level decreased to15.135 ± 2.887 µIU/ ml. but this intergroup difference is not significant (F = 0.576, p = 0.563).
- The mean of baseline C peptide level was 2.513 ± 0.562 ng/ml. There was no difference in the groups observed (F = 2.085, p = 0.128). The levels of C peptide were increased (mean 3.472 ± 0.576 ng/ml) but there was no statistically significant difference was observed in groups (F = 2.708, p = 0.070).

Discussion

The findings suggest that combined therapy provides superior metabolic improvements compared to monotherapy. Metformin primarily improves insulin sensitivity and reduces hepatic glucose output, while yoga and walking contribute to enhanced glucose uptake, reduced stress-induced hyperglycemia, and improved lipid metabolism.

Yoga has additional benefits in reducing cortisol levels and improving autonomic function, which may contribute to better glycemic control. Walking is an accessible aerobic activity that enhances cardiovascular fitness and weight reduction.

Thus, integrating lifestyle interventions with pharmacological treatment may represent an optimal approach for comprehensive diabetes management.

Conclusion

The combined use of metformin with lifestyle intervention (yoga and walking) significantly improves metabolic parameters in patients with T2DM. This integrated approach should be encouraged as part of standard diabetes care for better long-term outcomes.

References

1. DeFronzo RA, Ferrannini E, Groop L, et al. Type 2 diabetes mellitus. Nat Rev Dis Primers. 2015; 1:15019.
2. International Diabetes Federation. IDF Diabetes Atlas. 10th ed. Brussels: IDF; 2021.
3. World Health Organization. Global report on diabetes. Geneva: WHO; 2016.
4. Anjana RM, Deepa M, Pradeepa R, et al. Prevalence of diabetes and prediabetes in India. Diabetologia. 2017;60(12):2250–2260.
5. Bommer C, Heesemann E, Sagalova V, et al. Global economic burden of diabetes in adults. Lancet Diabetes Endocrinol. 2017;5(6):423–430.
6. Rawshani A, Rawshani A, Franzén S, et al. Mortality and cardiovascular disease in type 2 diabetes. N Engl J Med. 2018;379(7):633–644.
7. United Nations. Political declaration on NCDs. New York: UN; 2011.
8. American Diabetes Association. Classification and diagnosis of diabetes. Diabetes Care. 2023;46(Suppl 1):S19–S40.
9. Prentki M, Nolan CJ. Islet beta cell failure in type 2 diabetes. J Clin Invest. 2016; 126(12): 4217–4224.
10. Mahajan A, Taliun D, Thurner M, et al. Fine mapping of T2DM loci. Nat Genet. 2018; 50(11): 1505–1513.
11. Hotamisligil GS. Inflammation and metabolic disorders. Nature. 2017;444(7121):860–867.
12. World Health Organization. Definition and diagnosis of diabetes mellitus. Geneva: WHO; 2019.
13. American Diabetes Association. Standards of medical care in diabetes—2023. Diabetes Care. 2023;46(Suppl 1):S1–S291.
14. UK Prospective Diabetes Study Group. Effect of intensive blood-glucose control with metformin. Lancet. 1998; 352:854–65.
15. Innes KE, Selfe TK. Yoga for adults with type 2 diabetes. J Diabetes Res. 2016; 2016: 6979370.
16. Colberg SR, et al. Physical activity/exercise and diabetes. Diabetes Care. 2016;39(11):2065–7