Safety, Pharmacokinetics, and Pharmacodynamics of CT-996, an Oral Small-Molecule, Signal-Biased GLP-1 Receptor Agonist Over 4 Weeks in Adults With Obesity

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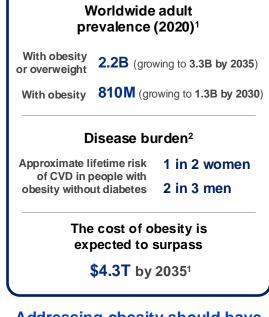
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Disclosures

- MV Chakravarthy, J Wu, and S Toussaint Touson are full-time employees of Roche and may hold Roche stock and/or stock options
- **P Wabnitz** is an employee of Avance Clinical, which has a consulting agreement with Carmot/Roche
- MA Elliott is a former employee of Carmot Therapeutics (now Roche), currently employed by ME Clinical Research Consulting, LLC
- CC Chang is an employee of Nucleus Network, which has a consulting agreement with Carmot/Roche. She is also an employee of Alfred Hospital (Melbourne, Victoria, Australia) and Monash University (Melbourne, Victoria, Australia)
- J Lickliter is an employee of Nucleus Network, which has a consulting agreement with Carmot/Roche

Challenges and Opportunities in the Treatment of Obesity



Addressing obesity should have a broad impact on population health and healthcare cost



Approved medications are effective for weight loss^{3–5} However, challenges remain:

Access^{6,7} | Adherence⁷ | Tolerability^{6,7}



Need for simpler, cost-effective solutions that can be applied at scale with adequate global reach

Oral treatment options with convenient dosing

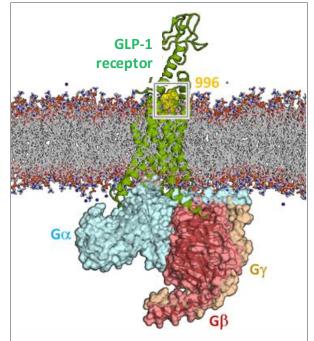
Efficacy = injectable GLP-1 receptor agonists

B, billion; CVD, cardiovascular disease; M, million; T, trillion.

1. World Obesity Federation. World Obesity Atlas 2024. Accessed August 14, 2024. https://data.worldobesity.org/publications/WOF-Obesity-Atlas-v7.pdf. 2. Fox CS, et al. Diabetes Care. 2008;31(8):1582–1584. 3. Rosenstock J, et al. Lancet. 2021;398:143–155. 4. Davies M, et al. Lancet. 2021;397:971–984. 5. Jastreboff AM, et al. N Engl J Med. 2022;387(3):205–216. 6. Brandfon S, et al. Cureus. 2023;15(10): e46623. 7. Gleason PP, et al. J Manag Care Spec Pharm. 2024;30(8):860–867. 8. Rybelsus (semaglutide). Prescribing information. Novo Nordisk; 2021. Accessed August 2, 2024. https://www.accessed.https//duregatifa.edu/data/21/21307:971–984.pdf.

CT-996 Is a Small-Molecule Oral GLP-1 Receptor Agonist

Intended for once-daily oral administration for T2D, obesity, and obesity-related comorbidities



Courtesy of: R Chowdhury, Roche-Genentech

Required design elements to achieve meaningfully differentiated attributes

Highly potent, cAMP biased, selective GLP-1 receptor agonist

Robust in vivo efficacy in preclinical models

High oral bioavailability and PK to support QD dosing with no significant food effect

Low DDI potential

No GSH adduct formation

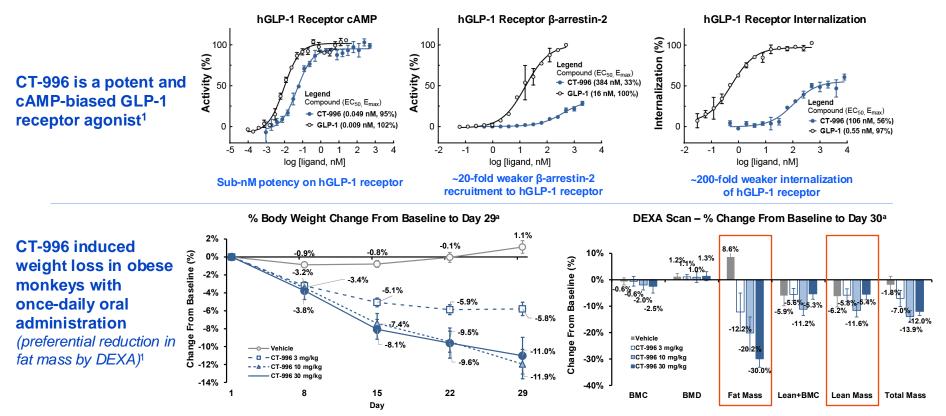
No significant toxicology findings and with large exposure margins



cAMP, cyclic adenosine monophosphate; DDI, drug-drug interactions; GLP-1, glucagon-like peptide-1; GSH, glutathione; PK, pharmacokinetic; QD, once daily; T2D, type 2 diabetes. 1. Luo J, et al. Efficacy of CT-996, an Oral Small Molecule GLP-1 Receptor Agonist, in Human GLP-1 Receptor Knock-in Mice and Obese Cynomolgus Monkeys. Poster presented at: the American Diabetes Association 84th Scientific

Sessions; June 21-24, 2024; Orlando, FL. Poster 771-P. 2. Roche Therapeutics, Data on File.

CT-996: In Vitro and In Vivo Properties



BMC, bone mineral content; BMD, bone mineral density; cAMP, cyclic adenosine monophosphate; DEXA, dual-energy X-ray absorptiometry; EC₅₀, half maximal effective concentration; E_{max}, maximum effect change; GLP-1, glucagon-like peptide-1; hGLP-1, human GLP-1; nM, nanomolar.

Data are presented as mean (SE).

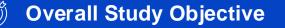
1. Luo J, et al. Efficacy of CT-996, an Oral Small Molecule GLP-1 Receptor Agonist, in Human GLP-1 Receptor Knock-in Mice and Obese Cynomolgus Monkeys. Poster presented at: the American Diabetes Association 84th Scientific Sessions; June 21–24, 2024; Orlando, FL. Poster 771-P.

an = 6 per group.

Study CT-996-201

First-in-Human, 3-Part, Multi-Cohort, Phase I, Randomized, Double-Blind, Placebo-Controlled Study

Part 1: SAD (Overweight/Obesity, n = 40) | Part 2: MAD (Obesity, n = 25) | Part 3: MAD (Obesity + T2D, n = ~30)



To investigate the safety, tolerability, pharmacokinetics, and pharmacodynamics of single and multiple ascending doses (up to 4 weeks) of CT-996 in adults with overweight or obesity, with or without T2D

This presentation focuses on results from the 4-week MAD portion of the study in adults with obesity without T2D

CT-996-201 MAD: 3 Sequential Dose Escalation Cohorts Over 4 Weeks

Single-center MAD study conducted in Australia^a

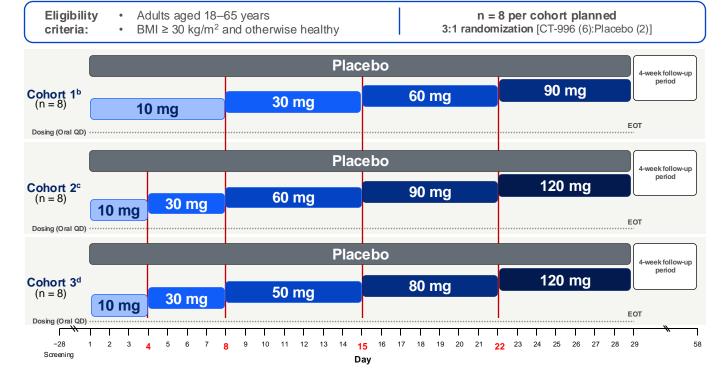
Primary endpoint

- Safety and tolerability

Secondary endpoints

- -PK
- Weight loss
- Glucose homeostasis

Flexibility was provided to attain target doses



BMI, body mass index; d, day; EOT, end of trial; MAD, multiple ascending dose; PK, pharmacokinetic; QD, once daily.

aNCT05814107; 3 MAD study cohorts were run sequentially.

^bCohort 1 (CT-996 10/30/60/90): planned 10/30/60/90 mg: each dose for 7 days.

°Cohort 2 (CT-996 10/30/60/90/120): planned 10 mg x 3d, 30 mg x 4d, 60 mg x 7d, 90 mg x 7d, 120 mg x 7d.

^dCohort 3 (CT-996 10/30/50/80/120): planned 10 mg × 3d, 30 mg × 4d, 50 mg × 7d, 80 mg × 7d, 120 mg × 7d.

Rationale for Rapid Up-Titration Design in the Phase 1 Study

"Fail fast" approach early in development

Titration approaches that "start low and go slow" have been known to improve the tolerability profile of incretin therapies

Objective >

Rapid determination if unexpected safety signals or efficacy patterns might exist – Early de-risking (primarily for safety/tolerability; not for maximizing efficacy)



Brisk up-titration

- Higher starting dose (10 mg), frequent (3 days to weekly), and 2-3x dose step-ups



Reasonable safety and tolerability in this setting, together with robust efficacy, provide support for continued investigation of CT-996 in studies of longer duration and larger sample sizes using slower titration approaches

The MAD Portion of the Study Included Participants With Obesity and Without T2D

	Study enrolled 25 participants in 3 sequential cohorts 3:1 randomization [CT-996 (6):Placebo (2)] in each cohort			
Category	Placebo (n = 6)	Cohort 1ª (n = 6)	Cohort 2 ^b (n = 7)	Cohort 3 ^c (n = 6)
Age, years	42.8 (9.3)	40.0 (8.6)	34.6 (8.6)	29.8 (8.8)
Sex, female, n (%)	4 (66.7)	4 (66.7)	3 (42.9)	4 (66.7)
Race, White, n (%)	5 (83.3)	4 (66.7)	5 (71.4)	4 (66.7)
Weight, kg	101.3 (21.2)	94.1 (8.0)	107.3 (19.4)	101.2 (18.7)
BMI, kg/m²	36.2 (3.5)	32.9 (2.5)	36.3 (3.9)	33.9 (3.3)
HbA1c, %	5.1 (0.4)	5.1 (0.2)	5.2 (0.5)	4.8 (0.3)
Fasting Glucose, mmol/L	5.3 (0.2)	5.2 (0.3)	5.0 (0.2)	4.9 (0.3)
HOMA-IR	2.5 (0.9)	2.0 (0.9)	3.1 (1.9)	2.6 (0.5)

BMI, body mass index; d, day; HbA1c, glycated hemoglobin A1c; HOMA-IR, Homeostasis Model Assessment of Insulin Resistance; MAD, multiple ascending dose; T2D, type 2 diabetes. Values represent means (SD). HOMA-IR ≥ 2.0 signifies insulin resistance.^{1,2}

1. Lee S, et al. J Clin Transl Endocrinol. 2019; 19:100210. 2. Gayoso-Diz P, et al. BMC Endocr Disord. 2013; 13:47.

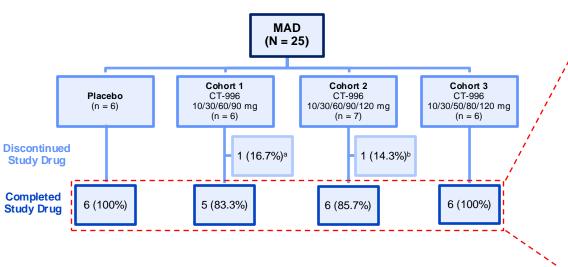
aCohort 1 (CT-996 10/30/60/90): planned 10/30/60/90 mg: each dose for 7 days (actual: all participants followed planned titration path).

Chort 2 (CT-996 10/30/60/90/120): planned 10 mg x 3d, 30 mg x 4d, 60 mg x 7d, 90 mg x 7d, 120 mg x 7d (actual: 2 participants needed 3 additional days at 90 mg before escalating to 120 mg; 1 participant remained at 60 mg).

•Cohort's (CT-996 10/30/50/80/120): planned 10 mg x 3d, 30 mg x 4d, 50 mg x 7d, 80 mg x 7d, 120 mg x 7d (actual: all except 1 participant followed the planned path; 1 participant decreased their dose from 50 mg to 30 mg to 10 mg and completed the study at 10 mg).

92% of Participants Completed Study Drug Treatment

No study drug-related discontinuations



Participant Disposition

Titrations in study completers who received CT-996

1	Cohort	ohort Actual vs planned dosing		
	Cohort 1	All participants followed the planned titration path		
	Cohort 2	2 participants needed 3 additional days at 90 mg before escalating to 120 mg; 1 remained at 60 mg		
	Cohort 3	All followed the planned titration path, except for 1 participant – decreased dose from 50 mg to 30 mg to 10 mg and completed the study at 10 mg		

Most if not all participants in cohorts 1 and 3 achieved and maintained their respective target dose(s) for the intended 1-week duration compared to those in cohort 2

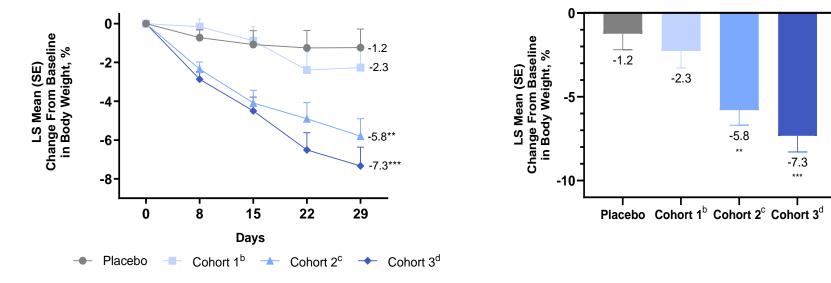
MAD, multiple ascending dose.

aParticipant discontinued due to a Grade 2 psychotic disorder (underlying history of schizophrenia), not related to study drug.

^bParticipant discontinued due to a Grade 1 right bundle branch block (body weight ~140 kg, history of obstructive sleep apnea), not related to the study drug.

Once-Daily Oral Dosing of CT-996 Over 4 Weeks Yielded Weight Loss of up to 7.3%

Percent change in body weight appears to be linear over time (~2.0% [~1.8 kg] per week), with no plateau



P* < 0.01^a; *P* < 0.001.^a

d, day; LS, least squares.

^aP values are nominal and have not been adjusted for multiplicity.

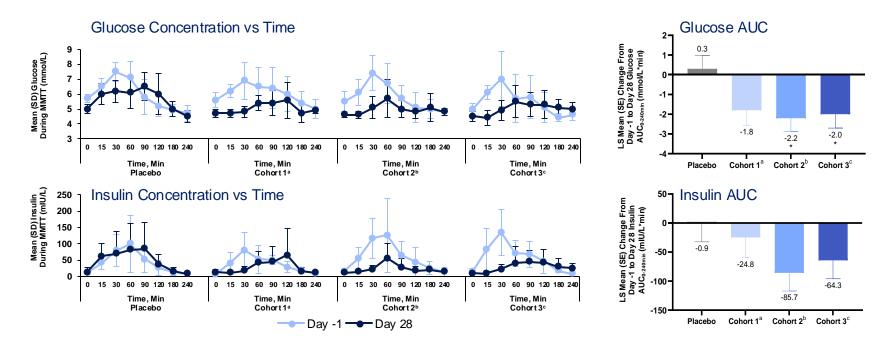
^bCohort 1 (CT-996 10/30/60/90): planned 10/30/60/90 mg: each dose for 7 days (actual: all participants followed planned titration path)

•Cohort 2 (CT-996 10/30/60/90/120): planned 10 mg x 3d, 30 mg x 4d, 60 mg x 7d, 90 mg x 7d, 120 mg x 7d (actual: 2 participants needed 3 additional days at 90 mg before escalating to 120 mg; 1 participant remained at 60 mg). •Cohort 3 (CT-996 10/30/50/80/120): planned 10 mg x 3d, 30 mg x 4d, 50 mg x 7d, 80 mg x 7d, 120 mg x 7d (actual: all except 1 participant followed the planned path; 1 participant decreased their dose from 50 mg to 30 mg to 10 mg and completed the study at 10 mg).

Clinically meaningful placebo-adjusted weight

loss of -6.1% for cohort 3 (P < 0.001)^a

CT-996 Treatment Over 28 Days Resulted in Reductions in Blood Glucose and Insulin During a Mixed Meal Tolerance Test



*P < 0.05.d

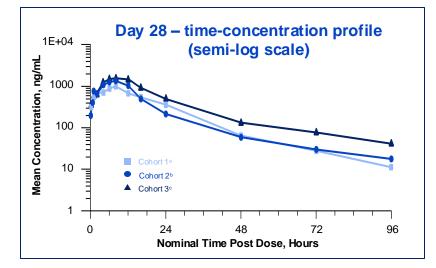
AUC, area under the concentration-time curve; d, day; LS, least squares; Min, minutes; MMTT, mixed meal tolerance test.

aCohort 1 (CT-996 10/30/60/90): planned 10/30/60/90 mg: each dose for 7 days (actual: all participants followed planned titration path)

^bCohort 2 (CT-996 10/30/60/90/120): planned 10 mg x 3d, 30 mg x 4d, 60 mg x 7d, 90 mg x 7d, 120 mg x 7d (actual: 2 participants needed 3 additional days at 90 mg before escalating to 120 mg; 1 participant remained at 60 mg). ^cCohort 3 (CT-996 10/30/50/80/120): planned 10 mg x 3d, 30 mg x 4d, 50 mg x 7d, 80 mg x 7d, 120 mg x 7d (actual: all except 1 participant followed the planned path; 1 participant decreased their dose from 50 mg to 30 mg to 10 mg and completed the study at 10 mg).

^dP values are nominal and have not been adjusted for multiplicity.

PK Parameters Support Once-Daily Dosing



Day 28 – PK parameters						
Cohort 1 ^a Cohort 2 ^b		Cohort 3 ^c				
1070	1550	1620				
(275)	(752)	(1130)				
22,900	23,900	37,900				
(3560)	(13,400)	(27,900)				
9.6	8.0	9.2				
(3.6)	(2.8)	(2.7)				
17.1	18.7	21.8				
(5.3)	(6.2)	(7.3)				
1.1	1.0	0.4				
(0.6)	(0.6)	(0.3)				
	Cohort 1ª 1070 (275) 22,900 (3560) 9.6 (3.6) 17.1 (5.3) 1.1	Cohort 1 ^a Cohort 2 ^b 1070 (275) 1550 (752) 22,900 (3560) 23,900 (13,400) 9.6 (3.6) 8.0 (2.8) 17.1 (5.3) 18.7 (6.2) 1.1 1.0				

C_{max} and AUC were generally dose proportional within each MAD cohort

No significant accumulation of CT-996 in plasma Low urinary fractional excretion (< 1.1% over 24 hours) No meaningful food effect on PK profile (from SAD portion of the study)

AUC, area under the concentration-time curve; AUC_{last}, area under the concentration-time curve from time 0 to the last measurable concentration; C_{max}, maximum observed concentration; d, day; Fe₀₋₂₄, fraction of dose excreted in urine; h, hour; MAD, multiple ascending dose; PK, pharmacokinetic; SAD, single ascending dose; t_{1/2}, elimination half-life; T_{max}, time to maximum concentration.

Data for cohorts 2 and 3 are included only for participants who completed the study at the 120-mg dose.

aCohort 1 (CT-996 10/30/60/90): planned 10/30/60/90 mg: each dose for 7 days (actual: all participants followed planned titration path).

^bCohort 2 (CT-996 10/30/60/90/120): planned 10 mg x 3d, 30 mg x 4d, 60 mg x 7d, 90 mg x 7d, 120 mg x 7d (actual: 2 participants needed 3 additional days at 90 mg before escalating to 120 mg; 1 participant remained at 60 mg). ^cCohort 3 (CT-996 10/30/50/80/120): planned 10 mg x 3d, 30 mg x 4d, 50 mg x 7d, 80 mg x 7d, 120 mg x 7d (actual: all except 1 participant followed the planned path; 1 participant decreased their dose from 50 mg to 30 mg to 10 mg and completed the study at 10 mg).

All TEAEs Were Mild or Moderate Across MAD Cohorts

- All TEAEs were mild or moderate in severity; no severe (Grade 3) TEAEs
- 1 serious AE (unrelated to study drug)
- No discontinuations related to study drug

Category, n (%)	Placebo (n = 6)	Cohort 1 ^a (n = 6)	Cohort 2 ^b (n = 7)	Cohort 3 ^c (n = 6)
Participants with at least 1 TEAE	6 (100)	6 (100)	7 (100)	6 (100)
Serious TEAEs	0	1 (16.7) ^d	0	0
Discontinuations due to TEAE	0	1 (16.7) ^d	1 (14.3) ^e	0
Severity				
Grade 1	4 (66.7)	4 (66.7)	4 (57.1)	3 (50.0)
Grade 2	2 (33.3)	2 (33.3)	3 (42.9)	3 (50.0)
Grade 3	0	0	0	0

AE, adverse event; d, day; MAD, multiple ascending dose; TEAE, treatment-emergent adverse event.

aCohort 1 (CT-996 10/30/60/90): planned 10/30/60/90 mg: each dose for 7 days (actual: all participants followed planned titration path).

Cohort 2 (CT-996 10/30/60/90/120): planned 10 mg x 3d, 30 mg x 4d, 60 mg x 7d, 90 mg x 7d, 120 mg x 7d (actual: 2 participants needed 3 additional days at 90 mg before escalating to 120 mg; 1 participant remained at 60 mg). Cohort 3 (CT-996 10/30/50/80/120): planned 10 mg x 3d, 30 mg x 4d, 50 mg x 7d, 80 mg x 7d, 120 mg x 7d (actual: all except 1 participant followed the planned path; 1 participant decreased their dose from 50 mg to 30 mg to 10 mg and completed the study at 10 mg).

dOne participant reported a Grade 2 psychotic disorder, not related to study drug.

•One participant reported a Grade 1 right bundle branch block, not related to study drug.

The Most Common TEAEs Were GI-Related, Consistent With Other Incretin Therapies

- Frequency of GI-related TEAEs consistent with brisk up-titration and early stage of development*
- Higher-dose cohorts exhibited more TEAEs, and a more gradual titration tended to improve tolerability

Most Frequently Reported ^a	Placebo	Cohort 1 [°]	Cohort 2 ^d	Cohort 3 ^e
GI TEAEs⁵ by PT, n (%)	(n = 6)	(n = 6)	(n = 7)	(n = 6)
Nausea	1 (16.7)	5 (83.3)	6 (85.7)	5 (83.3)
Gastroesophageal reflux disease	0	2 (33.3)	6 (85.7) —	→ 1 (16.7)
Vomiting	1 (16.7)	1 (16.7)	5 (71.4)	→ 2 (33.3)
Constipation	1 (16.7)	2 (33.3)	4 (57.1)	→ 3 (50.0)
Abdominal pain	1 (16.7)	0	4 (57.1)	→ 1 (16.7)
Abdominal distention	1 (16.7)	1 (16.7)	3 (42.9) —	→ 0
Diarrhea	1 (16.7)	0	3 (42.9)	3 (50.0)
Decreased appetite	1 (16.7)	1 (16.7)	1 (14.3)	5 (83.3)

*High rates of GI-related AEs have typically been seen with oral incretin therapies early in development,^{1,2} which generally improve with slower titrations over time³

AE, adverse events; d, day; GI, gastrointestinal; PT, preferred term; TEAE, treatment-emergent adverse event.

1. Pratt E, et al. Diabetes Obes Metab. 2023;25(9):2642–2649. 2. Saxena AR, et al. Nat Med. 2021;27:1079–1087. 3. Whatton S, et al. N Engl J Med. 2023;389:877–888.

^a≥ 2 participants in any treatment group.

^bOther common (≥ 2 participants in any treatment group) AEs included dysmenorrhea, chills, photosensitivity reaction, and presyncope.

cOhort 1 (CT-996 10/30/60/90): planned 10/30/60/90 mg: each dose for 7 days (actual: all participants followed planned titration path)

^aCohort 2 (CT-996 10/30/60/90/120): planned 10 mg × 3d, 30 mg × 4d, 60 mg × 7d, 90 mg × 7d, 120 mg × 7d (actual: 2 participants needed 3 additional days at 90 mg before escalating to 120 mg; 1 participant remained at 60 mg). ^aCohort 3 (CT-996 10/30/50/80/120): planned 10 mg × 3d, 30 mg × 4d, 50 mg × 7d, 80 mg × 7d, 120 mg × 7d (actual: all except 1 participant followed the planned path; 1 participant decreased their dose from 50 mg to 30 mg to 10 mg and completed the study at 10 mg).

GI-Related TEAEs Were Mostly Mild

<u>TEAE, n (%)</u>	Placebo (n = 6)	Cohort 1ª (n = 6)	Cohort 2 ^b (n = 7)	Cohort 3 ^c (n = 6)
Nausea	1 (16.7)	5 (83.3)	6 (85.7)	5 (83.3)
Grade 1	1 (16.7)	5 (83.3)	6 (85.7)	5 (83.3)
Grade 2	0	0	0	0
→ Grade 3	0	0	0	0
Constipation	1 (16.7)	2 (33.3)	4 (57.1)	3 (50.0)
Grade 1	1 (16.7)	2 (33.3)	3 (42.9)	2 (33.3)
Grade 2		0	1 (14.3)	1 (16.7)
→ Grade 3	0	0	0	0
Vomiting Grade 1	1 (16.7) 1 (16.7)	1 (16.7)	5 (71.4) 4 (57.1)	2 (33.3) 1 (16.7)
Grade 2		1 (16.7)	1 (14.3)	1 (16.7)
→ Grade 3	0	0	0	0
Diarrhea	1 (16.7)	0	3 (42.9)	3 (50.0)
Grade 1	1 (16.7)	0	2 (28.6)	3 (50.0)
Grade 2		0	1 (14.3)	0
Grade 3	0	0	0	0

→ There were no Grade 3 (severe) GI-related AEs

 No more than 1 participant in each cohort experienced Grade 2 AEs

GI events tended to improve over time (lower frequency-to-no events during days 23–29)

AE, adverse event; d, day; GI, gastrointestinal; TEAE, treatment-emergent adverse event.

aCohort 1 (CT-996 10/30/60/90): planned 10/30/60/90 mg: each dose for 7 days (actual: all participants followed planned titration path).

^bCohort 2 (CT-996 10/30/60/90/120): planned 10 mg x 3d, 30 mg x 4d, 60 mg x 7d, 90 mg x 7d, 120 mg x 7d (actual: 2 participants needed 3 additional days at 90 mg before escalating to 120 mg; 1 participant remained at 60 mg). ^cCohort 3 (CT-996 10/30/50/80/120): planned 10 mg x 3d, 30 mg x 4d, 50 mg x 7d, 80 mg x 7d, 120 mg x 7d (actual: all except 1 participant followed the planned path; 1 participant decreased their dose from 50 mg to 30 mg to 10mg and completed the study at 10 mg).

Despite Rapid Up-Titration Approach, No Unexpected Safety Signals Were Observed

Changes in laboratory parameters and vital signs



- Laboratory investigations were generally NCS
- No signals of liver injury
- 1 participant in cohort 3 experienced mild-to-moderate lipase elevation (dosing was not changed or interrupted), reported as probably related to study drug^a



- ECG findings (including QTc) were NCS, except for 1 participant who experienced an RBBB, reported as not related to study drug^b
- Systolic blood pressure tended to decrease (up to 13 mmHg), and heart rate tended to increase (up to 15 bpm), consistent with the incretin class

bpm, beats per minute; ECG, electrocardiogram; NCS, nonclinically significant; QTc, corrected QT interval; RBBB, right bundle branch block.

^aParticipant was monitored with repeat amylase and lipase testing, and the issue was determined to be resolved.

^bECG parameters were generally within normal range over the 4-week period, and changes were not clinically significant, except for 1 participant in cohort 2 who experienced 1 event of isolated RBBB (participant had morbid obesity with body weight ~140 kg with obstructive sleep apnea). A complete cardiac evaluation was performed, including cardiac enzymes and echo cardiography, all of which were normal. The participant was discontinued for abundance of caution. Not related to study drug.

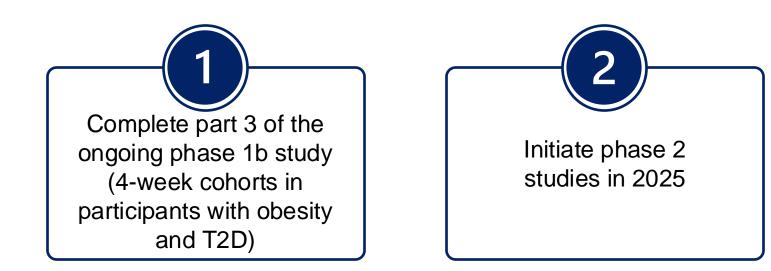
Summary

- CT-996 treatment produced robust weight loss of up to 7.3% (7 kg) over 4 weeks
 - Slowing the pace of titration in cohort 3 tended to yield more weight loss than cohort 2 → suggests slower titration approaches may not compromise the weight loss efficacy of CT-996
 - Magnitude of weight loss appears to be more dependent on an exposure threshold and the duration it can be maintained
- PK results support once-daily dosing of CT-996 (t_{1/2} ~17–22 hours), with a generally dose-dependent increase in plasma exposure and with no meaningful food effect on PK
- CT-996 exhibited a favorable safety profile and was generally well-tolerated up to 120 mg despite brisk up-titration over 4 weeks
 - AE profile is consistent with the incretin drug class at a similar (early) stage of development
 - Starting at doses ≤ 10 mg with a shallower (smaller dose increments) and longer (eg, 2–4 weeks at each dose level) titration regimen is expected to further improve the tolerability profile, as demonstrated with other incretins
 - Individualized dosing regimens can benefit and empower people living with obesity



Together, these data support the continued investigation of CT-996 in studies of longer duration with larger sample sizes and slower titrations

Next Steps



Acknowledgments



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