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The Ameliorative Effect of Dietary Interventions based on the Chinese Dietary Guidelines on Metabolic Syndrome

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Abstract: Metabolic syndrome is one of the risk factors leading to cardiovascular and cerebrovascular diseases, and is considered to be a public health problem threatening global human health. The correlation between dietary nutrition and metabolic diseases such as obesity and type 2 diabetes has been generally accepted, so dietary intervention based on dietary guidelines for Chinese residents is expected to become a new target for improving metabolic syndrome. Based on the background of Chinese diet characteristics, qualitative and quantitative dietary intervention was conducted for patients with metabolic syndrome, and the improvement effect of dietary intervention on metabolic syndrome was observed.

Keywords: Metabolic Syndrome; Dietary Interventions; Dietary Guidelines for Chinese Residents.

1. Introduction

According to the recommendations of the Chinese Medical Association's Diabetic Society, there are four reference data for the diagnostic criteria of metabolic syndrome. Of these, a patient is diagnosed with metabolic syndrome if he or she has three quarters or all of the abnormal data in the reference data:(i) overweight or obese: body mass index (BMI) ≥ 25.0; (ii) hyperglycaemia: fasting blood glucose (FPG) ≥ 6.1 mmol/L, 2h postprandial PG ≥ 7.8 and/or diagnosed and treated diabetes mellitus; (iii) hypertension; systolic blood pressure (SBP)/diastolic blood pressure (DBP) ≥ 140/90 mmHg and/or diagnosed and treated hypertension; (iv) dyslipidaemia: serum triacylglycerol (TG) ≥ 1.7 mmol/L and/or high-density lipoprotein cholesterol (HDL-C) < 0.9 mmol/L (men) and < 1.0 mmol/L (women).

The metabolic syndrome is a syndrome of metabolic disorders caused by disturbances in the metabolism of proteins, fats and carbohydrates in the body, including obesity, hyperglycaemia, hypertension, dyslipidaemia, hyperviscosity, hyperuricemia, hyperuricemia, high incidence of fatty liver and hyperinsulinemia. These factors form the pathological basis for the development of cardiovascular disease and diabetes, while central obesity and insulin resistance form important factors in the pathogenesis of the metabolic syndrome and the development of the disease. A large body of data suggests a causal relationship between dietary factors and the metabolic syndrome.

In recent years, the demand for nutrition is increasing, the phenomenon of irrational diet is becoming more and more prominent, the incidence of metabolic syndrome is increasing [1], there are limitations in drug treatment, and improving metabolic syndrome through dietary intervention has become a hot research topic. Over the past five to ten years, there has been a growing awareness of the role of dietary interventions in improving metabolic syndrome, and a strong demand for and experimentation with standardised and healthy dietary structures, such as the Mediterranean diet, balanced diets with plant and animal foods, and plant- or animal-based diets. With the collection of relevant data and follow-up trials, it is clear that dietary interventions have an ameliorative effect on the improvement of metabolic syndrome, however, there are still uncontrollable factors in dietary intervention trials conducted according to the dietary guidelines for Chinese residents.

As the Chinese diet reflects the geographical location, lifestyle and personality of a region, it is more complex and diverse than the Western diet, and interventions that are currently proven mainly in Western populations are difficult to carry out in the context of Chinese food culture. Therefore, at present in China, there will be books or guidelines to guide the population's diet such as the Chinese Dietary Guidelines and the Chinese Dietary Pagoda to quantify in detail on a qualitative basis, which will have far-reaching implications for the improvement of the metabolic syndrome.

2. Methodology

2.1. Experimental Study

The study is a parallel controlled trial with randomised patient groups. In this study, 100 patients with metabolic syndrome and no history of medication or treatment were randomly grouped based on the Chinese Dietary Guidelines. In the intervention group of 50, a qualitative dietary intervention and a quantitative dietary intervention were conducted based on the Chinese Dietary Guidelines, and in the control group of 50, a qualitative dietary intervention was conducted based on the Chinese Dietary Guidelines only [2]. The numerical changes and individual changes in data with confirmatory significance in metabolic syndrome were measured during the pre-, mid- and post-intervention periods.

The trial population was selected from hospital visits for metabolic syndrome and 100 patients were randomly selected based on an assessment of the patients' long-term residence, representing each of the six main Chinese cuisines: Lu, Sichuan, Cantonese, Huaiyang, Hunan and Min, which represent the dietary styles of nearly 80% of the Chinese population. A qualified catering establishment in Beijing was selected to provide sufficient space and equipment for the study, with quality chefs selected from catering establishments of different cuisines, with simple nutritional

training, and with dedicated staff to oversee the integrity of the experiment.

2.2. General Information

One hundred patients with metabolic syndrome who were admitted to the hospital from January 2021 to June 2021 and had not yet started pharmacological or other clinical treatment were selected for the study. The disrupted diet style was randomised in a 1:1 ratio into an intervention group and a control group of 50 patients each, with an approximately balanced proportion of men and women, aged eighteen to sixty-three years. There were no statistically significant differences between the two participating groups in terms of other clinical data. The study, therefore, was comparable.

2.3. Inclusion and Exclusion Criteria

Inclusion criteria: All patients met the diagnostic criteria for metabolic syndrome, had no history of medication or treatment, were conscious of their own volition, had intact feeding function, were aware of the trial, agreed to participate in the trial and signed an informed consent form. Exclusion criteria [3,4]: Patients with poor compliance, inability to eat on their own or incomplete feeding function, patients with severe organic disease, liver or kidney defects or failure, patients who have received clinical or pharmacological treatment for metabolic syndrome before the study, patients with hereditary or infectious diseases, patients who may affect the results of the study.

2.4. Test Trial Period (6 Days)

Patients who met the inclusion and exclusion criteria were invited to participate in a trial period of 6 days [5]. The participants' height, weight and metabolic syndrome-related data were measured and recorded prior to the start of the trial period, and their past and family histories and daily medication use were recorded; two servings of the appropriate diet were provided to participants in the intervention and control groups during the trial period to further verify their dietary style. Blood pressure, blood glucose and basal metabolic rate were measured daily for six days.

2.5. Interventions

After completing the trial period, the intervention group began a combined qualitative and quantitative dietary intervention based on the Chinese Dietary Guidelines and the Chinese Dietary Pagoda, with daily scores recorded; the control group had a daily qualitative dietary intervention based on the Chinese Dietary Guidelines and the Chinese Dietary Pagoda. All participants consumed the study meal at three meals per day (breakfast, lunch and dinner). Participants in both groups received no other interventions.

2.6. Methods

2.6.1. Intervention Group: Patients Underwent Qualitative and Quantitative Dietary Interventions based on the Chinese Dietary Guidelines and the Pagoda Chart, as Follows:

Health promotion and education was provided to the participating patients and the quantitative intervention of dietary nutrition was implemented on the basis of the data in the charts and in the control group.

Each food in the table needs to be scored daily, on the basis of which quantitative scores are given: 22 out of 22, with a passing score of 17. The daily intake of all types of food, which is not in the range of the chart, is scored 3 points.

Table 1. Quantitative scales per nutrient intake

Type	Intake	Score
Table 1		
Potatoes	50 to 75g	1
	76 to 100g	2
Whole grains and mixed legumes	50 to 100g	1
	101 to 150g	2
Fruits	200 to 275g	1
	276 to 350g	2
Animal and poultry meat	300 to 400g	1
	401 to 500g	2
Sugar	<25g	2
	25 to 50g	1
Table 2		
Water	Male ≥ 1700ml	2
	Female ≥ 1500ml	2
Vegetables	≥300g	2
Dairy products	≥300ml	2
Eggs	300 to 350g	2
Salt	<5g	2
Oil	25 to 30g	2

2.6.2. Control Group

Patients undergo qualitative dietary interventions based on the Chinese Dietary Guidelines and the pagoda chart, as follows: ensure a diversity of food intake each day; daily meals should include cereals and potatoes, vegetables and fruits, livestock, poultry, fish, eggs and milk, and legumes, with an average daily intake of more than 12 food items and more than 25 items per week in reasonable combinations; eat more fruits and vegetables, dairy, whole grains and soybeans, eat whole grains and soybean products regularly, and Eat moderate amounts of fish, poultry, eggs and lean meat[6], giving preference to fish, less fatty meat, smoked and cured meat products, less deeply processed meat products, more nutritious eggs, eat eggs without discarding the yolk; less salt and oil, cultivate a light diet, less high-salt and fried foods, control sugar and limit alcohol, no or less sugary drinks; eat regularly and moderately every day, no overeating, no partial and picky eating, no excessive Eat a reasonable diet, arrange three meals a day, regularly, do not miss meals, and eat breakfast every day; drink a sufficient amount of water every day, a few times, drink plain water or tea, drink less or no sugary drinks, and do not use drinks instead of plain water.

2.7. Blinding

Both groups of participating patients were unaware of the measures allocated to the intervention and arranged to eat in different places, with the intervention and control groups maintaining the same type of food at the same meal on the same day as far as possible, and patients participating in the intervention group should rate the type of food eaten each day as needing to be realistic. In addition, the researchers conducted process measures while blinded to the allocation of the intervention.

2.8. Observation Indicators and Assessment Criteria

To compare and observe the scores of the two groups of patients on each day of intervention, the data concerning metabolic syndrome were measured at the hospital during the pre-, mid- and post-stages: (1) fasting blood glucose value greater than 5.6 mmol/L; (2) diastolic blood pressure not less than 85.0 mmHg or systolic blood pressure not less than 130.0 mmHg; (3) HDL cholesterol less than 1.3 mmol/L; (4) triacylglycerol The disappearance of two or more of the above four indicators, when combined with the quantitative parity of the daily dietary intake and the report of the three-stage objective examination data, is assessed as a stable improvement of the metabolic syndrome by quantitative and qualitative dietary interventions based on the Chinese Dietary Guidelines and the Chinese Dietary Pita; the disappearance of one indicator is assessed as an insignificant effect; and no change is assessed as ineffective. The results were assessed as ineffective.

2.9. Statistical Methods

¯x Data processing was performed using SPSS software, with measurement data expressed as ẋ±s using the r test and technical data expressed as percentages using the x3 test [7], with $P < 0.05$ being considered a statistically significant difference.

3. Results

In Table 1.

The quantitative recommendation for the intervention group was to consume 50 to 100 g of potatoes per day, with 50 to 75 g receiving 1 point and 76 to 100 g receiving 2 points. The recommended daily intake of whole grains and legumes ranged from 50 to 150 g, with 50 to 100 g scoring 1 point and 101 to 150 g scoring 2 points. The recommended daily intake of fruit is 200 to 350 g, of which 200 to 275 g gets 1 point and 276 to 350 g gets 2 points. The recommended intake of livestock and poultry meat is 300 to 500 g per day, of which 300 to 400 g receives 1 point and 401 to 500 g receives 2 points. The intake of sugar is recommended to be no more than 50 g per day, preferably controlled to less than 25 g, of which 2 points are awarded for intake of less than 25 g and 1 point for 25 to 50 g.

In Table 2.

In mild climatic conditions, low physical activity level adult males received 2 points for drinking 1700 ml and more of water per day, and adult females received 2 points for drinking 1500 ml and more of water per day. 2 points were awarded for vegetable intake of at least 300 g per day. 2 points are awarded when the daily intake of dairy products is 300 ml or more. 2 points are awarded when the daily intake of eggs is 300 to 350 g. 2 points are awarded when the daily intake of salt does not exceed 5g. A score of 2 was obtained when the daily intake of cooking oil was 25-30g.

In the double-blind trial, regarding the food intake in Table 1, the intervention group scored on average between 7 and 10 points per day, and the control group scored on average more than 11 points per day. For the food intake in Table 2, the intervention group scored an average of 12 points per day and the control group scored an average of more than 3 to 5 times more per day than the intervention group. At the cutoff of the experiment, metabolic syndrome-related data were measured for both groups, in which patients in the intervention group had a mean body fat percentage less than 25.0, glycosylated hemoglobin less than 6 mmol/L, and significant decreases in both lipids and blood pressure, while patients in the control group showed improvement in some of the metabolic syndrome-related data examined, but measured insignificant decreases, and the remaining patients did not achieve effective improvement. Comparing the effects of the two groups, the quantitative and qualitative dietary interventions based on the Chinese dietary guidelines and the Chinese dietary pagoda had a more significant and stable effect on the improvement of the metabolic syndrome compared to the qualitative dietary interventions alone.

4. Discussion

Metabolic syndrome is a disease in which multiple abnormal symptoms manifest themselves in the same organism, and is a risk factor for cardiovascular disease and diabetes. In recent years, with the gradual development of the economy and society, people's demand for nutrition has become more and more exuberant, and the imbalance in dietary structure has become more and more pronounced, with the incidence of metabolic syndrome showing a clear and continuous increase in China and even worldwide. People are guided to eat a healthy and rational diet and to avoid excessive intake of high-calorie and high-protein substances. While quantitative and qualitative nutrient intake is easier to implement in foreign countries, as opposed to the context of a diverse diet in China, is it more valuable to improve metabolic syndrome in China based on the Chinese Dietary Guidelines and the Chinese Dietary Pagoda, with the same quantitative approach to food intake. The innovation of this experiment lies in the combination of not only qualitative dietary guidelines, but also quantitative food intake to develop dietary interventions from both aspects together. The trial can also provide a reference for the revision of the Chinese Dietary Guidelines.

In conclusion, the dietary intervention based on the Chinese Dietary Guidelines has an ameliorative effect on metabolic syndrome, which can preferentially alleviate the clinical symptoms of patients and improve the quality of life, and the trial has certain clinical value.

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