OP-0219: Effect of Meal Replacement Therapy on Body Weight and Glycemic Control in Obese Type 2 Diabetes Adults: Asian Experiences

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Background:
Excess body weight is a common manifestation in adults with type 2 diabetes (T2D), which associated with non-optimum glycemic control. While the use of meal replacement therapy (MRT) to induce weight loss and improve glycemic control is recommended as part of the medical nutrition therapy (MNT), its feasibility remains unclear especially from the Asian perspective.

Aim:
This study aims to determine the effect of 12-weeks of MRT on body weight and glycemic control in obese T2D adults.

Method:
We recruited a total of 32 participants from National Diabetes Institute (NADI). They were randomly assigned to receive the MRT (n = 16) or conventional dietary intervention (n = 16) for 12-weeks study. Table 1 shows the similarities and differences in the structure of MRT and conventional intervention. MRT and conventional participants received the MNT from a researcher and a NADI's dietitian, respectively. The prescriptions designed as iso-caloric. Participants in the MRT group were asked to replace their two meals with two meal replacements in a day.

Table 1: Structure of MRT and Conventional Dietary Intervention		
	MRT	Conventional
Daily Energy Intake [#] (kcal/day)	~1200 (100%)	~1200 (100%)
Macronutrients ^{##}		
Carbohydrate (g)	130 (40%)	150 (50%)
Protein (g)	86 (30%)	56 (20%)
Fat (g)	40 (30%)	37 (30%)
Nutritional Strategies	Received MRT and healthy eating advice from researcher	Received MNT advice from NADI's dietitian
	Weight loss orientation	Carbohydrate-controlled orientation
	2 meals are liquid products of MRT, 1 meal is solid food and 1 snack	3 meals are solid food and 1 snack
PAL [#]	Gradual increase with a goal of 150 min/week	
Medication [#]	Medication changes by physician or endocrinologist	
[#] Adapted of MRT from Look AHEAD and Conventional from MNT guidelines for T2D.		
^{##} Adapted of MRT from Joslin Diabetes Clinical Nutrition Guideline and Conventional from MNT guidelines for T2D.		

Body weight and glycemic control were assessed at baseline, 6 and 12-weeks of the study. Data presented based on intention-to-treat (ITT) analysis.

Results:
A total of 27 participants completed the study providing 84.4% responses rate (MRT = 14, 87.5%; Conventional = 13, 81.3%). Baseline characteristics (mean; age = 46.4 ± 8.2 years old, female = 34.4%, body mass index (BMI) = 31.8 ± 4.9 kg/m², HbA1c = 8.8 ± 1.5%, duration of T2D = 5.0 ± 4.1 years) were comparable between groups (Table 2).

Table 2: Baseline Characteristics of Participants						
Characteristics		MRT (n=16)		Conventional (n=16)		Between Groups p-Value
		%	n	%	n	
Age (years old)		45.25 ± 8.35		47.50 ± 8.15		0.447
Sex	Male	35	11	31	10	0.721
	Female	15	5	19	6	
Education	Primary	3	1	3	1	0.073
	Secondary	19	6	37	12	
	Tertiary	28	9	10	3	
Diabetes Duration (years)		5.30 ± 4.61		4.60 ± 3.54		0.637
Types of OAD	Diet	9	3	13	4	0.440
	Single	28	9	19	6	
	Dual	13	4	9	3	
	Triad	0	0	9	3	
Income (monthly)	≤ USD 480	19	6	25	8	0.426
	> USD 480	13	4	12	4	
	≥ USD 1200	19	6	12	4	
Statistical analysis by descriptive statistics and independent t-test.						

At 12-weeks, MRT group had a significant reduction in body weight (83.3 ± 13.0 kg, Δ baseline = -3.5 ± 0.5 kg) than the conventional group (87.2 ± 20.8 kg, Δ baseline = -1.1 ± 2.4 kg; p < 0.01) (Table 3).

Table 3: Changes in Body Weight and Body Composition of Participants									
Outcome Measurement	MRT Group (n = 16)				Conventional Group (n = 16)				Between Groups p-Value
	Baseline	Mid-point	End-point	Changes	Baseline	Mid-point	End-point	Changes	
Body Weight (kg)	86.81 ± 13.37	84.88 ± 13.60	83.33 ± 12.98	-3.49 ± 1.90**	88.24 ± 19.53	87.82 ± 19.90	87.20 ± 20.79	-1.05 ± 2.35	0.010**
BMI (kg/m ²)	30.95 ± 3.69	30.24 ± 3.78	29.70 ± 3.62	-1.25 ± 0.65**	32.68 ± 5.89	32.52 ± 6.06	32.28 ± 6.43	-0.39 ± 0.87	0.011**
BF (%)	33.42 ± 6.01	32.62 ± 6.26	31.93 ± 6.37	-1.49 ± 1.02**	35.75 ± 7.04	35.42 ± 7.04	35.52 ± 7.19	-0.23 ± 1.47	0.027**
VF (%)*	16.69 ± 4.96	16.00 ± 4.71	15.69 ± 4.42	-1.00 ± 1.25**	15.96 ± 4.15	15.58 ± 4.48	15.38 ± 4.37	-0.58 ± 1.00	0.579
Statistical analysis by repeated measures ANOVA. **p < 0.05. *VF assessment participant number for conventional group is n=13.									

The percentage of weight loss in MRT (-4.1 ± 2.1%) was significantly larger than the conventional group -1.4 ± 2.5%; p < 0.01) (Figure 1). A significant improvement in BMI and percentage of body fat were also observed in MRT group as compared to the conventional group.

Figure 1: Changes in Percentage of Weight Loss at End-point
Although generally the differences between groups in HbA1c were not significant, we attained significant differences between both groups (p = 0.006) in HbA1c after excluding confounders effect of the participants who had changed the types of OAD. Within MRT group had reduced HbA1c level from 9.1 ± 1.5% at baseline to 7.9 ± 1.2% at 12 weeks (Δ baseline = -1.1%; p < 0.01), which were not observed in the conventional group (baseline = 8.5 ± 1.5%; 12 weeks = 8.0 ± 1.1%; Δ baseline = -0.5%; p = 0.11) (Figure 2).

Figure 2: Changes in HbA1c on ITT (MRT, n = 16; SDT, n = 16) and Participants who Maintained the Same Types of OAD (MRT, n = 16; SDT, n = 12) Analysis at End-point

About 72.5% of the participants in the MRT group adhered to meal-replacement intervention.

Conclusion:

- The used of meal replacement therapy induces larger weight loss, BMI and percentage of body fat than the conventional dietary intervention at 12-weeks.
- In general, the improvement in HbA1c was not significant between groups, but removing confounding effect of diabetes medication had produced significant in differences between groups. Within the MRT group was evident in HbA1c reduction (> 1%).
- The high adherence rate demonstrated the feasibility of meal replacement implementation in Asian adults with type 2 diabetes.