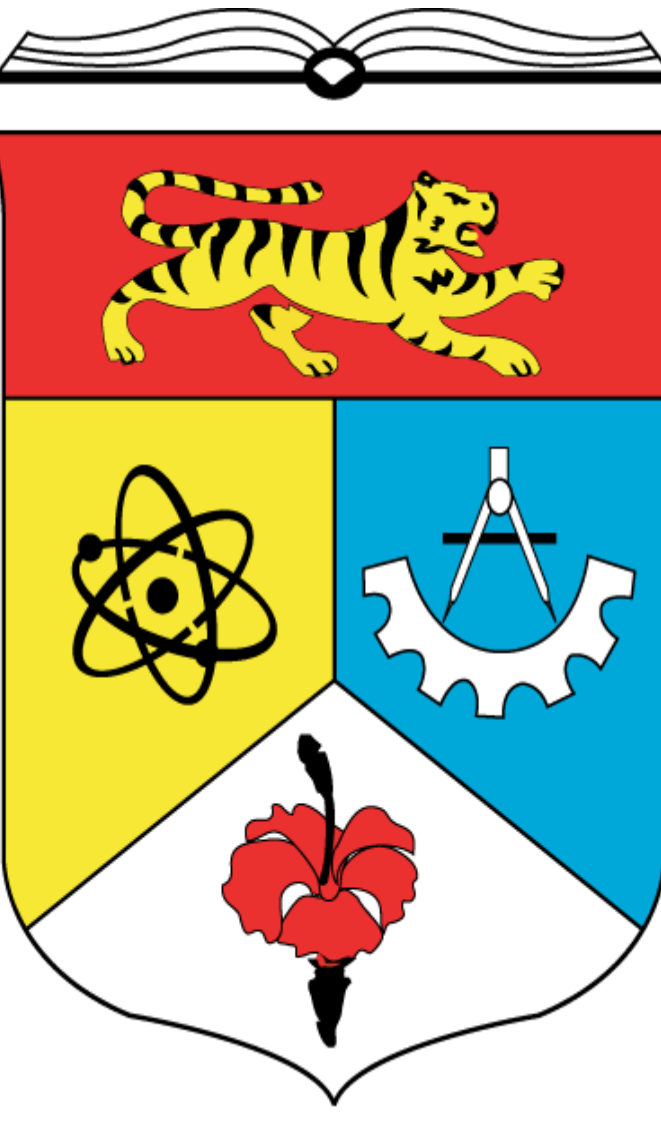


Improved Intake of Essential Nutrients Following Structured Nutrition Therapy versus Individualized Dietary Plan for Overweight and Obese Patients with Type 2 Diabetes: A Randomized Clinical Study

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INTRODUCTION

Nutrition therapy (NT) is essential in managing patients with type 2 diabetes (T2D) and obesity. While it aims to improve glycemia and induce weight less, it is often associated with depletion of essential micronutrients.

AIM

This study evaluates the effect of NT implemented in 2 different models on macro- and micronutrient dietary intake in patients with T2D and are overweight/obese.

METHODS

We randomized 108 participants (ratio 1:2) to receive individualized dietary plan (IDP) or structured dietary plan (SDP) (fig. 1); that includes specified menus, diabetes-specific meal replacements and snacks (fig. 2). SDP were further randomized to receive additional weekly phone coaching or not. Participants had 3 visits and 2 follow-up phone calls with a registered dietitian (RDN) over 16 weeks. They were asked to provide a 3-day dietary log at each visit. We analyzed data from 81 participants (75%) who completed 16 weeks of follow-up and had completed 3-day dietary records. Their baseline characteristics are listed in Table 1.

Figure 1.

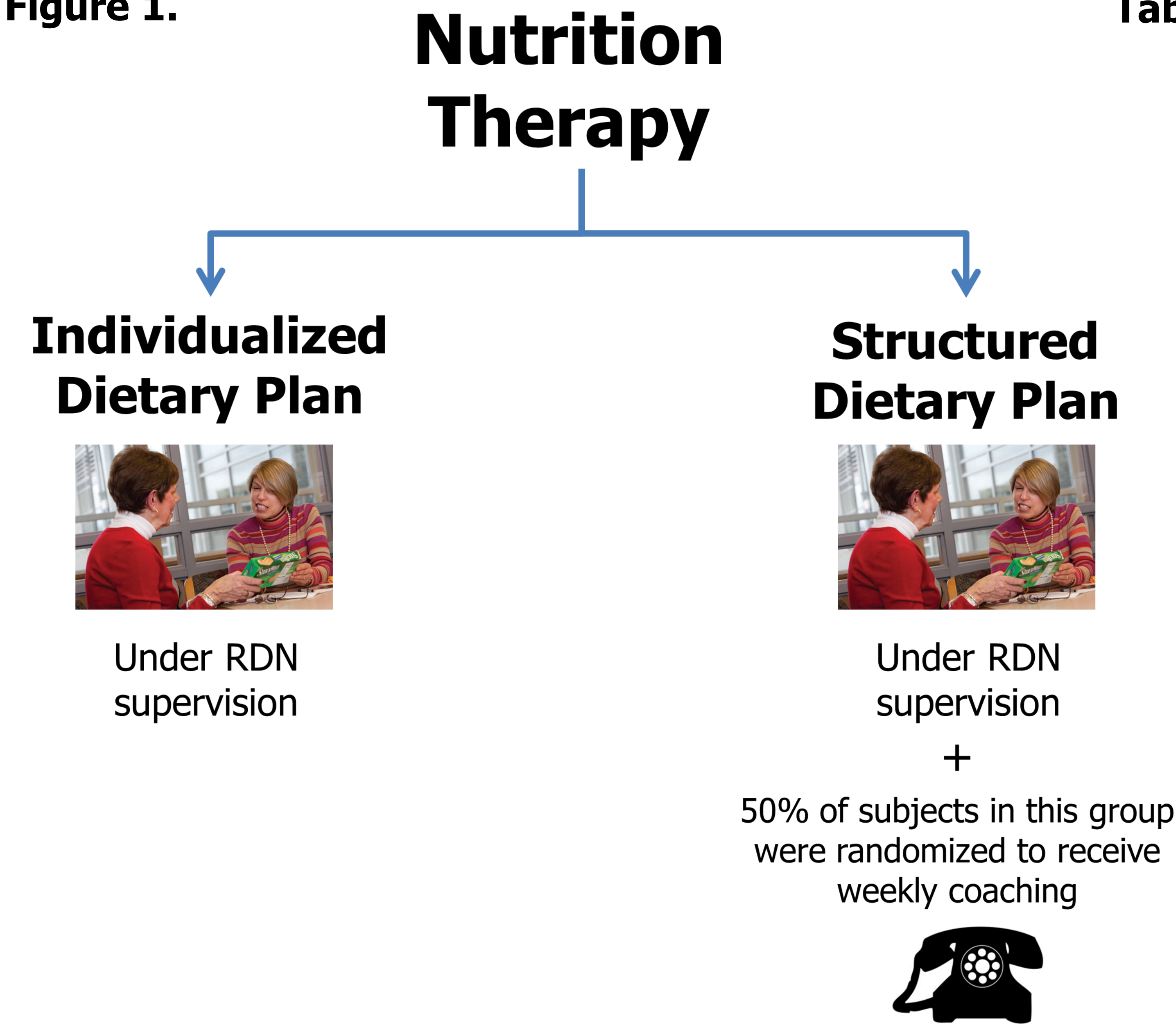


Figure 2.

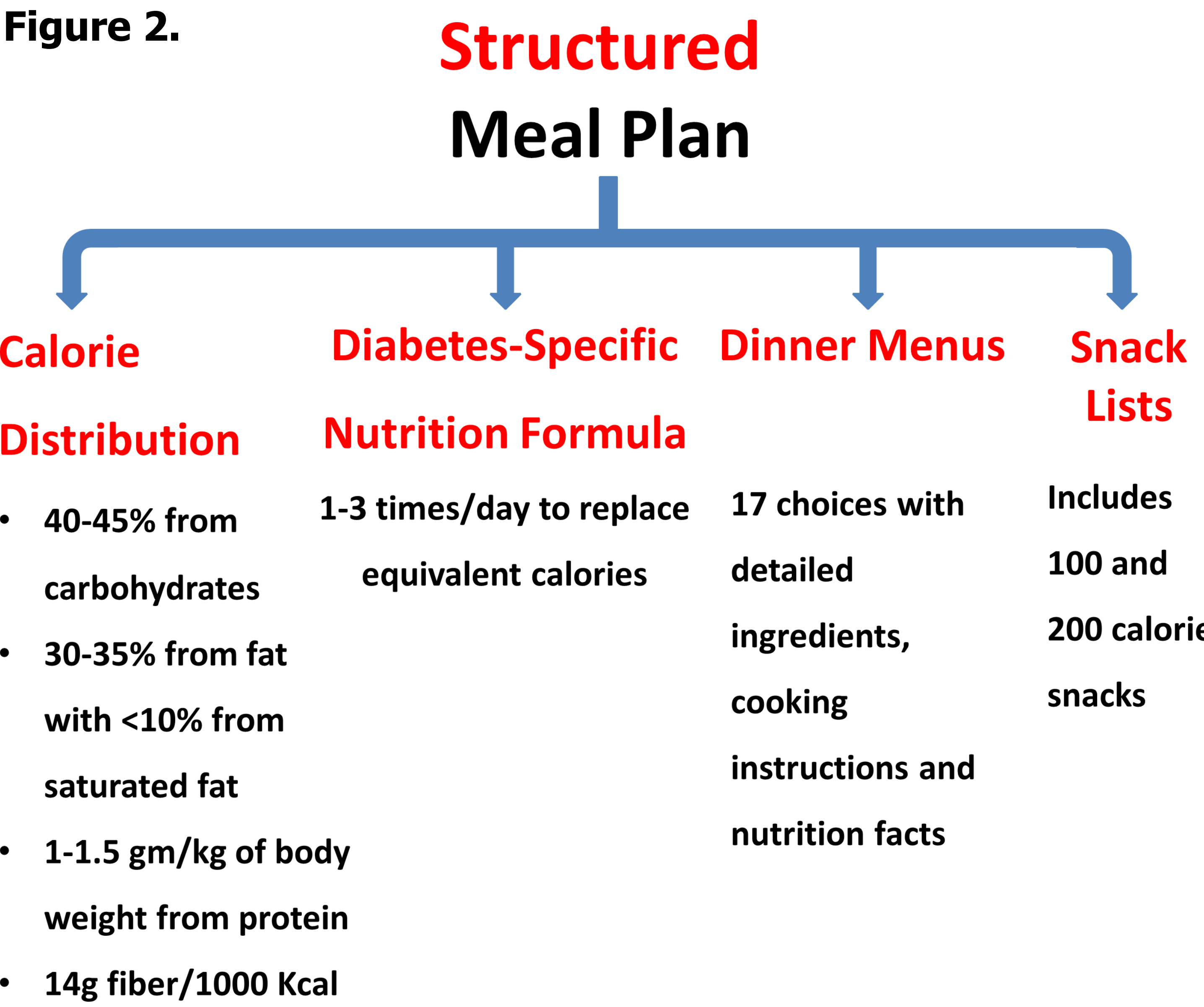


Table 1. Baseline Characteristics

	Individualized Dietary Plan (n=33)	Structured Dietary Plan (n=48)
Age (years)	57 ± 10	60 ± 9
Sex (Female %)	66.7	56.3
Diabetes Duration (years)	10.8 ± 9.3	11.1 ± 6.4
HbA1c (%)	8.19 ± 1.04	7.91 ± 0.97
Body weight (kg)	100.4 ± 21.3	100.1 ± 22.3
BMI (kg/m ²)	35.2 ± 7.2	34.2 ± 7.6
Energy intake (kcal/day)	1916 ± 675	1913 ± 596
Carbohydrate intake (g/day)	212 ± 86	215 ± 84
% of energy	43 ± 8	44 ± 7
Fiber intake (g/day)	15 ± 6	20 ± 6
Total fat intake (g/day)	85 ± 39	82 ± 29
% of energy	38 ± 6	38 ± 6
Saturated fat intake (% of energy)	12 ± 2	12 ± 3
Protein intake (g/day)	81 ± 22	86 ± 23
% of energy	17 ± 4	18 ± 4

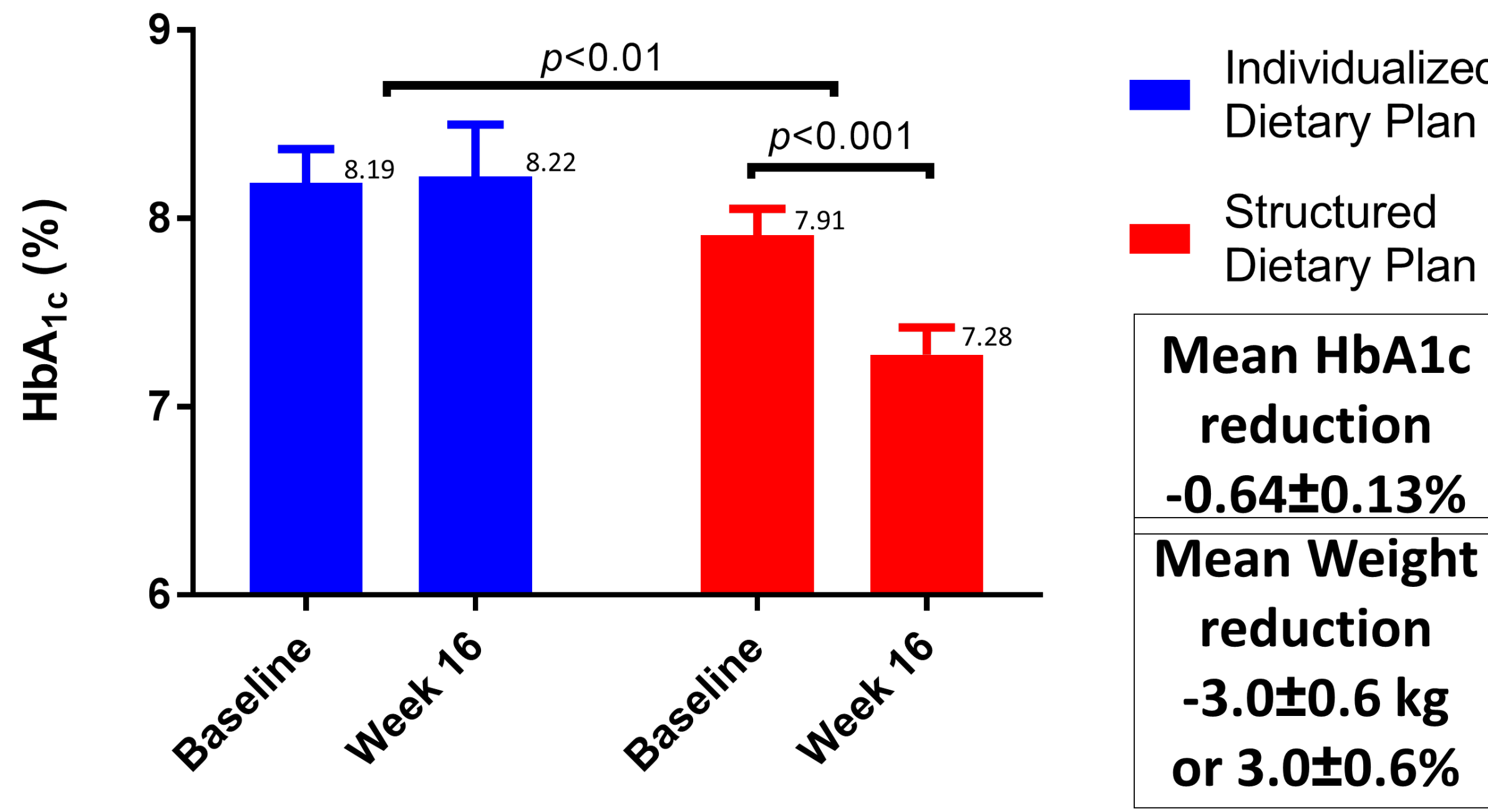
Values are mean ± SD. Groups were not significantly different at baseline

Table 2. Change in Energy, Macronutrient & Fiber Intake Over 16 Weeks

	Individualized Dietary Plan (n=33)		Structured Dietary Plan (n=48)		<i>P value</i> difference between groups over time
	Baseline	Week 16	Baseline	Week 16	
Energy intake (kcal/day)	1916 ± 118	1727 ± 83*	1913 ± 104	1624 ± 68***	NS
Carbohydrate intake (g/day)	211.8 ± 14.9	182.1 ± 9.9*	215.0 ± 14.6	175.2 ± 9.0***	NS
% of energy	43 ± 1	42 ± 2	44 ± 1	41 ± 1	NS
Fiber intake (g/day)	15.3 ± 1.0	17.0 ± 1.3*	19.8 ± 1.1	22.9 ± 1.0**	<0.01
Total fat intake (g/day)	84.9 ± 6.8	75.1 ± 5.1	81.8 ± 5.0	66.5 ± 3.2***	NS
% of energy	38 ± 1	38 ± 1	38 ± 1	36 ± 1**	NS
Saturated fat (% of energy)	12 ± 1	12 ± 1	12 ± 1	9 ± 1***	<0.01
Protein intake (g/day)	81.1 ± 3.9	83.2 ± 4.6	86.0 ± 3.9	92.5 ± 3.2*	NS
% of energy	17 ± 1	19 ± 1	18 ± 1	23 ± 1***	NS

Values are mean ± SEM. **p*<0.05, ***p*<0.01, ****p*<0.001 compared to baseline. N=68 in each cohort. The Why WAIT cohort was enrolled in a 12-week intensive lifestyle intervention program. The Usual Care cohort received care from an endocrinologist.

Figure 3. Change in HbA_{1c} Over 16 Weeks



Values are mean ± SEM. Individualized Dietary Group (n=33), Structured Dietary Group (n=48)

Figure 4. Change in Body Weight Over 16 Weeks

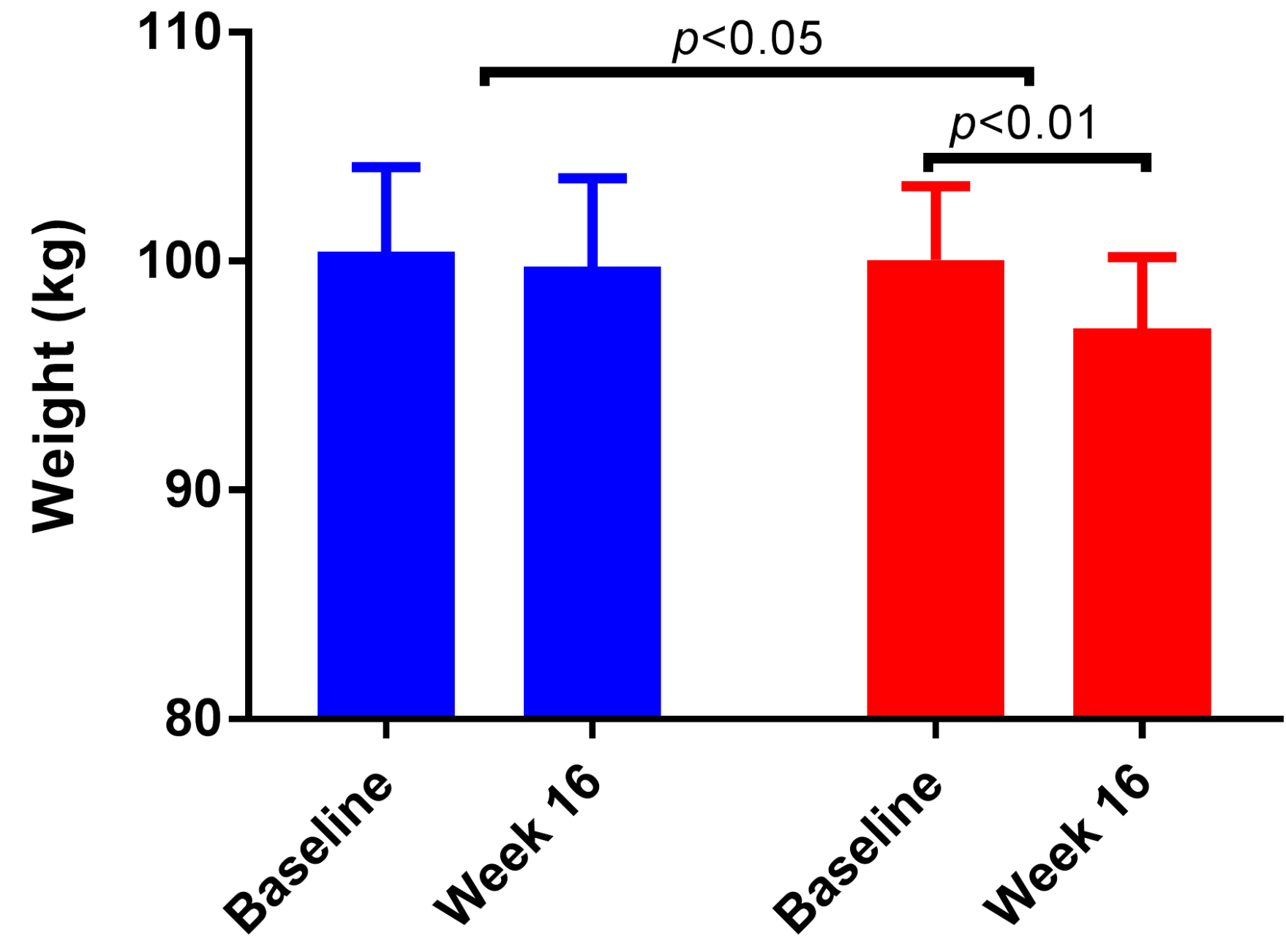


Table 3. Change in Dietary Vitamin & Mineral Intake Over 16 Weeks

	Individualized Dietary Plan (n=33)		Structured Dietary Plan (n=48)		<i>P value</i> difference between groups over time
	Baseline	Week 16	Baseline	Week 16	
Vitamin A (RAE/day)	633.9 ± 177.7	461 ± 49.3	487.3 ± 43.7	502.4 ± 88.8	NS
Vitamin B ₁ (mg/day)	0.93 ± 0.08	0.86 ± 0.07	0.93 ± 0.06	1.42 ± 0.06**	<0.001
Vitamin B ₂ (mg/day)	1.3 ± 0.1	1.1 ± 0.1	1.4 ± 0.1	1.7 ± 0.1*	<0.01
Vitamin B ₃ (mg/day)	15.3 ± 1.0	15.5 ± 1.3	16.5 ± 1.3	23.8 ± 1.1	<0.01
Vitamin B ₆ (mg/day)	1.3 ± 0.1	1.3 ± 0.1	2.2 ± 0.3	2.2 ± 0.1*	NS
Vitamin B ₁₂ (mcg/day)	4.7 ± 1.4	2.5 ± 0.3	3.9 ± 0.5	5.9 ± 0.4**	NS
Vitamin C (mg/day)	183.2 ± 108.5	88.9 ± 10.3	84.0 ± 7.3	121.4 ± 8.0	NS
Vitamin D (mcg/day)	2.3 ± 0.4	2.2 ± 0.3	4.0 ± 1.4	10.3 ± 5.5	NS
Vitamin E (mg/day)	4.5 ± 0.7	12.3 ± 8.3	4.9 ± 0.5	3.8 ± 0.3	NS
Folate (mcg/day)	240.3 ± 26.5	228.2 ± 24.9	263.0 ± 24.0	354.8 ± 23.1	<0.05
Vitamin K (mcg/day)	121.5 ± 31.9	91.7 ± 16.9	122.4 ± 19.2	118.0 ± 18.1	NS
Pantothenic acid (mcg/day)	3.6 ± 0.3	3.2 ± 0.2	3.9 ± 0.2	10.4 ± 2.0**	<0.01
Calcium (mg/day)	656.1 ± 50.0	552.3 ± 38.5	681.8 ± 42.8	909.2 ± 31.3***	<0.001
Copper (mg/day)	0.9 ± 0.3	0.6 ± 0.1	4.9 ± 4.1	4.0 ± 0.1	NS
Iron (mg/day)	13.5 ± 1.4	33.2 ± 19.7	18.4 ± 5.3	18.8 ± 0.6	NS
Magnesium (mg/day)	147.9 ± 15.4	139.8 ± 10.5	173.6 ± 12.2	559.0 ± 18.5***	<0.001
Phosphorous (mg/day)	754.8 ± 53.6	700.7 ± 51.8	754.8 ± 44.4	1087.8 ± 41.7**	<0.001
Potassium (mg/day)	1680.8 ± 115.5	1607.9 ± 93.9	1852.3 ± 89.5	2288.8 ± 117.3**	<0.01
Selenium (mcg/day)	62.9 ± 6.3	197.7 ± 136.6	65.8 ± 4.1	172.7 ± 6.0***	NS
Sodium (mg/day)	3301.1 ± 296.6	2798.7 ± 206.4	2977.6 ± 174.9	2232.4 ± 130.9	NS
Zinc (mg/day)	6.5 ± 0.6	6.0 ± 0.6	7.5 ± 0.9	40.5 ± 1.3***	<0.001

RESULTS

Both interventions reduced energy, carbohydrate and fat intake compared to baseline with no difference between groups. HbA_{1c} and weight decreased in SDP compared to IDP (HbA_{1c} -0.64±0.13% vs 0.01±0.19%, *p*<0.01; weight -3.0±0.6 kg vs -0.9±0.5 kg, *p*<0.05) (fig 3 & 4). Dietary fiber intake increased while saturated fat intake decreased in SDP compared to IDP (*p*<0.01) (table 2). Energy intake from protein was higher in SDP compared to baseline (*p*<0.001) (table 2). Participants in the SDP significantly increased intake of vitamins B₁, B₂, B₃, B₉, B₁₂, pantothenic acid (B₅), dietary calcium, magnesium, phosphorus, potassium and zinc compared to IDP (table 3). No difference in micro- or macronutrients between SDP with or without weekly RDN phone support.

CONCLUSION

For overweight and obese patients with T2D, a structured nutrition plan provided by RD reduces A1C, body weight and improves level of 11 essential nutrients compared to current recommendation of individualized meal plan despite providing similar caloric level and macronutrient composition.