

The Influence of Probiotics on Middle-aged and Senior People

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Abstract. With the growth of the requirement of Chinese people for a healthy diet, the exacerbation of the aging population, and the younger trend of the “three highs”, “three highs” has become the main diseases which endanger the health of middle-aged and senior people. However, most of the middle-aged and senior people have poor medication compliance and side effects of most medicine, it has become a new idea to assist in regulating the “three highs” by probiotics, which have effects on improving intestinal health, regulating metabolic function, and regulating immune function. In this text, the subjects we are going to study are *Lactobacillus acidophilus*, probiotic Probio-X, and other strains that are used to assist in the regulation of hypertension. Synergistic effect of probiotics and organisms like *Lactobacillus mucinus* Roy SD586, *Akkermansia muciniphila*, and others assist in regulating hyperglycemia. The synergistic network made by probiotic construction enzymes and metabolites assists in the regulation of hyperlipidemia. To confirm that probiotics can assist in regulating the “three highs” in these three ways. However, in existing studies, there are still some problems, such as strong strain specificity, a lack of sample size, and a lack of specificity for middle-aged and elderly patients. The article suggests that doctors should choose probiotics with strong colonization ability and design personalized probiotic diet intervention programs for patients in combination with their individual conditions. Scientists should expand the sample size, search for the synergy between probiotics and medicine, and develop research for middle-aged and elderly people to provide intervention programs with more scientificity and security.

Keywords: Probiotic, Middle-aged and Senior People, Three Highs, Targeted Regulation, Synergistic Regulation.

1. Introduction

With the increasing demand for healthy diets in China, the exacerbation of the aging population, and the population over 60 years old in my country has exceeded 310 million. And with the younger trend of the “three highs”, the incidence of “three highs” in middle-aged and senior people has increased significantly, even exceeding half, and has become one of the three among these most common diseases in this population. This not only seriously affects the quality of life of middle-aged and senior people, but also increases the burden on many families.

In one study about medication compliance of middle-aged and senior people. The study found that only half of the 457 middle-aged and senior people had good medication compliance. And consider that some drugs will have certain side effects on the human body. Therefore, it is possible to adjust according to the original diet plan. Achieve the purpose of improving the “three highs” problems of middle-aged and senior people. This is because microbes benefit the host's health and are responsible for improving gut health. Control the function of the metabolic system and the function of the immune system. Therefore, probiotics can be used to optimize the diet plans of middle-aged and senior people and optimize the “three serious” problems.

Although a number of studies in recent years have clarified that probiotics have positive effects, such as regulating intestinal flora and maintaining the health of the immune system. For instance, the probiotic *Lactobacillus casei* HY2782 can regulate decay accelerating factor-16 (DAF-16) / forkhead box transcription factors class O (FOXO) and skinhead-1 (SKN-1) / nuclear factor E2 related factor 2 (NRF2) signaling pathways to improve intestinal barrier function, and promote the proliferation of butyric acid-producing bacteria and inhibit pathogenic bacteria at the same time, so it can improving intestinal permeability consequently, reducing inflammatory response and oxidative stress, and ultimately achieving the purpose of delaying intestinal aging and prolonging life [1]. Additionally,

the compound probiotics consist of animal bifidobacterium lactic acid bacteria subspecies XLTG11 and plant bacillus CCFM8661 can also regulate immune cell activity and improve intestinal probiotic flora to improve the immune function of mice significantly [2].

By reviewing and integrating multiple literatures, this text summarizes the relevant research results and their significance, focusing on the auxiliary regulation effect of probiotics on the "three highs" of middle-aged and senior people, it provides clear new references for researchers, doctors, and patients.

2. Current of Middle-aged and Senior People's "Three Hings" Problem

Currently, probiotics in food haven't been directly confirmed in the "three highs" of middle-aged and senior people, so the various probiotics mentioned in the article cannot replace clinically prescribed medicine to treat patients. However, a large number of clinical studies have fully verified the role of probiotics in adjuvant treatment of the "three highs": to assist in regulating blood pressure, blood sugar, and blood lipids, to improve the structure of intestinal flora, and to alleviate adverse inflammatory reactions from medicine. However, there are still many problems in the relevant studies of middle-aged and senior patients, such as strong strain specificity, insufficient sample size, and lack of pertinence for middle-aged and senior patients.

3. Organization of the Text

3.1. Aspect of blood pressure

In present studies, it have confirmed that probiotics have a unique targeting mechanism in regulating hypertension. For example, *Lactobacillus acidophilus* can inhibit the renin-angiotensin system by decomposing tyrosine to generate γ -aminobutyric acid activity, indirectly assisting in lowering blood pressure to relieve the symptoms of hypertension [3]. This mechanism converts nutrients in food into functional molecules with regulatory effects through the biotransformation of probiotics, which has become a major innovation in probiotics assist in the regulation of hypertension.

What is more clinically valuable is that the researcher Jin Chu conducted an experiment on the therapeutic effect of probiotic Probio-X auxiliary lipid-regulating therapy in the treatment of elderly hypertension, and confirmed the innovative application of probiotics in the "three high" treatment through controlled experiments. During the study, the control group was only treated with conventional medicine, and the observation group was treated with probiotic Probio-X and followed lipid-regulating therapy while taking medicine. The results show that probiotic Probio-X lipid-regulating therapy can not only lower blood pressure, but also regulate the balance of intestinal flora through various mechanisms and improve intestinal health, on the other hand, it optimizes metabolic function [4], it's greatly reduces the impact of poor medicine efficacy and side effects caused by middle-aged and senior people who are unwilling or forget to take drugs. It not only meets the long-term treatment needs of the "three highs" groups of middle-aged and senior people, but also realizes the systematic improvement from a single treatment indicator to overall health adjustment. Additionally, a more sustainable health maintenance plan is proposed, aiming to ensure that middle-aged and elderly people can enjoy a high-quality, long-lived, healthy life.

3.2. Aspect of blood glucose

In traditional hyperglycemia regulation, a single reduction of hypoglycemia can lead to disruptions in other metabolic functions in the body. One of the greatest innovations in probiotic-based hyperglycemia regulation is the ability to modulate blood glucose levels by adjusting the balance of gut microbiota, thereby influencing gut immunity, the microbe-gut-brain axis, and the microbe-gut-liver axis [5]. This multi-organ synergy not only alleviates high glucose symptoms at the source but also controls the entire body's metabolic system.

A specific example confirms this mechanism: The strain enhances the metabolic capabilities of the gut microbiota by regulating the structure of the gut microbiome, thereby improving oral glucose

tolerance. Experimental data show that after supplementation with *Lactobacillus reuteri* SD5865, the human gut's GLP-1 levels, which are dependent on glucose stimulation, increased significantly by 76%, while insulin levels also increased by 49%. Due to the synergistic effects of these two factors, the effectiveness in maintaining human blood sugar balance is significantly enhanced [6]. It proves the regulatory effect of multi-organ synergy and strengthens the innovative significance of probiotic regulation once again.

Another very representative strain is *Akkermansia muciniphila*. What makes *Akkermansia muciniphila* highly salient is that it has strong links to metabolic health. Studies have shown that the population of this microorganism increases following treatment with α -defensins in C57BL6/J mice (28, 29, 42, 44, 45). Building on this observation, researchers further evaluated insulin sensitivity within each experimental group and discovered a consistent trend: the insulin sensitivity of AB mice was significantly higher than that of AA control mice, and also exhibited a higher trend compared to their cage mates from the AA group [7]. That is good proof that probiotics have a significant positive effect in the adjuvant treatment of hyperglycemia.

3.3. Aspect on blood lipids

The specific mechanisms by which probiotics help control hypercholesterolemia are evident in the actions of bile hydrolase enzymes: Probiotics secrete highly effective bile hydrolase enzymes. These enzymes then cleave bile acids that specifically bind to proteins in the intestines. By disrupting the balance of the bile acid cycle within the liver and intestines, this promotes the conversion of cholesterol into bile acids, thereby significantly lowering the levels of LDL cholesterol in the blood. This alleviates symptoms of hyperlipidemia [8]. This innovative regulatory approach has reduced the incidence of complications associated with hyperlipidemia, such as atherosclerosis of the root artery. This method creates a combined network of enzyme and metabolite regulation, thereby circumventing the limitations of the previously used single lipid regulation pathway.

At the same time, another adjustment scheme, SCFAs produced by probiotic fermentation, also plays a crucial role in inhibiting cholesterol synthesis. For instance, Propionic acid can lower the levels of total cholesterol (TC) in the blood. Additionally, research has shown that short-chain fatty acids (SCFAs) and bile acids (BAs) can stimulate the production of hormones related to lipid metabolism by the intestines [9].

Also, Probiotics can effectively regulate the gut-liver axis, thereby controlling lipid metabolism: they modulate the CYP7A1 enzyme in the liver, facilitating the process of cholesterol conversion into bile acids; they also regulate sterol regulatory element-binding protein 1C (SREBP-1C) to inhibit the synthesis of lipids in the liver. Additionally, probiotics have the ability to restore the balance of the gut microbiome, reduce the number of pathogens that interfere with lipid metabolism (such as *Desulfovibrio*), and elevate the levels of beneficial bacteria (such as *Akkermansia muciniphila*). This helps to enhance the integrity of the gut barrier, thereby reducing the risk of systemic inflammation and can synergistically improve lipid status[10].

4. Suggestions on probiotic diet intervention program for middle-aged and senior people with "three highs"

When selecting probiotics, strains with gastric acid resistance and strong colonization ability should be chosen first. These strains have excellent resistance, enabling them to resist the destructive effect of gastric acid in the acidic gastric juice environment of the human body, overcome the acid barrier, and successfully reach the intestinal tract, and then stabilize and multiply rapidly on the intestinal mucosa, forming a dominant microbial structure. This enables them to effectively regulate substance and energy metabolism in the body and promote the improvement of metabolic health in middle-aged and elderly people.

With regard to dietary choices, individualized protocols should be developed based on the overall health of each individual. For example, diabetics should pay attention to eating sugar-free or low-

sugar foods, and strictly control the intake of added sugars in their meals to prevent violent fluctuations in blood sugar levels. Fluctuations in blood sugar burden the pancreas and negatively affect blood sugar balance and overall metabolic health.

It is also important to supplement the diet with foods rich in prebiotics, which provide nutrients for the beneficial bacteria. When implementing dietary interventions, a specific dry period can be set, during which the patient's blood glucose, blood pressure, and lipid profiles can be monitored regularly, providing real-time data for subsequent treatment.

5. Challenges and Development

The physiological functions of probiotics have strict specificity among different strains, and there are significant differences in their roles in regulating the three serious problems of middle-aged and elderly people. Therefore, it is difficult to provide unified clinical guidance in terms of probiotic dosage, intervention cycle, and which strain combinations to apply.

The sample size of clinical research on probiotics intervening in the "three serious" problems of middle-aged and elderly people is insufficient. Most of the experimental follow-up patients are fewer than 100 people, and the long-term follow-up research is insufficient. The probiotic intervention cycle actually applied in the treatment procedure is relatively short, making its sustainability and safety doubtful. In addition, due to the differences in intervention factors, research population indicators, and research detection methods, some results are heterogeneous.

Clinical studies of probiotic intervention have not fully considered the impact of comorbidities and medication history on the intervention effect of middle-aged and elderly patients. Most hypertensive patients suffer from both osteoporosis and renal dysfunction. Hyperglycemia often leads to a decline in pancreatic islet function and even leads to diabetes. Hyperlipidemia is often accompanied by complications such as cardiovascular disease and fatty liver. Some middle-aged and elderly patients with "hypertriad" (hypertension, hyperlipidemia, and hyperlipidemia) use drugs that inhibit probiotics and their metabolic pathways, which may affect the colonization and efficacy of probiotics in the body. However, there are few studies on this aspect, and the existing research results are controversial.

In order to solve these problems in the future, researchers can expand the sample size by finding patients in multiple places for collaborative research for later data collection and analysis. It is also necessary to increase the exploration of the synergistic effect of antihypertensive drugs, hypoglycemic drugs, lipid-lowering medicine, and probiotics, and select targeted experiments based on the physiological characteristics of the intestinal tract of middle-aged and senior people.

6. Conclusion

The text base on the systematic analysis of the efficacy of probiotics on hypertension, hyperglycemia, and hyperlipidemia in the "three major indicators" of middle-aged and senior people, the text clarified the potential clinical value of probiotics in regulating these indicators. The limitations of the existing clinical application norms of probiotics in middle-aged and elderly people were pointed out, and the future research directions were given on this basis.

In terms of assisting the regulation of hypertension, the "probiotic Probio-X" studied to date has demonstrated synergistic effects with antihypertensive drugs, without impairing the action of these drugs or causing significant adverse reactions, making it safe. Additionally, it is typically a strain with high tolerance. Regarding assisting the regulation of high blood sugar, probiotics primarily achieve glucose regulation through the "probiotic-organ" axis. In this combination, the colonization ability of probiotics is enhanced. In terms of assisting the regulation of hyperlipidemia, probiotics lower serum low-density lipoprotein cholesterol levels by promoting the conversion of cholesterol into bile acids, thereby reducing blood lipid levels.

There are still some problems with probiotic regulation. However, as mild dietary supplements, probiotics show significant potential for regulating and supplementing "three highs" treatments in

middle-aged and senior people. In the future, sample sizes should be expanded, and long-term follow-up doses should be increased to obtain safer and more reliable data on the use of probiotics in the supplemental regulation of "three highs" in middle-aged and older individuals.

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