

A Comparison of the Weight Loss Effect between a Low-carbohydrate Diet and a Calorie-restricted Diet in Combination with Intra-gastric Balloon Therapy

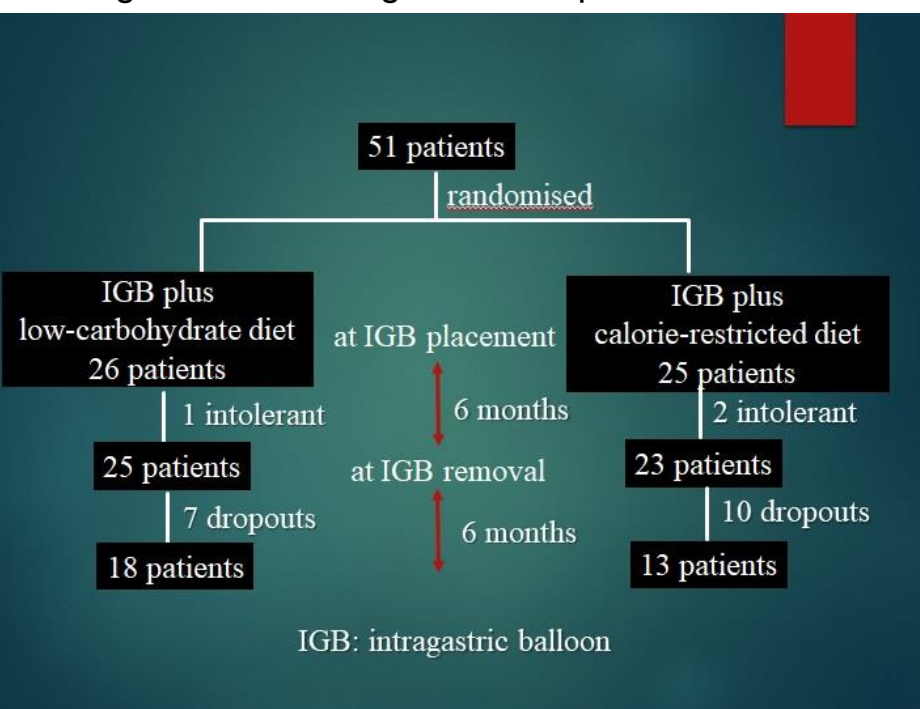
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OBJECTIVES

Intra-gastric balloon (IGB) therapy is a low-invasion treatment for obesity. Recently, a low-carbohydrate diet has shown effectiveness for encouraging weight loss, but whether or not a low-carbohydrate diet improves the efficacy of IGB therapy remains unclear. Therefore, we examined the effectiveness of a low-carbohydrate diet compared with a calorie-restricted diet in combination with IGB therapy.

Figure 1. Flow diagram of the patients



METHODS

A prospective study was conducted on 51 patients who had undergone IGB therapy from October 2012 to December 2017. Overall, 31 of the 51 patients were included in this study (12-month assessment after IGB placement). These 31 cases consisted of 18 IGB plus low-carbohydrate diet and 13 IGB plus calorie-restricted diet. We compared the two groups with respect to body weight loss as outcomes.

Table 1. Characteristics of the Patients at Baseline

Characteristics	IGB plus		p value
	low-carbohydrate diet n=18	calorie-restricted diet n=13	
Age (years)	45.6 ± 12.8	46.5 ± 13.8	0.8516
Female sex - no. (%)	11 (61.1)	7 (53.8)	0.6977
BH (cm)	163.7 ± 8.0	165.2 ± 8.7	0.6322
BW (kg)	101.9 ± 25.8	103.5 ± 17.0	0.8461
BMI (kg/m ²)	37.6 ± 7.1	38.0 ± 6.1	0.8883
FPG (mg/dl)	107.6 ± 25.3	103.9 ± 11.4	0.6555
HbA _{1c} (%)	6.1 ± 0.7	6.2 ± 0.6	0.7627
HOMA-IR	3.7 ± 2.2	3.7 ± 2.5	0.9848
TGs (mg/dl)	116.7 ± 54.6	128.9 ± 55.1	0.5659
HDL-C (mg/dl)	52.4 ± 11.4	45.3 ± 11.4	0.1110
LDL-C (mg/dl)	128.7 ± 25.9	111.1 ± 40.3	0.1556
UA (mg/dl)	6.3 ± 1.1	6.3 ± 2.4	0.9325
SBP (mmHg)	136.1 ± 15.6	130.9 ± 17.7	0.3996
DBP (mmHg)	85.7 ± 16.0	82.8 ± 9.7	0.5669
VFA (cm ²)	213.0 ± 86.3	249.3 ± 93.6	0.2743
SFA (cm ²)	426.8 ± 189.1	390.1 ± 185.9	0.5949
ORD	2.9 ± 1.9	2.2 ± 1.2	0.3026
IGB volume (ml)	644.4 ± 68.4	653.8 ± 66.0	0.7043

Values are the means ± standard deviation. BH: body height, BW: body weight, BMI: body mass index, FPG: fasting plasma glucose, HbA_{1c}: hemoglobin A_{1c}, HOMA-IR: homeostasis model assessment of insulin resistance, TGs: triglycerides, HDL-C: high-density lipoprotein-cholesterol, LDL-C: low-density lipoprotein-cholesterol, UA: uric acid, SBP: systolic blood pressure, DBP: diastolic blood pressure, VFA: visceral fat area, SFA: subcutaneous fat area, ORDs: obesity-related diseases.

RESULTS

At 12 months after IGB placement, the body weight was significantly lower than that observed at baseline in both the IGB plus low-carbohydrate diet group (baseline 101.9 ± 25.8 kg, 12 months 88.2 ± 21.9 kg) (p<0.0001) and the IGB plus calorie-restricted diet group (baseline 103.5 ± 17.0 kg, 12 months 89.1 ± 6.2 kg) (p<0.005). The percentage of excess weight loss(%EWL) in the IGB plus low-carbohydrate diet group was slightly higher than that in the IGB plus calorie-restricted diet group, but there was no significant difference between the 2 groups at 12 months after IGB placement (IGB plus low-carbohydrate 49.9% ± 60.0%, IGB plus calorie-restricted diet 33.1% ± 27.0%).

Figure 2. Changes in %EWL after IGB placement during the 12-month intervention.

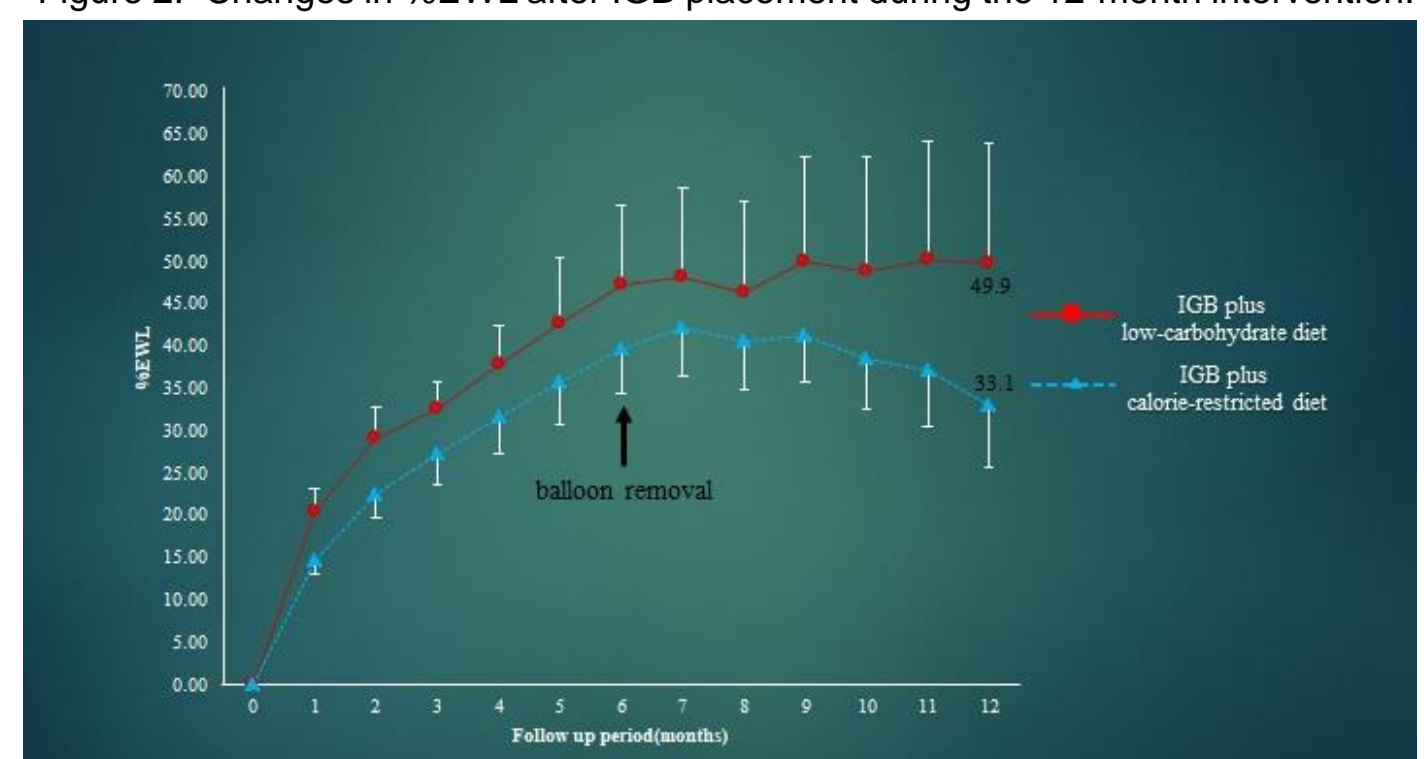


Table 2. Efficacy Outcomes

Variable	IGB plus low-carbohydrate diet			IGB plus calorie-restricted diet			p value†
	Baseline	12 months	p value*	Baseline	12 months	p value*	
BW (kg)	101.9 ± 25.8	88.2 ± 21.9	< 0.0001*	103.5 ± 17.0	89.1 ± 6.2	0.0025*	0.8862
BMI (kg/m ²)	37.6 ± 7.1	32.6 ± 6.3	< 0.0001*	38.0 ± 6.1	32.9 ± 3.8	0.0022*	0.9130
%EWL (%)	—	49.9 ± 60.0	—	—	33.1 ± 27.0	—	0.3555
BW rebound - no. (%)	—	3 (16.7)	—	—	7 (53.8)	—	0.0290†
FPG (mg/dl)	107.6 ± 25.3	100.5 ± 13.2	0.1738	103.9 ± 11.4	101.5 ± 14.6	0.6113	0.6555
HbA _{1c} (%)	6.1 ± 0.7	5.7 ± 0.6	0.0165*	6.2 ± 0.6	5.9 ± 0.5	0.0992	0.4308
HOMA-IR	3.7 ± 2.2	2.6 ± 1.3	0.0323*	3.7 ± 2.5	2.6 ± 2.2	0.0378*	0.9310
TGs (mg/dl)	116.7 ± 54.6	88.1 ± 41.0	0.0029*	128.9 ± 55.1	109.6 ± 53.2	0.3876	0.2301
HDL-C (mg/dl)	52.4 ± 11.4	58.4 ± 14.5	0.0123*	45.3 ± 11.4	48.8 ± 9.8	0.2041	0.1616
LDL-C (mg/dl)	128.7 ± 25.9	128.6 ± 32.2	0.9837	111.1 ± 40.3	116.1 ± 42.4	0.3402	0.3675
UA (mg/dl)	6.3 ± 1.1	5.9 ± 1.2	0.1801	6.3 ± 2.4	6.0 ± 1.7	0.5944	0.8293
SBP (mmHg)	136.1 ± 15.6	125.7 ± 15.6	0.0103*	130.9 ± 17.7	124.1 ± 17.2	0.0452*	0.7899
DBP (mmHg)	85.7 ± 16.0	75.2 ± 11.6	0.0013*	82.8 ± 9.7	72.1 ± 11.8	0.0032*	0.4642
VFA (cm ²)	213.0 ± 86.3	141.5 ± 64.6	0.0002*	249.3 ± 93.6	174.3 ± 117.3	0.0252*	0.3259
SFA (cm ²)	426.8 ± 189.1	337.7 ± 186.6	0.0094*	390.1 ± 185.9	330.6 ± 191.8	0.2090	0.9187
ORDs	2.9 ± 1.9	2.3 ± 2.1	0.0370*	2.2 ± 1.2	2.0 ± 1.4	0.0821	0.6221

*The results were considered significant at p < 0.05 for within-group comparisons.

†The results were considered significant at p < 0.05 for between-group comparisons.

Values are the means ± standard deviation.

%EWL: [weight loss / (initial weight - weight at BMI 25)] × 100.

The BW (body weight) rebound was defined when the value of %EWL (6 months) - %EWL (12 months) was more than 10%

Table 3. Nutrition Intake at 12 Months

	IGB plus low-carbohydrate diet		IGB plus calorie-restricted diet		p value*
	Intake	Energy ratio (%)	Intake	Energy ratio (%)	
Calorie intake (kcal)	1550.0 ± 146.5	100	1523.1 ± 178.7	100	0.6486
Calorie intake / IBW	23.2 ± 2.8	—	22.6 ± 3.8	—	0.5615
Carbohydrate (g)	103.9 ± 42.0	26.8 ± 10.4	201.2 ± 35.4	52.9 ± 7.0	< 0.0001*
Protein (g)	91.7 ± 25.7	23.6 ± 5.7	66.2 ± 14.2	17.3 ± 2.6	0.0009*
Fat (g)	76.1 ± 11.1	44.3 ± 5.7	49.2 ± 13.1	28.9 ± 6.0	< 0.0001*

*The results were considered significant at p < 0.05 for between-group comparisons.

Values are means ± standard deviation. IBW: ideal body weight.

CONCLUSION

Our study demonstrated that both a low-carbohydrate diet and a calorie-restricted diet were effective interventions for weight reduction in combination with IGB therapy.

REFERENCES

1. A Comparison of the Weight Loss Effect between a Low-carbohydrate Diet and a Calorie-restricted Diet in Combination with Intra-gastric Balloon Therapy. Intern Med 59:1133-1139, 2020.