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High-Fibre Dietary Patterns in Weight Management for Obese Individuals: Composition, Mechanisms and Clinical Application

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Abstract. The prevalence of obesity rises rapidly worldwide and evolves into a severe public health crisis endangering human health. Unbalanced dietary patterns act as a critical modifiable factor governing the onset and progression of obesity. The high-fibre dietary pattern, a wholesome eating regimen centered on naturally fibre-rich foods, delivers pronounced benefits in weight management and metabolic wellness. Existing studies verify that elevated dietary fibre intake effectively boosts satiety, cuts total energy intake, slows postprandial glucose absorption, lifts insulin sensitivity, reshapes intestinal microbiota composition, and stimulates short-chain fatty acid synthesis. Multiple pathways therefore alleviate metabolic abnormalities linked to obesity. Nevertheless, most current investigations focus solely on effects of isolated fibre supplements. Comprehensive summaries and mechanistic syntheses regarding holistic, structured high-fibre dietary patterns remain insufficient. Larger-scale, long-term cohort studies and personalized nutritional intervention trials are required in future analyses to develop targeted high-fibre dietary tactics. This paper systematically reviews the definition and core traits of high-fibre dietary patterns, classifications and food origins of dietary fibre, physiological mechanisms underlying weight regulation, clinical evidence, and practical guidance. Evidence-based references for nutritional intervention among obese populations are thereby supplied.

Keywords: High-fibre dietary patterns, Obese, Mechanisms, Clinical Application

1. Introduction

In recent years, the global obesity prevalence has shown a rapid upward trend, which has evolved into a serious public health problem that threatens human health and is listed as the fifth largest risk factor for death in the world. Obesity is defined as excessive or abnormal fat accumulation that impairs health, with a body mass index (BMI) of 30 kg/m^2 or higher [1]. As one of the main chronic non-communicable metabolic diseases, obesity can significantly induce a series of pathophysiological changes such as insulin resistance, blood lipid disorders, and chronic low-grade inflammation, thereby increasing the risk of type 2 diabetes, metabolic syndrome, cardiovascular diseases and a variety of malignant tumours, seriously reducing residents' health level. At the same

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time, it brings a heavy burden to the medical and health system and the social economy [2]. Among many influencing factors, unreasonable diet pattern is a key intervention factor leading to the occurrence and development of obesity, especially manifested in long-term insufficient dietary fibre intake, excessive intake of refined staple food, high sugar and high fat, and excessive consumption of ultra-processed food. Therefore, the nutritional intervention strategy, which takes optimising the overall diet structure as the core and uses increased intake of natural foods as a guide, is recognised as the most economical, safe and sustainable core public health means to prevent and control obesity at present.

The high-fibre dietary pattern is mainly characterised by the sufficient intake of natural high-fibre foods such as whole grains, vegetables, fruits, beans and algae, emphasising the integrity of the dietary structure and the low degree of food processing. Many epidemiological and clinical trials have confirmed that it has significant benefits for weight regulation and metabolic health. Studies have shown that increasing dietary fibre intake can effectively enhance satiety, reduce total energy intake, delay intestinal glucose absorption and regulate intestinal flora structure, thus improving obesity-related metabolic abnormalities in multiple ways [3]. Clinical trials also show that continuous high-fibre dietary intervention can safely and effectively help obese people reduce body weight and body fat content, and have good long-term compliance [4]. Notably, the benefits of high-fibre dietary patterns extend beyond weight loss; they also improve cardiovascular risk factors such as blood pressure, LDL cholesterol, and inflammatory markers, making them a comprehensive metabolic health strategy. However, at present, most studies still focus on the effect of single dietary fibre supplements, and the systematic summary and mechanism summarization of the holistic and structured high-fibre dietary pattern are still relatively insufficient.

Based on the above background, this article reviews the high-fibre dietary pattern, clarifies its definition, characteristics and food sources, systematically explains its key physiological mechanism in weight management, and puts forward practical dietary suggestions for obese people. This study can provide evidence-based basis for the nutritional intervention of obese people and promote the scientific application of high-fibre diet in public health nutrition practice.

2. Overview of high-fibre dietary patterns

2.1. Definition and core characteristics

The high-fibre dietary pattern is a scientific and healthy diet model built on natural foods rich in dietary fibre as the core, emphasising the integrity of dietary structure and a low degree of food processing. Unlike the simple use of dietary fibre supplements, this pattern focuses on the overall balance and rationality of the diet, advocating that the recommended daily dietary fibre intake of 25–30 g be achieved through natural foods [3]. This dietary model is characterised by low energy density, prolonged satiety, and a balanced combination of macronutrients and micronutrients, making it suitable for long-term adherence and applicable to various populations.

2.2. Classification and food source of dietary fibre

According to their water solubility, dietary fibre is classified as soluble or insoluble [3]. Soluble fibres form a gel in the gut and are fermented by gut microbiota into short-chain fatty acids (SCFAs), which help lower blood cholesterol and glucose; they are found in oats, barley, beans, apples, citrus fruits, carrots, and psyllium. Insoluble fibres add bulk to stool and promote regular bowel movements without dissolving; they are abundant in whole grains (e.g., wheat bran, brown

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rice), nuts, seeds, and vegetable skins (e.g., celery, cucumbers, potatoes). Both types protect the gastrointestinal tract and regulate metabolism [5], and a wide variety of fibre-rich foods—including whole grains, legumes, leafy greens, low-glycaemic fruits, mushrooms, kelp, konjac, nuts, and seeds—contain both fibres along with vitamins, minerals, and polyphenols that work synergistically to reduce oxidative stress and chronic inflammation.

3. Physiological mechanisms of high-fibre diet for weight control

Obesity is associated with abnormal appetite regulation, insulin resistance, a disturbance in the gut microbiota, an imbalance in glucose and lipid metabolism, and chronic low-grade inflammation [6, 7]. Increase the intake of high-fibre foods to address the above problems in obesity.

3.1. Enhancement of satiety and reduction in energy intake

A high-fibre diet significantly enhances satiety and effectively reduces total energy intake. Dietary fibre itself is neither digested nor absorbed in the small intestine of the human body; rather, it increases the volume of food significantly, extends the time for chewing and eating, and reduces gastric emptying to make people feel full for a longer time. At the same time, dietary fibre stimulates intestinal endocrine cells to release endogenously produced satiety hormones, such as GLP-1 and PYY, through both mechanical pull and chemical signalling pathways to inhibit the transmission of hunger signals. Therefore, this will reduce voluntary food intake and the total energy consumed in a day [8]. The mild regulatory mechanism will not trigger severe hunger; thus, the reduction in appetite will be relatively gentle and more tolerable for a long time, helping to form a good eating habit gradually and sustainably. A randomized cross-over trial conducted by Wu et al. [8] investigated a new RPG (R+PolyGly) dietary fibre product in healthy adults and found that taking RPG capsules (5.6g) with meals significantly enhanced satiety and suppressed appetite more effectively than pectin, along with a rise in serum GLP-1 levels. The above results provide support for the satiation enhancement effect of fibre. Importantly, the satiety effect of dietary fibre is dose-dependent, and it is most noticeable when fibre is consumed in conjunction with whole-food meals rather than as an independent supplement; thus, a strategy of incorporating whole foods is preferable to the one-nutrient supplement approach.

3.2. Stabilization of blood glucose and enhancement of insulin sensitivity

An excess of fibre is likely to reduce the rise in blood glucose after a meal and increase the sensitivity of the body to insulin. Soluble dietary fibres in carbohydrate metabolism can form a viscous gel in the gut, hindering the breakdown and absorption of starch and glucose; thus, they slow down the rise in blood sugar after a meal, reduce the peak level of blood sugar, and limit excessive release of insulin. Reduce the fluctuations of insulin to slow down the uptake and synthesis of fat cells directly, thereby reducing excessive accumulation of visceral fat and body fat [9]. Obese people with pre-diabetes and type 2 diabetes have impaired insulin function and damage to the pancreatic islets, so this therapy can be applied to reduce this harm and thus improve blood sugar control and delay the development of severe diabetic complications. Janssen put forward a new model for understanding obesity-related hyperinsulinemia and believed that continuous excess calories in life cause long-term high insulin levels [9]. Thus, fat in non-fat tissues builds up and insulin resistance occurs. Dietary fibre can reduce the speed at which sugar and fat are absorbed in the digestive tract; therefore, insulin does not rise rapidly after eating. It has also been shown that

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when people eat more high-fibre foods, their insulin sensitivity will rise; thus, these people will be able to reduce glucose production by the liver and increase the amount of glucose taken up by other parts of the body.

3.3. Regulation of gut microbiota and production of short-chain fatty acids

An excess of fibre in the diet may alter the profile of the gut microbiome and thus reduce the production of short-chain fatty acids. As a vital prebiotic, dietary fibre can also be fermented by good bacteria in the intestine; thus, only beneficial bacteria such as Akkermansia and Firmicutes are promoted in number and activity, and the increase of pathogenic bacteria is kept under control. Optimize the gut microbiota, strengthen the integrity of the intestinal barrier, reduce the entry of endotoxins into the blood, and thus alleviate the chronic low-grade inflammation that occurs in obesity [5]. Additionally, short-chain fatty acids produced by microbial fermentation enter the blood, influencing all-body metabolism through multiple routes to regulate appetite at the center and periphery, increase energy expenditure, and thus help control weight [3]. Borrego-Ruiz and Borrego [5] conducted an all-encompassing review showing that individuals with obesity often have reduced microbial diversity and a lower ratio of beneficial to pathogenic bacteria. Dietary intervention rich in fibre has been shown to ameliorate these changes to some extent, and the extent of the shift in microbial communities correlates with the size of weight loss and metabolic improvement. Therefore, an increase in butyrate produced by fibre fermentation has also been linked to improved mitochondrial function in fat and muscle tissue to enhance energy consumption and reduce body fat.

3.4. Binding of fats and promotion of fecal excretion

Some types of dietary fibres can bind with fats, cholesterol and bile acids in the intestine to form insoluble complexes, thus reducing the absorption and reabsorption of lipids and cholesterol and promoting the excretion of fats and cholesterol in the feces. Reduce the amount of energy in the body, improve the lipid profile, decrease body fat, and optimise body composition [4]. All of the above ways work together to provide a safe, effective, and well-supported diet of high-fibre food for long-term weight control.

Table 1. Representative studies on high-fibre dietary interventions for weight management in obese individuals

Study design/Population	Main outcomes related to weight/fibre	Key mechanisms	Ref.
Systematic review of epidemiological and mechanistic studies	Higher fibre intake consistently associated with lower obesity risk, improved metabolic health	Satiety hormones regulation, glucose absorption delay, gut microbiota modulation	[3]
Meta-analysis of 27 RCTs (1,428 overweight/obese participants	Weight reduction of 1.25 kg (95% CI: −2.24, −0.25), reduced BMI and waist circumference	No extreme dieting required; good long-term compliance; sustainable weight management	[4]
Comprehensive review on gut microbiome and obesity	Fibre-induced microbial shifts (↑ Akkermansia, Bifidobacterium), reduced obesity and metabolic dysfunction	Improved intestinal barrier, reduced endotoxemia, alleviated chronic low-grade inflammation	[5]
Randomized cross-over trial in healthy adults (12 participants)	5.6 g RPG fibre with meals significantly improved satiety and reduced hunger compared to pectin	Increased serum GLP-1 levels; direct experimental evidence for fibre's satiety-enhancing effect	[8]

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Table 1. (continued)

Cross-sectional analysis of NHANES 1999–2018 (39,184 U.S. adults)	Highest fibre quartile (≥20.8 g/day) had 26% lower obesity prevalence, independent of energy intake/activity	Non-linear dose-response; protective effect in all age and gender subgroups	[10]

Based on the above evidence, Table 1 presents some studies that have examined the effects of high-fibre diets on obesity-related outcomes, along with details such as the type of research, main results, and underlying mechanisms.

4. Clinical application and recommendations of high-fibre diet in obesity intervention

4.1. Clinical evidence of high-fibre diet for weight management

In clinical and public health practice, high-fibre dietary intervention has shown stable, reliable and clinically significant effects on weight loss and metabolic improvement. According to meta-analyses of randomized controlled trials, high-fibre or soluble fibre intervention for at least 12 weeks can significantly reduce body weight by an average of 1.25 kg (95% CI −2.24, −0.25; 27 RCTs; 1428 participants), decrease BMI, and reduce waist circumference in obese individuals, without extreme dieting or forced energy restriction [4]. These improvements are sustainable and less likely to rebound rapidly. Compared with strict calorie-restricted weight loss methods, the high-fibre diet is based on natural foods with strong satiety, and it is not easy to cause problems such as severe hunger, fatigue, mental depression or micronutrient deficiency. It has better compliance and is more suitable for long-term sustainable promotion and implementation.

Large-scale epidemiological studies have also supported the above clinical findings. Lai and others [10] used data from the National Health and Nutrition Examination Survey (NHANES) between 1999 and 2018 to show that, compared with those in the lowest quartile of fibre intake (≤9.1 g/day), the highest quartile (≥20.8 g/day) had a 26% lower risk of obesity; this protective effect was not due to a reduction in total energy consumption or exercise. Huwiler and others [4] also pointed out in their meta-analysis that the weight-reducing effect of soluble fibre was more pronounced in studies lasting 12 weeks or longer than in short-term studies; thus, adaptation of the gut microbiota and satiety pathways probably requires a relatively long period to appear. It can be expected that after three months of a change in diet, the results will be more representative of the real situation for overweight people. For public health, a relatively low-cost high-fibre diet does not need to be used to treat obesity-related diseases such as hypertension, dyslipidaemia and type 2 diabetes with medication.

As presented in Table 1, the magnitude of weight loss from fibre interventions may appear modest (approximately 1–2 kg on average), but it should be interpreted in the context of population-level impact. Even a 5% reduction in body weight is associated with clinically meaningful improvements in cardiovascular risk factors. Moreover, high-fibre dietary patterns are not weight-loss drugs but rather sustainable lifestyle modifications that also lower the risk of diabetes, cardiovascular disease, and colorectal cancer through mechanisms independent of weight change.

4.2. Practical recommendations and implementation strategies

In the actual application scenario, obese people can improve daily dietary fibre intake through gradual adaptation to avoid discomfort caused by excessive haste. Specific implementable practical strategies include: gradually replacing some refined staple foods such as polished rice and white

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flour with whole grains such as oats, brown rice and whole wheat products; ensuring adequate daily intake of fresh vegetables, and eating an appropriate amount of vegetables before meals to enhance satiety in advance, so as to reduce the intake of staple foods; replacing all kinds of sugary beverages, desserts and processed snacks with whole fruits; appropriately increasing the intake of high-fibre ingredients such as beans, konjac, mushrooms and kelp; at the same time, ensuring sufficient and regular water intake, so that dietary fibre can fully absorb water and expand, and better play the role of delaying absorption, enhancing satiety and maintaining intestinal function. Combined with the existing evidence-based basis and dietary guidelines, the daily vegetable intake of obese people should not be less than 500 grams, fruit intake should be controlled at 200–350 grams, and the proportion of whole grains in daily staple foods should reach more than half [3].

During implementation, the principle of gradual progress should be strictly followed, and fibre intake should be increased slowly to avoid gastrointestinal adverse reactions such as abdominal distension, increased exhaust gas, diarrhea or abdominal discomfort caused by a substantial increase in a short period. It is also recommended to increase fluid intake proportionally to fibre intake, as water is essential for fibre to exert its beneficial effects on bowel function and satiety. For people with special health conditions such as chronic gastrointestinal diseases, severe intestinal dysfunction or renal insufficiency, individualized adjustments must be made under the guidance of professionals such as doctors or clinical nutritionists, and fibre intake should not be increased arbitrarily. Furthermore, combining a high-fibre dietary pattern with regular physical exercise can further enhance weight control efficacy, increase muscle mass, improve body composition, and yield more significant metabolic benefits. Overall, the high-fibre dietary pattern is safe, gentle, easy to implement, highly acceptable, and conducive to widespread adoption, making it an ideal nutritional intervention for scientifically managed weight control and improved metabolic health in obese populations.

5. Conclusion

In summary, obesity has become a global public health problem, which is closely related to unreasonable dietary patterns. As a safe, feasible and sustainable nutritional intervention, the high-fibre dietary pattern plays an important and irreplaceable role in the weight management of obese people. High-fibre diet can effectively reduce body weight, BMI, waist circumference and body fat percentage without strictly limiting calories by enhancing satiety, reducing energy intake, stabilising postprandial blood sugar, improving insulin sensitivity, regulating intestinal flora structure, promoting short-chain fatty acid production, and alleviating chronic low-grade inflammation, so as to achieve stable and sustainable weight control effect. This dietary pattern not only aids in weight management but also improves overall metabolic health and reduces the risk of various chronic diseases.

This article systematically reviews the definition, characteristics, food source, physiological mechanism and practical application of the high-fibre dietary pattern, and provides evidence-based dietary advice for obese people, which can support clinical and public health nutrition interventions.The key evidence from representative studies is summarized in Table 1, which highlights the consistency of findings across observational studies, randomized trials, and mechanistic investigations. However, this study also has certain limitations. Most of the evidence is based on the group level, and the differences in individual responses to dietary fibre intake still need to be further verified. In the future, larger sample sizes, long-term cohort studies and personalised nutritional intervention tests should be carried out to explore more targeted high-fibre diet strategies

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to better promote the application of high-fibre dietary patterns in obesity prevention and control, and improve the national metabolic health level.

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