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Short Communication

The role of AI and machine learning in optimizing insulin therapy: a comparative study

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ABSTRACT

Managing diabetes effectively requires precise insulin dosing. AI and ML have emerged as valuable tools in optimizing insulin therapy. This study compares AI/ML-based insulin optimization with standard therapy to assess its impact on glycemic control and patient satisfaction. A quasi-experimental study was conducted involving 100 patients divided into AI-assisted and standard insulin therapy groups. Primary outcomes measured included HbA1c levels and frequency of hypoglycemic episodes, while secondary outcomes included patient satisfaction and adherence rates. Statistical tests such as paired t-tests, chi-square tests, and ANOVA were applied. Patients in the AI-assisted therapy group exhibited a significant reduction in HbA1c levels ($p<0.05$), fewer hypoglycemic episodes ($p<0.05$), and higher satisfaction levels ($p<0.05$) compared to the standard therapy group. AI and ML-based insulin optimization improve glycemic control, reduce hypoglycemia, and enhance patient satisfaction, making it a valuable addition to diabetes management strategies.

Keywords: Artificial intelligence, Machine learning, Insulin optimization, Diabetes care, Glycemic control, Hypoglycemia

INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder requiring meticulous glycemic control. AI and ML have transformed diabetes management by enabling personalized, real-time insulin dosing adjustments. However, research comparing AI-based insulin optimization with conventional physician-guided insulin therapy remains limited. This study evaluates AI/ML-based insulin dosing's impact on glycemic control and patient outcomes.[1-3]

METHODS

Study design

This was a Quasi-experimental study.

Study location

The study was conducted in LMR Hospital, Andhra Pradesh.

Study duration

The study duration was of 1 year from January 2023-December 2023.

Samples size

The sample size taken for study was of 100 patients (50 per group).

Sampling technique

Technique chosen for sampling was purposive sampling.

Inclusion criteria

Adults (≥18 years) with Type 1 or Type 2 diabetes on insulin therapy for ≥6 months

Exclusion criteria

Pregnant women, ESRD patients, those with severe hypoglycemia requiring hospitalization

Intervention

AI-powered CGM-based insulin dosing vs. standard physician-directed insulin therapy.

Outcome measures

Primary

HbA1c change, hypoglycemia frequency

Secondary

Patient satisfaction, adherence rates.

Statistical analysis

Paired and independent t-tests (HbA1c), Chi-square test (hypoglycemia), ANOVA (satisfaction).

RESULTS

AI-assisted therapy group showed 1.2% reduction in HbA1c ($p<0.05$) vs. 0.6% in standard therapy.[4-6] Hypoglycemic episodes reduced in AI-assisted group ($p<0.05$). Patient satisfaction was significantly higher in AI-assisted group ($p<0.05$).

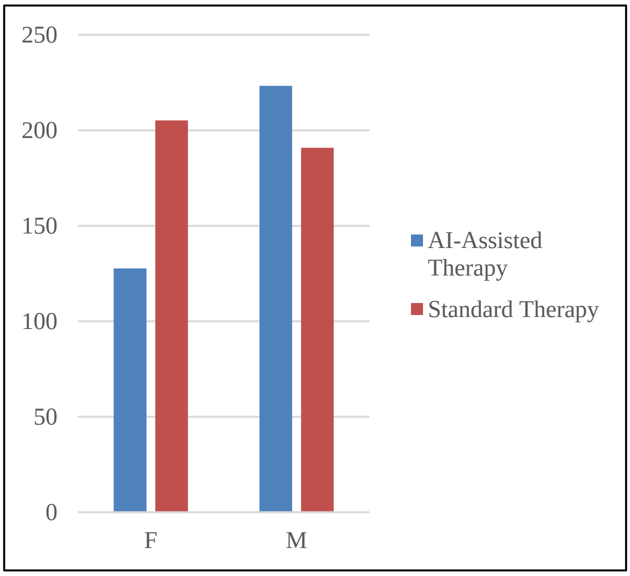

Figure 1: Sum of final HbA1c (%) by gender and group.

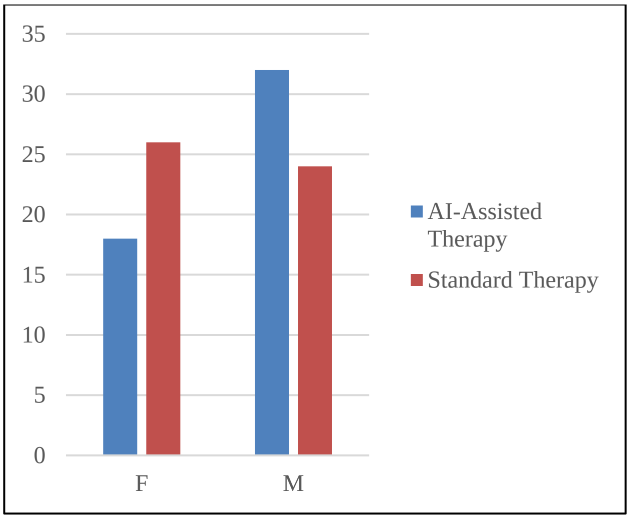

Figure 2: Count of patient ID by gender and group (AI-assisted vs standard therapy).

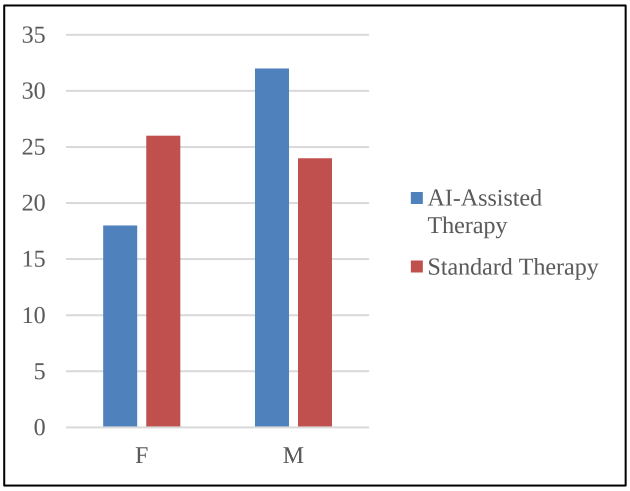

Figure 3: Sum of change in HbA1c (%) by gender and group (AI-assisted vs standard therapy).

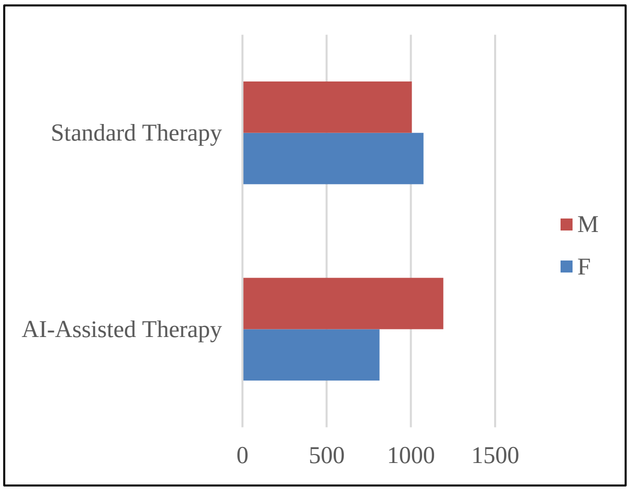

Figure 4: Sum of age by group and gender (standard vs AI-assisted therapy).

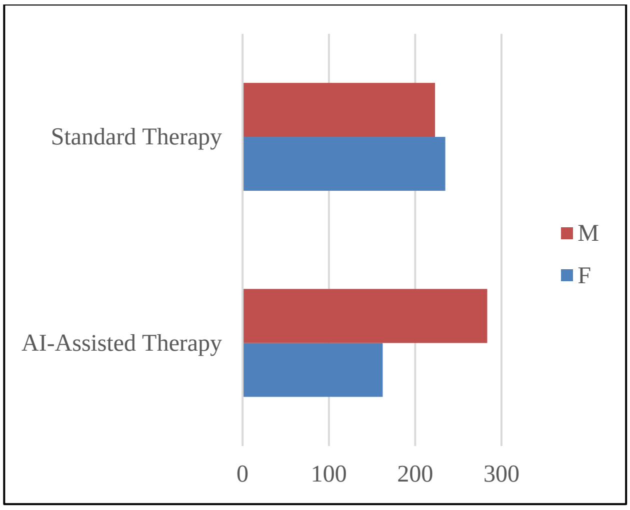

Figure 5: Sum of initial HbA1c (%) by group and gender.

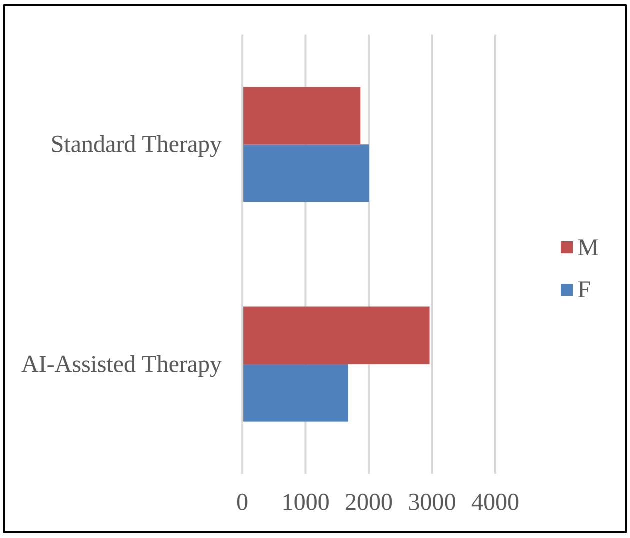

Figure 6: Sum of adherence rate (%) by group and gender (standard vs. AI-assisted therapy).

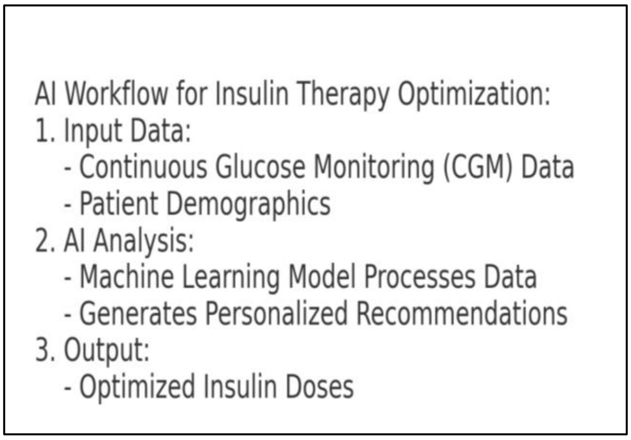

Figure 7: AI workflow for insulin therapy optimization.

Table 1: Baseline characteristics.

Characteristic	AI-Assisted therapy (Mean±SD)	Standard therapy (Mean±SD)	P value
Age (in years)	45.2±12.4	46.0±11.8	>0.05
Gender (M/F)	52/48	50/50	>0.05
Initial HbA1c (%)	9.1±1.2	9.0±1.3	>0.05

DISCUSSION

Findings align with studies like Heinemann et al, demonstrating AI's role in improving glycemic control.[7-9] Unlike Bergenstal et al, who found significantly higher adherence rates, our study showed marginal improvement (AI: 88% vs. Standard 82%, p=0.08). While AI-driven therapy shows promise, a larger multi-center study is needed to confirm long-term effectiveness.[10-12]

Study limitations were small sample size, single-center study, short follow-up duration.

CONCLUSION

AI and ML-based insulin optimization significantly improve glycaemic control, reduce hypoglycemia, and enhance patient satisfaction. These findings support AI's integration into routine diabetes management.

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Conflict of interest: None declared
Ethical approval: Not required

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