

# Evening Oral Insulin (ORMD-0801) Glycemic Effects in Uncontrolled T2DM Patients

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# FINANCIAL DISCLOSURE

**Presenter: Roy Eldor**

Oramed Pharmaceuticals: Medical consultant

**Alexander Fleming**

Oramed Pharmaceuticals: Scientific advisory board member

**Joel Neutel**

Integrium: Clinical Research Organization for this study

**Kenneth Homer**

Integrium: Clinical Research Organization for this study

**Miriam Kidron**

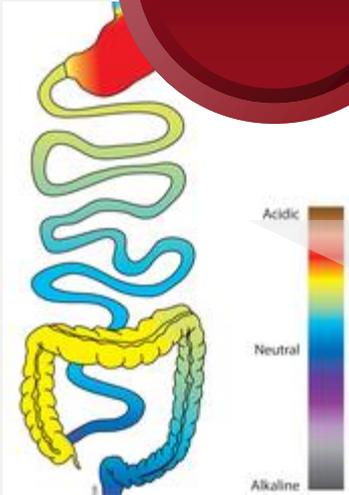
Oramed Pharmaceuticals: Chief Scientific Officer

**Julio Rosenstock**

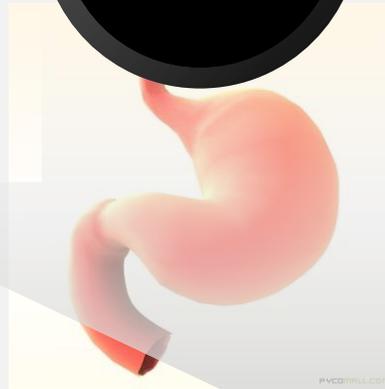
Oramed Pharmaceuticals: Scientific advisory board member

# FATE OF PROTEIN/PEPTIDES IN THE GIT

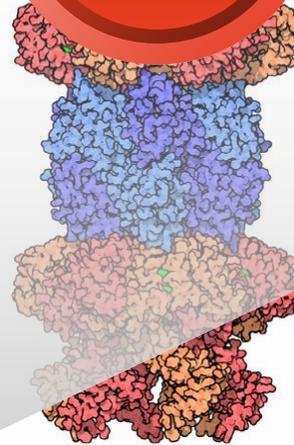
Harsh pH



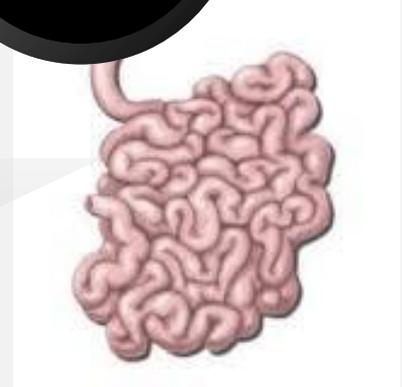
Mechanical challenges



Protease threat

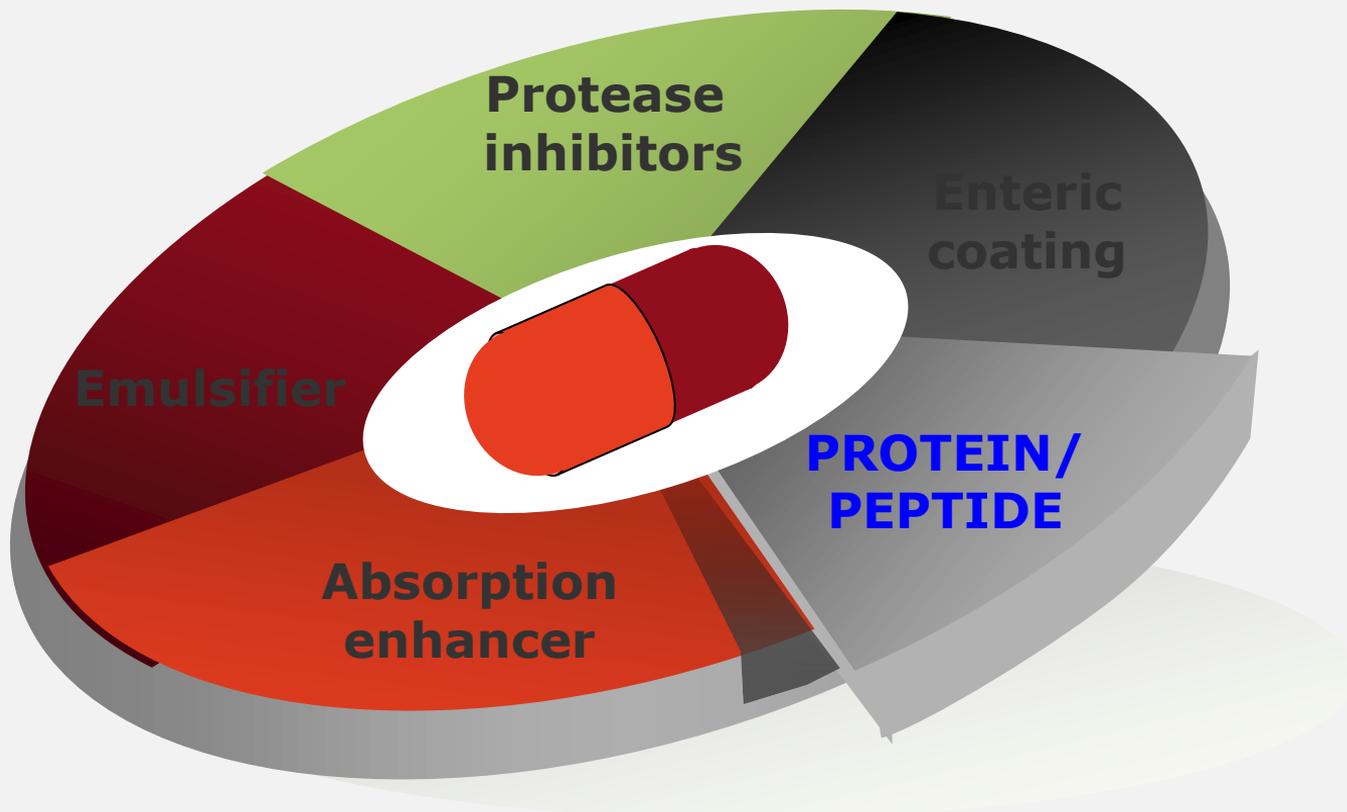


Absorption barrier



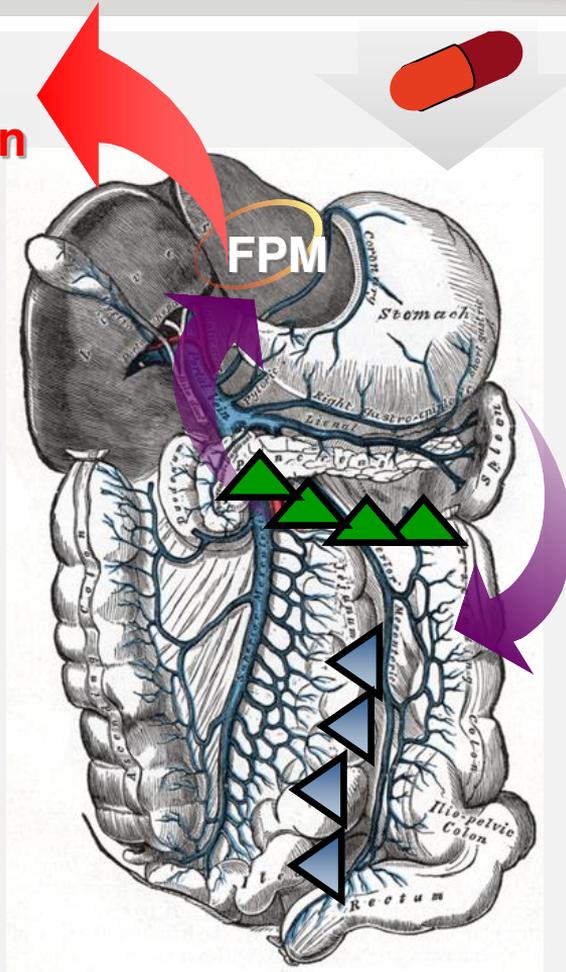
**Protein breakdown, low bioavailability**

## *Making needles needless*



# INSULIN ROUTE

Systemic circulation



20% of secreted insulin reaches the bloodstream



Portal/peripheral ratios are retained → lower risk of hypoglycemia

# BACKGROUND/OBJECTIVE

## ORAL INSULIN

Systemically administered insulin is associated with risk of hypoglycemia and weight gain. Portally infused insulin brings to a more rapid and pronounced suppression of hepatic glucose production, reduced fasting blood glucose concentrations and to reduced circulating peripheral insulin levels. Orally delivered insulin is expected to similarly mimic physiological gradients and natural sites of action.

## BARRIERS

Protein-based drugs are poorly absorbable owing to their high molecular weight and hydrophilicity. Furthermore, they are susceptible to mechanical and enzymatic degradation along the gastrointestinal tract (GIT). Numerous works have demonstrated the protective role of protease inhibitors (PIs) against degradative threats along the GIT, when incorporated in drug formulations.

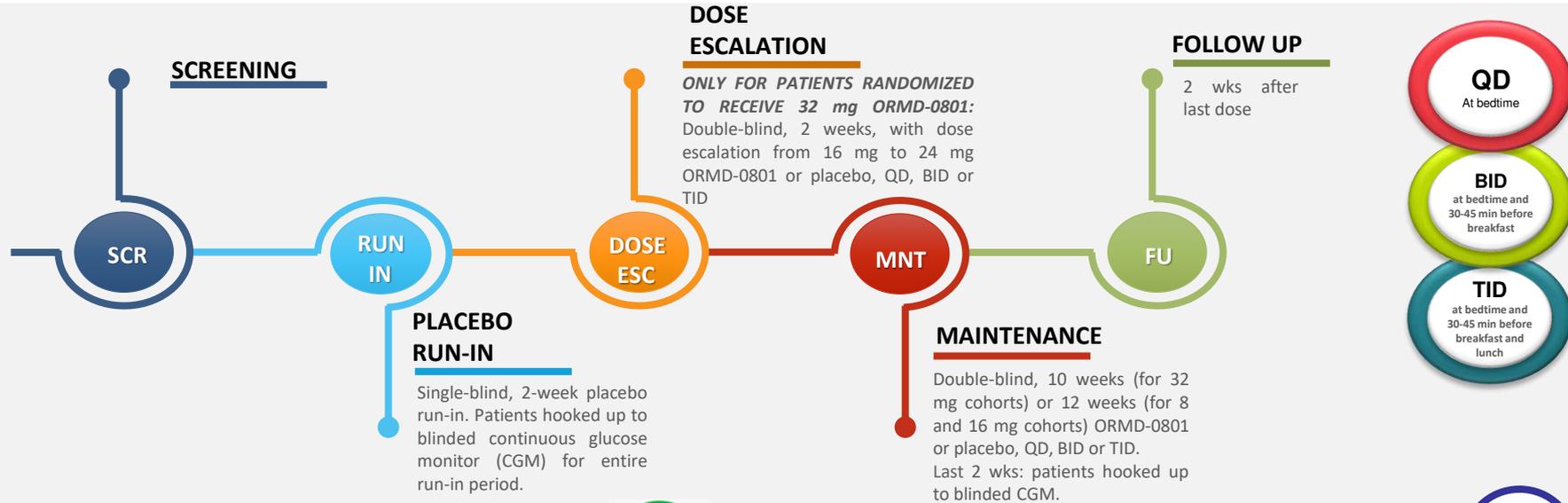
## ORMD-0801

ORMD-0801 is a novel oral human insulin formulation, which integrates both a species-specific protease inhibitor that provides a protective environ for active ingredients, and a potent absorption enhancer that promotes absorption of the active ingredient across the intestinal epithelium.

## OBJECTIVE

This randomized, placebo-controlled, multi-center, phase 2b, dose-finding study aimed to assess the efficacy of 12 weeks of 8, 16 and 32 mg ORMD-0801, administered once, twice or three times daily in T2DM subjects.

# STUDY DESIGN



## INCLUSION CRITERIA



- Adult patients, with T2DM diagnosis at least 6 months prior to study
- HbA1C  $\geq 7.5\%$
- Stable metformin dose  $\geq 1500$  mg or maximal tolerated dose for at least 3 months
- Taking up to two oral antidiabetics (SU, DPP-4, SGLT-2, or TZD), with stable dose for at least 3 months
- BMI  $\leq 40$  mg/kg<sup>2</sup>
- Renal function eGFR  $>30$  ml/min/1.73 m<sup>2</sup>
- Women not pregnant, use of effective contraceptive required, when relevant

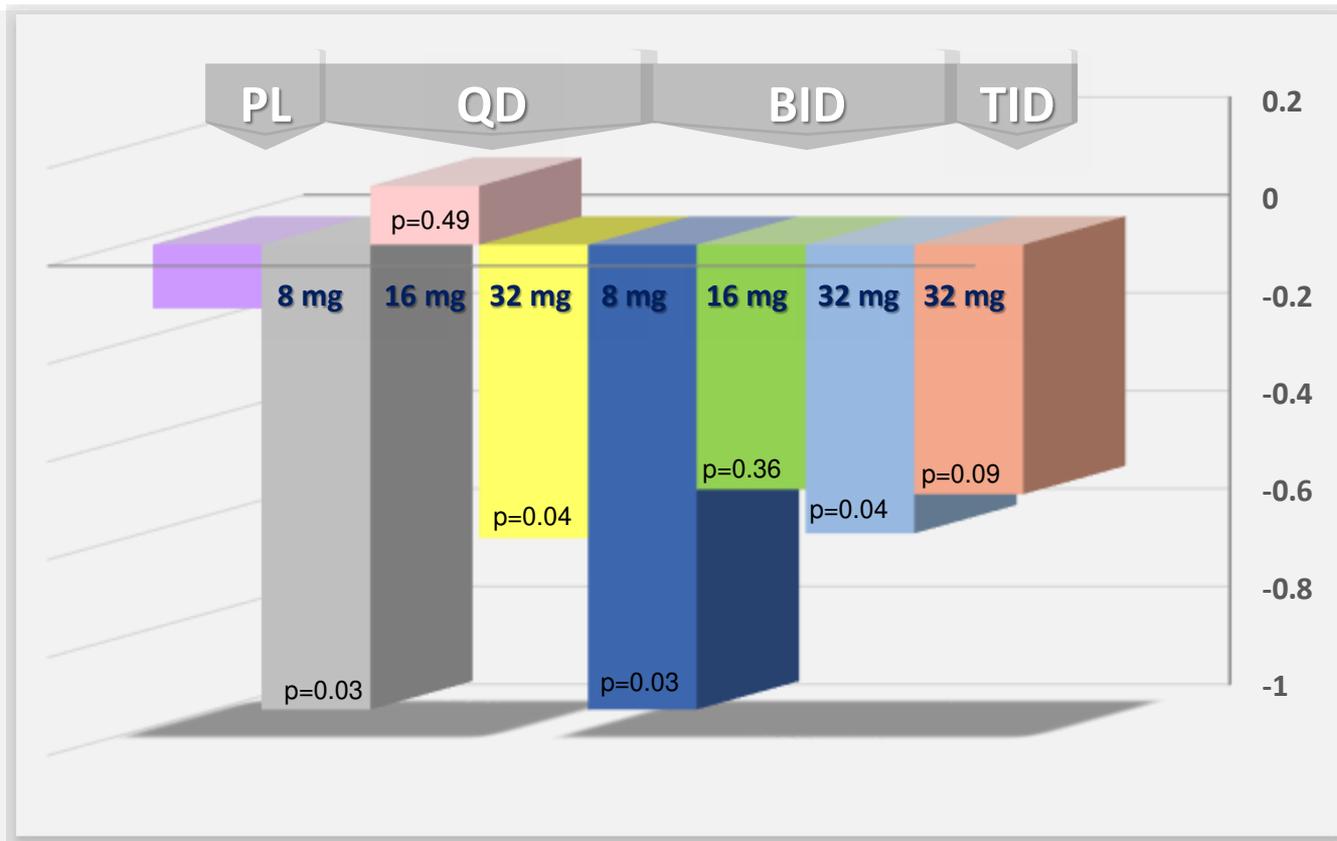
## EXCLUSION CRITERIA



- Use of GLP-1 agonist within 3 months of study
- Use of basal, pre-mix, or prandial insulin for more than 7 days within 6 months of study
- $>2$  episodes of hypoglycemia within 6 months of study
- History of hypoglycemic unawareness
- Uncontrolled or untreated severe hypertension



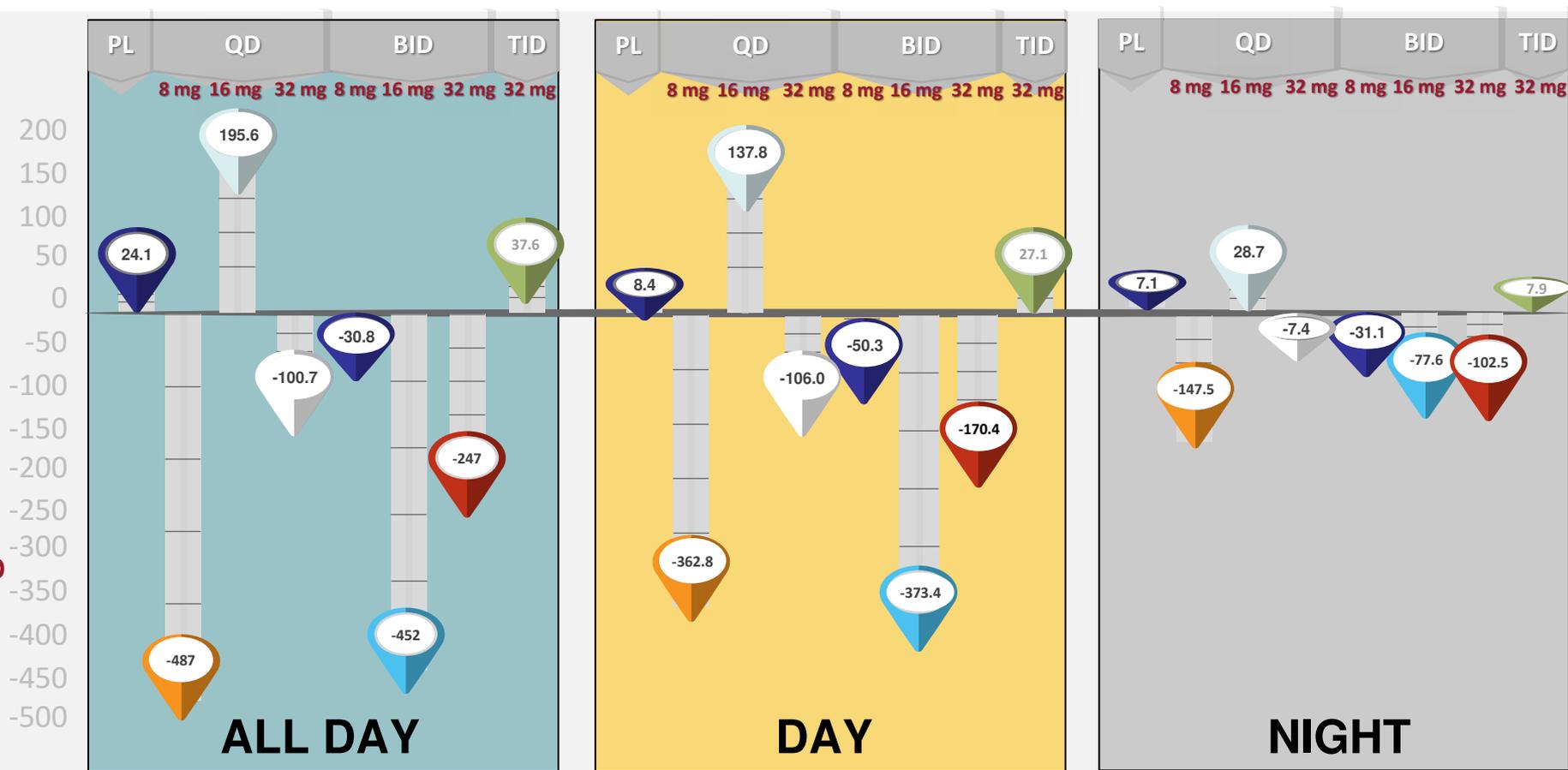
# RESULTS – HBA1C CHANGE FROM BASELINE – INTENT TO TREAT (ITT) POPULATION



**\* Least square means are presented.** \*\*The number of subjects at baseline and at 12-weeks differ.  
p-values obtained using Analysis of Covariance model with treatment as the primary effect and site, baseline value, metformin usage, sulfonylureas usage, and number of additional diabetes medications used as covariates.

# RESULTS – WEEKS 10-12 CONTINUOUS GLUCOSE AREA UNDER THE CURVE (MG\*H/DL) - ITT

Change from run-in AUC



# RESULTS – BODY WEIGHT (KG)

	PLACEBO	QD			BID			TID
		8 mg	16 mg	32 mg	8 mg	16 mg	32 mg	32 mg
Baseline	95.7 ± 5.3	109.3 ± 6.5	95.4 ± 6.6	96.3 ± 5.1	100.9 ± 6.4	96.7 ± 6.5	94.0 ± 4.9	97.2 ± 5.1
Week 12	92.8 ± 5.5	110.3 ± 6.9	97.0 ± 6.9	95.8 ± 5.3	99.7 ± 6.9	92.5 ± 7.3	92.8 ± 5.0	96.6 ± 5.2
Change from baseline	-0.3 ± 0.8	-1.4 ± 1.0	0.5 ± 1.0	0.1 ± 0.8	-0.6 ± 1.0	0.8 ± 1.0	-0.4 ± 0.7	-0.5 ± 0.8
N (BL/W12)	51/44	14/13	14/13	62/59	13/12	14/10	62/55	58/52

Least Square Means ± Standard Error are presented. The number of subjects at baseline and at 12-weeks differ.

# SAFETY - HYPOGLYCEMIA

#  
HYPOGLYCEMIA

PL

25 events, 5 patients

25 mild

8QD

0 events

16QD

20 events, 1 patient

20 mild

32QD

16 events, 6 patients

15 mild, 1 moderate

16 events, 4 patients

15 mild, 1 moderate

8BID

0 events

16BID

4 events, 3 patients

4 mild

32BID

32 events, 6 patients

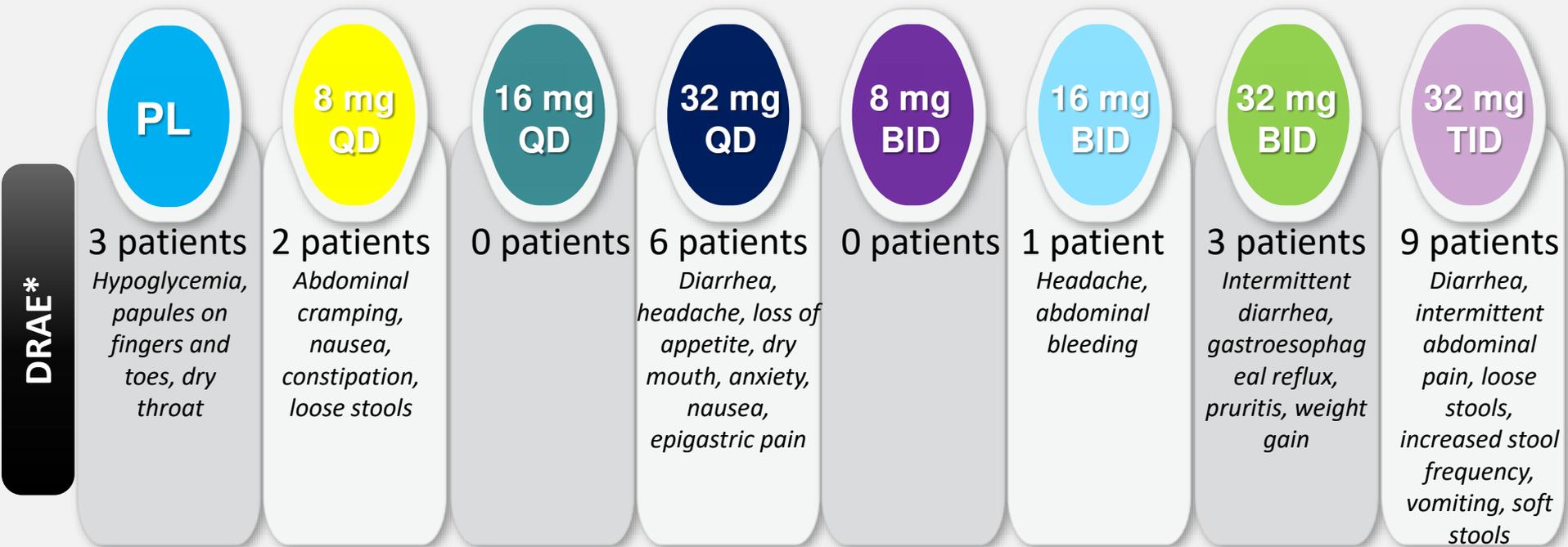
32 mild

32TID

HYPOGLYCEMIA

# All patients experiencing hypoglycemia were concomitantly taking sulfonylurea

# SAFETY –DRUG-RELATED ADVERSE EVENTS\* (DRAEs)



*\*Numbers of patients experiencing at least one hypoglycemic event/DRAE are presented*

## CONCLUSION AND DISCUSSION



The 12-week 8-32 mg ORMD-0801 QD and BID treatments elicited clinically significant HbA1c reductions among T2DM patients inadequately controlled on standard therapies and with mean HbA1c levels >8%. CGM and serum glucose measures showed similar trends.

ORMD-0801 was not associated with an increased risk of hypoglycemia or with severe or serious side effects. No significant weight gain or postprandial glucose parameters (not shown) were recorded over the 12-week treatment period.



This study clearly demonstrated that when considering changes in 12-week HbA1c levels, there is no significant benefit to be derived from dosing more than once daily, at night. QD dosing will certainly enhance subject compliance and reduce treatment costs.