Comparing the Effectiveness of the Ketogenic Diet and Intermittent Fasting on 12-Weeks Weight Management in Women with Obesity

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Abstract

The optimal dietary strategies for weight loss and maintenance have been at the center of debate for decades. Proponents of each camp presented their assertions, but they could not approve of one diet due to the sophisticated determinants and limited empirical evidence. This study aims to compare the effectiveness of the Ketogenic diet and Intermitting fasting concerning weight loss and risk factors of cardiovascular outcomes. Fifty-eight obese female participants agreed to participate in the 12-week randomized clinical trial followed by a 6-months observational period. The participants are randomly assigned to the ketogenic diet with an aggressive reduction in carbohydrate content or intermitting fasting that involve a restricted meal time. The results reveal that the ketogenic diet will result in rapid, short-term weight loss. In contrast, intermitting fasting will demonstrate better long-term weight maintenance and no noticeable correlation with reducing risk factors of cardiovascular diseases. In conclusion, this study indicates no absolute advantage to any single treatment.

Keywords: Ketogenic diet, Intermittent fasting, Weight management

1. Introduction

According to a paper published by the World Health Organization (WHO), it has been estimated that by the time of 2025, one in five adults worldwide will be obese and has a body mass index (BMI) over 30 kg/m². For women, obesity has become one of the most progressive health issues associated with type-2 diabetes, vascular heart disease, breast cancer, and decline in physical function [1-3]. Over one million women during the reproductive stage suffer from obesity, throwing them and their babies into vulnerability to poor health conditions and high healthcare costs. This suggests that more high-priority dietary research for weight management in women should be conducted.

Many weight management diets have been proposed and proven effective for women in recent decades. Researchers and healthcare professionals have been working painstakingly to find the most effective one. This study will focus on the Ketogenic diet and Intermitting fasting. The ketogenic diet is an exceedingly low-carbohydrate diet. In contrast, intermittent fasting is defined as restricted daytime feeding, in which the participants must finish all the meals within a set window. According to a randomized control trial, the patients with obesity in the low carbohydrate group experienced a successful weight loss of -9.43 kg (±4 kg) in 12 weeks and improved cardiovascular disease risk factors [4,5]. Nevertheless, rapid weight regaining from the ketogenic diet is typical, demonstrating no superiority over other dietary treatments after one year. A recent review shows that intermitting fasting can introduce beneficial effects on the body mass index, bound up with outcomes of reducing blood pressure, level of low-density lipoprotein, and blood cholesterol in 6 months. However, more evidence still needs to be pertinent to the effectiveness and long-term compliance and maintenance of this type of fasting [6], which calls for more relevant research. At present, micronutrient composition and meal timing have been widely acknowledged as the fundamental factors influencing the reduction of energy intake and contribution to weight loss [7,8].

The study aims to test the different effects of the ketogenic diet and intermittent fasting on weight management and maintenance for women. The hypothesis is that the ketogenic diet will result in more rapid weight loss during the 12 weeks intervention period. In contrast, intermitting fasting will have better long-term weight loss and maintenance in the observational follow-up period.

2. Study Design

This 12-week randomized controlled trial will be conducted with female participants from 3 provinces in China, with an observational follow-up period lasting another six months.

2.1. *Participants*

Sixty women were recruited, 18 to 60 years of age, with body mass index (BMI) within the range of 35.0 to 40.0 km/m2, physically inactive for over six months, through

the newspapers and advertisements in the community health center. The criteria for exclusion were participating in other weight loss intervention studies or having a history of drug or alcohol abuse.

2.2 *Dietary Intervention*

The participants will be randomly assigned to one of two groups: The Ketogenic diet or Intermitting fasting diet. The ketogenic diet group will consume a diet with a significant reduction in carbohydrates (<50g of carbohydrate a day from vegetables only) and a compensated increase in protein (1.2 g per kilogram of ideal body weight) and lipids. There will be no restrictions on calories. The intermitting fasting group has to finish all the meals within a set window from 10 am to 6 pm with a fasting duration of approximately 16 hours. There will be no restrictions on calories. Dietitians will give dietary instructions at baseline.Furthermore, participants will meet with dietitians weekly throughout the protocol for diet reinforcement and recipes. They will be requested to keep a 3-day food record for two working days and one non-working day for the 6th and 12th week. Physical activity should be recorded if there is any. The observational follow-up period will be six months, during which the participants will not receive dietary instructions but will keep a 3-day food record for one week per month.

2.3. Measurements

2.3.1. Anthropometric measurements

The primary outcome is the change in body weight, which will be measured by using a digital scale with a precision of 0.1 kg, participants are instructed to stand on both feet in the centre of the scale, and any heavy outwear and shoes should be removed before the measurements. The weight recorded minus weight at baseline is the weight change. A stadiometer will measure height with a precision of 0.5 cm. The participants are asked to take off their shoes with their heads, shoulders, buttocks, and heels touching the wall. Using the measurements, BMI can be calculated by weight(kg)/height(m^2). Waist circumference is measured by placing a retractable measuring tape horizontally around the middle of the torso. The measurements above will be recorded at baseline, at the end of the intervention period, and the end of the follow-up period.

2.3.2. Clinical measurements

Participants will have fasting blood glucose in the morning after 12 hours of fasting, both for the last week of the intervention period and after six months during the follow-up period. The fasting blood sample collected should be stored in a Vacutainer tube under cool conditions. The concentration of glucose, low-density lipoprotein, high-density lipoprotein, and blood cholesterol levels are measured at baseline, at the end of the intervention period, and at the end of the follow-up period will be used for assessing the outcomes. The blood pressure will be measured by using the mercury sphygmomanometer weekly.

3. Result

Fifty-eight participants completed the study. (one dropout per each group because the participants moved away) Similar anthropometric measurements of the 58 women randomized in 2 groups were recorded at baseline.

Table 1. Anthropometric measurements (baseline, postintervention after 12 weeks, after six months follow-up period).

Anthropometric measurements (mean values)	Ketogenic group			Intermitting fasting group		
	Baseline	12 week	6 months follow-up	Baseline	12 week	6 months follow-up
Weight/kg(%)	88.9	83.6 (-5.96%)	87.9 (+5.14%)	93.0	92.4 (-0.645%)	92.2 (-0.216%)
Height/m(%)	1.64	no change	no change	1.65	no change	no change
Body mass index/kgm-2(%)	31.9	31.1 (-2.51%)	32.7 (+5.14%)	34.2	33.9 (-0.877%)	33.8.0 (-0.295%)
Waist circumference /cm(%)	103.5	99.76 (-3.61%)	102.86 (+3.11%)	106.6	105.9 (-0.657%)	105.2 (-0.661%)

As shown in Table 1, participants in the ketogenic diet lost more weight during the 12 weeks of intervention but gained most of the weight loss in the six months of follow-up. However, the Intermittent fasting group lost weight throughout the study. BMI and waist circumference demonstrate a similar trend.

Table 2. Clinical measurements (Baseline, Post-intervention after 12 weeks, after six months observational follow-up period).

Clinical measurements (mean values)		Ketogenic group			Intermitting fasting group		
		Baseline	12 week	6 months follow-up	Baseline	12 week	6 months follow-up
Fasting blood glucose/mgL-1		4.9	4.6	4.5	4.8	4.8	4.7
High-density lipoprotein cholesterol		1.28	1.29	1.29	1.4	1.5	1.4
Low-density lipoprotein cholesterol		2.89	2.94	2.91	3.1	2.8	2.9
Blood pressure/ mm Hg	Systolic	122.9	122.9	122.8	125.2	123.1	125.0
	Diastolic						
Urine ketone /mmolL-1		81.0	81.2	81.0	80.1	80.2	80.1

According to the Table 2, the reasults of blood sample show fasting blood glucose exhibited heterogeneous declination in both groups, with the ketogenic group to a larger extent. Nevertheless, the level of low-density lipoprotein increased in the former group and decreased in the latter group, whereas the level of high-density lipoprotein revealed a trend of levelling off with less noticeable ascending. The blood pressure in both groups was not greatly affected throughout the period. According to the urine sample, the amount of ketone in the urine was soaring during the ketogenic group, then fell back to its baseline value in the follow-up period.

Table 3. Daily Dietary Records (Baseline, Post-intervention after 12-week, after 6 months observational follow-up period).

Daily Dietary Records (mean values)	Ketogenic group			Intermitting fasting group		
	Baseline	12 weeks	6 months follow-up	Baseline	12 weeks	6 months follow-up
Total Energy Intake, kcal	2356	1754	1882	2148	1515	1624
Carbohydrates/g (%kcal)	350(49%)	45(12%)	190	242(44.5%)	205(52.6%)	211
Protein/g (%kcal)	107(35%)	132(64%)	112	87.0(34.8%)	42.0(24.0%)	50.3
Saturated fat/g	105(15%)	130(28%)	128	92.1(17.9%)	79.5(21.5%)	81.9
Fibre/g	35.1	45.8	33.2	28.9	12.7	15.3

Table 3 shows the total energy consumed by the two groups significantly declined during the dietary

intervention. The ketogenic diet group used dietary fat as the major source of calories, while carbohydrate was the energy source of the intermittent fasting diet. During the observational period, most of the participants managed to maintain the pattern of the diet, but low energy intake is difficult to be achieved without strict restrictions and close monitoring.

4. Discussion

The study's results support the hypothesis that the ketogenic diet will lead to more rapid weight loss in 12 weeks of dietary intervention, while intermittent fasting has better weight stability six months after the intervention. The reason for this outcome could be long-term compliance with the diets. The participants may struggle to stick with the carbohydrate-restrictive ketogenic diet, which may cause long-term risks of obsessiveness and eating disorders. On the other hand, intermittent fasting with reduced feasting hours to avoid late-night snacking and no carbohydrate, lipid and protein restrictions might be more acceptable and achievable.

Despite the weight loss, the risk factors measured with cardiovascular disease did not improve. A plausible explanation could be the short duration of the intervention. The data of fasting blood sugar and urine ketone also contribute to a clearer understanding of the ketogenic diet can control the level of blood sugar, which can benefit patients with diabetes, as well as decisively jeopardize the chemical balance in the blood, ascribed to ketogenesis (ketone synthesize when the blood sugar drop to suppress appetite, which results in eating less), that will increase risk of other chronic diseases.

The study does have some limitations. Firstly, the generalizability of the results might be limited by the small sample size and specific group of Chinses women who participated. Thus results may not apply to women from other countries. Secondly, the reliability is impacted by the short duration of intervention. Further studies should focus on long-term dietary interventions and compare the effectiveness of these weight control diets for women in other countries.

5. Conclusion

In this 12-week intervention study and 6-month observational study, the ketogenic diet demonstrates more rapid short-term weight loss, whereas intermittent fasting shows better long-term weight maintenance. However, the correlation with reducing risk factors of cardiovascular diseases has not been shown.

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