Inhaled Insulin in Pediatric Diabetes Results of the INHALE-1 Trial

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OBJECTIVE

To assess efficacy and safety in pediatric subjects with Type 1 Diabetes with inhaled Technosphere Insulin compared to Rapid Acting Insulin Analogs (RAA) over 26 weeks

CONCLUSIONS

- INHALE-1 results support the safety of inhaled TI in a pediatric population with Type 1 Diabetes
- TI is an important mealtime insulin alternative to injected RAA for youth with diabetes

INTRODUCTION

Inhaled Technosphere Insulin (TI) has an ultra-rapid acting profile, due to its unique pharmacokinetic and pharmacodynamic properties, resulting in a much faster time-to-peak effect and clearance compared to subcutaneously (SC) administered rapid-acting insulin analogs (RAA).

TI is approved for use in adults in USA, India, and Brazil and is available in three color-coded dosage cartridges: 4U (blue), 8U (green), and 12U (yellow)[1].

METHODS

MKC-TI-155 Part 2 Study Design

MKC-TI-155 Part 2 is a Phase 3, open-label, randomized clinical study evaluating the efficacy and safety of TI + basal insulin versus injectable RAA insulin + basal insulin in pediatric subjects with type 1 or type 2 diabetes mellitus. Subjects were randomized and received 26 weeks of treatment according to their treatment group. 1) TI group: TI in combination with a basal insulin 2) RAA injection group: RAA insulin in combination with a basal insulin. Both groups used real-time CGM. Primary Endpoint: Change in HbA1c from baseline to Week 26, for noninferiority assessment.

Eligibility Criteria

- Age 4 to <18 years
- T1D or T2D clinical diagnosis
- Used insulin for at least 6 months for T1D or at least 3 months for T2D
- MDI for at least 2 weeks
- HbA1c ≥7.0% and ≤11.0%
- At least 2 units RAA per meal

RESULTS

Table 1. Baseline Characteristics

Age *mean*	12.6 yrs (range 4-17)
Female	38%
T1D/T2D	225 (98%) / 5 (2%)
Mean Diabetes Duration	4.5 yrs (range 0.5-15yrs)
Parent Education <BA	45%
Annual Household Income <100K	44%
Private Insurance	67%
BMI *mean percentile / ≥95th%*	74 / 23%

230 study participants were randomized, N=117 in the TI group and N=113 in the RAA group. In the TI Group, N=105 completed 26 weeks and in the RAA Group, N=108 completed 26 weeks, Figure 2.

Figure 1. Race and Ethnicity

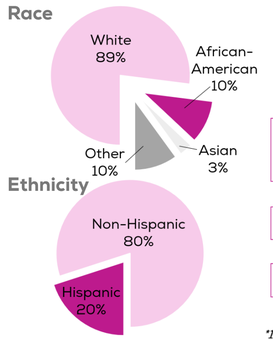
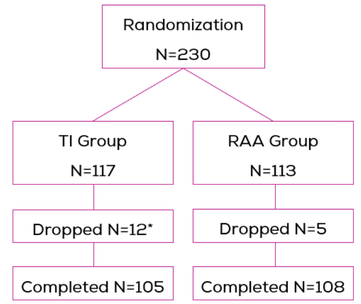


Figure 2. Study Completers



15 additional participants stopped TI but completed the trial

Efficacy

Between group comparison of HbA1c from Baseline to Week 26 resulted in a treatment difference of 0.18% (95% CI −0.10 to 0.43), p=0.091 for non-inferiority (NIM margin 0.4%), Figure 2. A sensitivity analysis excluding one outlier from the TI arm resulted in a treatment difference of 0.14% (95% CI −0.10 to 0.37), p=0.016 for non-inferiority, Figure 3.

Mean CGM glucose by hour resulted in similar trend between TI and RAA, Figure 4.

Figure 3. HbA1c Primary Endpoint

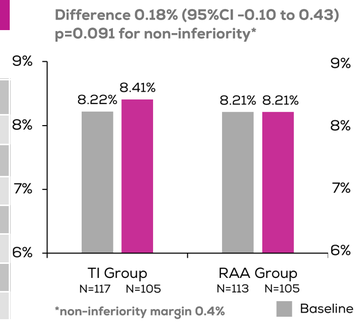


Figure 4. HbA1c Sensitivity Analysis

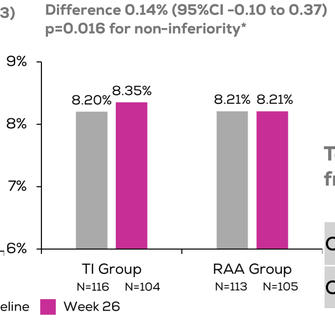
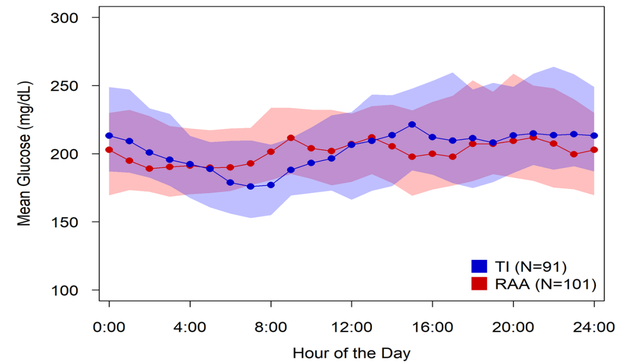


Figure 5. Mean Glucose by Hour of the Day at 26 Weeks



Safety

No new safety signals identified in the pediatric study including adverse events, hypoglycemia, and FEV1.

Table 2. Summary of Adverse Outcomes

	TI (n=117)	RAA (n=113)
All Adverse Events (AEs) N Events	234	191
# of Participants with ≥ 1 AE	88 (75%)	74 (65%)
Severe Hypoglycemia Events	2	1
Diabetic Ketoacidosis Events	0	1
Other Serious Adverse Events	1	2

Figure 6. Change in FEV1 Percent Predicted from Baseline to Week 26

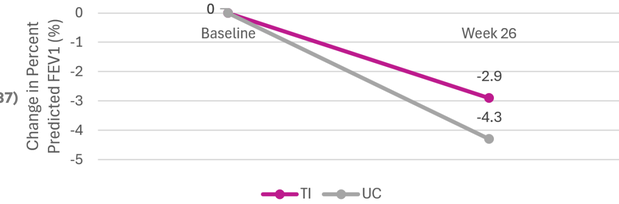


Table 3. Change in % CGM Time Below Range from Baseline to Week 26

	TI (n=117)	RAA (n=113)
Change in Percent Time <70 mg/dL	0.10%	0.10%
Change in Percent Time <54 mg/dL	0.00%	0.10%

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1. Afrezza (insulin human) Inhalation Powder Prescribing Information. MannKind Corporation. Danbury, CT; February 2023.

Original Presentation: "Inhaled Insulin in Pediatric Diabetes Results of the INHALE-1 Trial," presented at ADA, 2025, Chicago, IL USA by Michael Haller.