

# An Optimized Low-Carbohydrate Diet (OLCD) Plan for Overweight Management: An Open-Label, Non-Randomized, Controlled Study

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## Abstract

To explore the effectiveness and safety of an Optimized Low-Carbohydrate Diet (OLCD) plan for overweight management, an open-label, non-randomized, controlled study was performed. The test group was given OLCD intervention in addition to conventional drug treatment and the control group was given only conventional drug treatment. After 42 days of intervention, the physiological and biochemical indicators of the two groups were compared. The weight, BMI, waist circumference, fasting blood glucose, fasting insulin and insulin resistance index of the intervention group were significantly decreased and the difference was statistically significant ( $P < 0.05$ ). The OLCD overweight management program can effectively reverse insulin resistance and improve the symptoms of obesity, which is better than simply using drug treatment.

**Keywords:** Low-carbohydrate diet; Obesity; Overweight management; Health education

## Introduction

Obesity, as a chronic metabolic disorder, is a major public health problem worldwide. It is a main factor to diabetes which is high blood sugar levels caused by insulin secretion defects or insulin resistance and more than 90% are type diabetes [1, 2]. According to the IDF 2017 global obesity map, the current number of obesity patients in china is 89.6 million and it is estimated that the number of obesity patients in the world will reach 642 million by 2040 [3]. The increase in the number of patients with obesity may be due to population growth, aging and urbanization, the increase in unhealthy lifestyle and the decrease in physical activity [4]. Obesity control emphasizes the comprehensive management of lowering blood sugar, lowering blood pressure and lowering lipids. It cannot rely solely on drug treatment, but also requires continuous health management. Health management for overweight patients, such as exercise, diet, medication compliance, etc., can improve the patient's health status [5]. At present, a variety of low-carbohydrate diet models have emerged worldwide, but due to the influence of many factors, the effectiveness of management still needs to be further investigated [6]. This study proposes an Optimized Low-Carbohydrate Diet (OLCD) management programs on obesity and present an open-label, non-randomized, controlled trail. It aims to provide insights on clinical treatments of obesity.

## Methods

All patients with obesity were diagnosed in the top hospitals

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in china and are divided into a test group and a control group according to specific conditions. The study was conducted from June 2018 to December 2020 and the clinic registry is ChiCTR1800016609. .

## Obesity diagnostic criteria

According to international diagnostic criteria: BMI of 25 kg/m<sup>2</sup> or greater, waist circumference greater than 35 in (88 cm) in women or 40 in (102 cm) in men, fasting blood glucose (fasting blood glucose, the FBG) >7.0 mmol/L or postprandial 2 h blood glucose (2 hours of postprandial blood glucose, 2 h PBG) >11.1 mmol/L, with clinical symptoms or blood glucose >11.1 mmol/L 2 hours after the glucose tolerance test [7].

## Inclusion criteria

- Those who meet the criteria for diagnosis of obesity.
- Have the ability to act independently.
- Those who voluntarily sign an informed consent form and agree to participate in all inspections and interventions in accordance with the requirements of the OLCD plan.

## Exclusion criteria

- Obesity particular type of gestational overweight and impaired glucose tolerance unexplained abnormalities.
- Patients with acute cerebrovascular sudden cardiac infarction, acute ketoacidosis, acute infection and surgery in a state of acute

stress.

- Mass in patients with cancer or cachexia.
- Patients with psychiatric disorders or missing awareness.

### Intervention plan

The control group received routine medical treatment and treatment in the hospital. The OLCD intervention group is as follows:

- Tailor-made menu, choose low-sugar and low-fat ingredients, pay attention to food matching, balanced nutrition and strictly control carbohydrate, pork and lamb, the cooking method is mainly steaming and blanching cold salad.
- Nutrition-enhanced meal pack; the main ingredients of the meal pack are soy protein, black soybean and flaxseed oil.
- Moderate aerobic exercise every day 2-3 times aerobic exercise.
- Health management consultant tracking guidance, one to one service to solve problems encountered during the intervention, to develop nutrition recipes, supervise and guide subjects and carry out targeted health education. The entire intervention cycle was 42 days.

### Observation indicators

Height, weight, BMI, waist circumference, fasting blood glucose, fasting insulin and insulin resistance index.

### Statistical analysis

Use Epi data 3.1 software to establish a database, SPSS13.0 statistical software to analyze the data, use t test or analysis of

variance for measurement data , use c 2 test for count data and the test level is  $\alpha=0.05$ .

## Results

### Basic result

A total of 856 cases (462 males and 394 females) were included in the study and their ages were ( $44.61 \pm 9.49$ ). The intervention group had 435 patients (213 males and 222 females), aged ( $43.71 \pm 9.80$ ); the control group was selected diabetic patients at the same time, with a total of 421 patients (249 males and 172 females), aged ( $45.54 \pm 9.08$ ).

### Comparison of various indicators between the two groups before the intervention

Before the OLCD intervention, the physiological and biochemical indicators of the two groups were compared. The results showed that there was no statistical difference in body weight, waist circumference, fasting blood glucose, fasting insulin and insulin resistance index ( $P>0.05$ ) (Table 1).

### Comparison of various indicators between the two groups after the intervention

After the 42-day intervention period, the physiological and biochemical indicators of the two groups were compared. The results showed that the weight, BMI, waist circumference, fasting blood glucose, fasting insulin and insulin resistance index of the intervention group were significantly lower than those of the control group. The difference is statistically significant ( $P<0.05$ ) (Table 2).

**Table 1:** Comparison of indicators between the two groups before intervention ( $\pm s$ ).

Category	Weight (kg)	BMI	Waist circumference (cm)	Fasting blood glucose (mmol/l)	Fasting insulin (MU/L)	Insulin resistance index
Intervention group	76.04 $\pm$ 14.37	27.59 $\pm$ 3.93	94.98 $\pm$ 11.37	6.23 $\pm$ 2.08	32.31 $\pm$ 80.74	9.44 $\pm$ 31.10
Control group	74.66 $\pm$ 12.82	26.82 $\pm$ 3.39	93.78 $\pm$ 9.82	6.23 $\pm$ 2.15	27.84 $\pm$ 41.99	7.51 $\pm$ 12.73
t	1.48	3.08	1.65	-0.05	1.01	1.18
P	0.14	0.002	0.09	0.95	0.31	0.23

**Table 2:** Comparison of indicators between the two groups after intervention ( $\pm s$ ).

Category	Weight (kg)	BMI	Waist circumference (cm)	Fasting blood glucose (mmol/l)	Fasting insulin	Insulin resistance index
Intervention group	69.45 $\pm$ 12.46	25.03 $\pm$ 3.48	87.55 $\pm$ 9.98	5.65 $\pm$ 1.67	22.47 $\pm$ 42.86	5.60 $\pm$ 10.77
Control group	74.00 $\pm$ 12.77	26.45 $\pm$ 3.44	94.76 $\pm$ 38.75	6.04 $\pm$ 2.05	31.46 $\pm$ 73.18	8.87 $\pm$ 26.09
t	-5.27	-6.00	-3.75	-3.03	-2.20	-2.41
P	0.00	0.00	0.00	0.00	0.03	0.02

## Discussion

The concept of health management was first advocated in the United States. Today, 77 million Americans enjoy medical services in approximately 650 health management organizations [8]. The 2017 version of the obesity diagnosis and treatment standards recommends that every patient with obesity should actively carry out health education, self-management and treatment planning with his/her health care team, including cooperation in the development of a personalized diet plan [9]. Based on this study, we introduced an optimized low-carbohydrate diet plan for patients with obesity; it also includes a comprehensive health management program.

Before the intervention, the physiological and biochemical indicators of the two groups were compared. The results showed that there was no statistical difference in body weight, waist circumference, fasting blood glucose, fasting insulin and insulin resistance index ( $P>0.05$ ), indicating that the baseline data of the two groups of patients before the intervention were comparable.

After 42 days of intervention, the weight, BMI, waist circumference, fasting blood glucose, fasting insulin and insulin resistance index of the intervention group were significantly lower than those of the control group, the difference was statistically significant ( $P<0.05$ ) and the fasting of the intervention group blood sugar levels have returned to normal levels. Asians rely on white rice as the main food, which provides more than 30% of the daily energy [10]. The high intake of white rice is closely related to the occurrence of obesity and various metabolic syndromes [11]. Asian populations are more likely to suffer from obesity than caucasian populations and the transition from overweight to obesity is more rapid and severe [12]. During the entire intervention process, we worked with patients to formulate nutritional diets and strictly controlled the intake of carbohydrate in the diets. Increase the intake of beef, chicken and vegetables. Studies have shown that increasing the intake of fat, dietary fiber, animal and plant protein in food can reduce blood sugar response [13]. Therefore, the weight, BMI, fasting blood glucose, fasting insulin and insulin resistance index of the intervention group were significantly improved through changes in diet.

Sedentary lifestyle is closely related to the occurrence of obesity, regular exercise can reduce diseases such as obesity and metabolic syndrome [14,15]. During the intervention process, a health management consultant accompanied the patient to carry out aerobic exercise to improve the effect of blood sugar control. It is difficult for many obesity patients to adhere to the task of self-management [16-19]. Therefore, we have equipped each patient with one-to-one professional health management coach to supervise, encourage and help them complete diet and exercise intervention programs. Improve compliance, which is a powerful guarantee for weight control.

## Conclusion

In summary, this study presents an optimized low-carbohydrate diet method and once again confirmed that changes in diet and

exercise have positive significance for the treatment of obesity, although the exact mechanism of the relationship between lifestyle intervention, weight reduction and improvement of obesity is still unclear. Changes in hormone signal transduction, especially adipocyte-derived factors may play an important role. Structured health education, lifestyle changes and appropriate medical interventions are effective in controlling blood sugar. After the intervention, the patient's weight change levels, blood sugar and disease change levels, as well as the quality of life, require long-term follow-up for observation. A more in-depth explanation of the intervention effect of OLCD plan on obesity is needed in the future.

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