

Nutrient Intake Status, Existing Problems and Countermeasures of Chinese Residents in the Past 30 Years

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Abstract: Nutrients are the basic substances to promote human metabolism and maintain health, and their long-term unreasonable intake will increase the risk of chronic diseases among residents. The time series analysis method was used to comprehensively and systematically analyze the nutrient intake status, existing problems and adverse consequences of Chinese residents in the past 30 years. The analysis results show that the structural imbalance of nutrient intake caused by insufficient overall intake of nutrients, excess partial intake of nutrients and uneven overall intake of nutrients is the main problem of nutrient intake of Chinese residents, which is mainly manifested as "two more and four less", that is, more fat intake, more sodium intake, less mineral intake, less water intake, less vitamins intake, and less dietary fiber intake. There is a significant causal relationship between the long-term structural imbalance of nutrient intake and the high incidence of chronic diseases among Chinese residents. Effective measures can be taken to cope with the high incidence of chronic diseases by controlling the quality of nutrients intake, balancing the amount of nutrients intake, developing good daily eating habits, and improving the overall level of public awareness of nutrients. The research results provide a new theoretical perspective and application path for the prevention and treatment of chronic diseases in China, and have important theoretical value and practical significance for promoting the construction of a healthy China.

1. Introduction

Nutrients are the material basis for human survival, people have always attached great importance to the intake of nutrients. "Medicine and food are of the same origin, and medicine and food are of the same root", Nutrition can be adult, cause disease, and cure disease [1]. Nutrition plays an extremely important role in metabolism, energy conversion, disease prevention and treatment of human body. According to the Report on Nutrition and Chronic Diseases of Chinese

Residents (2020), reasonable and balanced nutrition intake is an important guarantee for human health. Previous studies have also shown that poor dietary intake structure of nutrients is closely related to people's chronic diseases, especially cardiovascular, cerebrovascular, tumor, respiratory system and other diseases. Dietary habits are an important influencing factor leading to coronary heart disease, stroke, diabetes and other chronic diseases [2-5]. Since the reform and opening up more than 40 years ago, the prevention and treatment of chronic diseases in China is increasingly facing serious challenges. According to statistics, the prevalence of chronic diseases in China has risen from 12.3% in 2003 to 23.0% in 2018. The number of chronic diseases has increased from 159 million in 2003 to 300 million in 2018. The proportion of deaths caused by chronic diseases has increased from 73.8% in 1991 to 88.5% in 2019. In 2020, the burden caused by chronic diseases has accounted for 76% of the total burden of diseases. The expenditure on chronic diseases has exceeded 5 trillion yuan. The prevalence of chronic diseases Both the number of patients and the mortality rate of chronic diseases have shown a rapid growth trend, which has become a major health and social problem seriously affecting the health of residents and the economic and social development of the country. Is there an inevitable causal relationship between the nutrient intake of Chinese residents and the high frequency of chronic diseases in China? In this paper, the time series method is used to analyze the nutrient intake of Chinese residents in the past three decades, analyze the existing problems of nutrient intake of Chinese residents in the past three decades and the adverse consequences and impacts caused by it, and propose targeted countermeasures on this basis to provide basic theoretical support and practical approaches to promote the construction of a healthy China.

2. Nutrient Intake Status of Chinese Residents in the Past 30 Years

China carried out five national nutrition surveys in 1959, 1982, 1992, 2002 and 2012. In the early 30 years after the founding of the People's Republic of China, the nutritional problems that plagued the health of Chinese residents mainly included malnutrition caused by insufficient energy-protein intake and nutritional deficiency diseases such as Keshan disease, rickets and anemia caused by vitamin deficiency; In the past 40 years of reform and opening up, the quantity and quality of food intake of Chinese residents have changed greatly, and the disease spectrum of Chinese residents has also changed fundamentally from infectious diseases to chronic diseases, which is directly related to the changes in nutrient intake of Chinese residents in the past 40 years of reform and opening up. Since 1992, this paper has made an in-depth analysis of the main nutrient index data (Table 1) in the national nutrition survey report for the past 30 years to comprehensively understand the development and trend of the nutrient intake of Chinese residents.

2.1. Capacity Nutrient Intake

In 1992, 2002, 2012 and 2015-2017, the daily average intake of nutrients in the three major production capacities was 2328.3kcal, 2251kcal, 2172kcal and 2007kcal respectively, showing a downward trend in turn, reaching 95.57% of the reference value of the Reference Dietary Nutrient Intake of Chinese Residents (DRIs) (2013 Edition), indicating that the energy supply of Chinese residents has been sufficient in the past three decades, and the nutritional status has been generally satisfied. Among them, the supply of protein and carbohydrate conforms to the acceptable range of macro-nutrients (ADMR), and their daily average intake shows a downward trend, which conforms to the overall capacity intake trend; the daily average intake of fat showed an upward trend, exceeding the acceptable range of macro-nutrients (ADMR) except in 1992.

2.2. Main Mineral Intake

From 1992, 2002, 2012 to 2015-2017, the intake of major minerals by Chinese residents declined year by year. Among them, the intakes of phosphorus, iron, zinc and copper are in the reasonable range between the reference intake (RNI) and the maximum tolerable intake (UL); The intakes of calcium, magnesium, potassium and selenium were lower than the requirements of the reference intake (RNI), and the minimum values were only 44.54%, 80.27%, 77.36% and 66.5% of the reference intake (RNI); The sodium intake is higher than the reference intake (RNI) value and the recommended intake (PI) for the prevention of non-infectious chronic diseases.

Table 1: Daily average nutrient intake of Chinese residents in the past three decades, 1992, 2002, 2012, 2015-2017

type	Energy/nutrient	1992	2002	2012	2015-2017	DRIs reference value (2013 edition)
Productive nutrients	Energy(kcal)	2328.3	2251	2172	2007	2100-2400(RNI)
	Protein/g(%)	68.0(11.7%)	65.9(11.8%)	64.5(11.8%)	60.4(12.0%)	55/65 (RNI)(10%-15%(ADMR))
	lipids/g(%)	58.3(22.5%)	76.3(30.7%)	79.9(33%)	79.1(35.2%)	20%-30%(ADMR)
	carbohydrates/g(%)	378.4(65.8%)	321.2(57.5%)	300.8(55.2%)	266.7(52.8%)	50%-65%(ADMR)
main minerals	Macroelement:Ca(mg)	405.4	388.8	366.1	356.3	800(RNI)-2000(UL)
	P(mg)	1058.0	978.8	954.6	909.8	720(RNI)-3500(UL)
	Mg(mg)	321.6	308.8	284.9	264.9	330(RNI)
	K(mg)	1721.3	1700.1	1616.9	1547.2	2000(RNI)-3600(PI)
	Na(mg)	6750.6	6268.2	5702.7	6046.0	1500(RNI)-2000(PI)
	microelement: Fe(mg)	23.4	23.2	21.5	21.0	12/20(RNI)-42(UL)
	Zn(mg)	12.0	11.3	10.7	10.3	7.5/12.5(RNI)-40(UL)
	Cu(mg)	2.4	2.2	1.9	1.7	0.8(RNI)-8(UL)
	Se(ug)	42.0	39.9	44.6	41.6	60(RNI)-400(UL)
fiber	dietary fiber(g)	13.3	12.0	10.8	10.4	25(RNI)
vitamin	vitamin A(ug)	476.0	469.2	443.5	432.9	700/800(RNI)-3000(UL)
	Vitamin B1(mg)	1.2	1.0	0.9	0.8	1.2-1.4(RNI)
	Vitamin B2(mg)	0.8	0.8	0.8	0.7	1.2-1.4(RNI)
	nicotinic acid (mg)	15.7	14.7	14.3	14.4	12/15(RNI)-35/310(UL)
	Vitamin C(mg)	100.2	88.4	80.4	80.3	100(RNI)-200(PI)-2000(UL)
	Vitamin E(mg)	33.4	35.6	35.9	37.4	14(RNI)-700(UL)
water	water(ml)	Adult 2200-2900ml/d (World Health Organization 2003), Adult 1500-1700ml/d is recommended in Chinese Dietary Guidelines 2016				

Notes: DRIs—Dietary nutrient reference intake, RNI—Reference intake, ADMR—Acceptable range of macro nutrients, UL—Tolerable maximum intake, PI—Recommended intake for prevention of non-communicable chronic diseases.

The above information and data are from the National Nutrition Survey Report in 1992, 2002 and 2012, the Monitoring Data of Chinese Residents' Nutrition and Health Status in 2015-2017, and the Reference Dietary Nutrient Intake of Chinese Residents (2013 Edition).

2.3. Dietary Fiber Intake

In 1992, 2002, 2012 and 2015-2017, the average daily intake of dietary fiber of Chinese residents was 13.3g, 12.0g, 10.8g and 10.4g respectively, showing a downward trend as a whole. There was a large gap between the average daily intake and the reference intake of dietary fiber (RNI) of 25g in the Reference Value of Nutrients in China Food Label.

2.4. Vitamin Intake

In 1992, 2002, 2012 and 2015-2017, in addition to adequate intake of vitamin E and niacin, the intake of other vitamins decreased year by year. Among them, the intake of retinol equivalent, thiamine, riboflavin, ascorbic acid and other vitamins failed to meet the basic requirements of the reference intake (RNI), and the minimum value only reached 54.11%, 57.14%, 50% and 80.3% of

the reference intake (RNI).

2.5. Water Nutrient Intake

In 2007, China proposed the recommended drinking water standard of at least 1.2L per day in the Dietary Guidelines for Chinese Residents, and in 2016, the number was raised to 1.5L (female) and 1.7L (male).

3. Problems, Adverse Consequences and Impacts of Nutrient Intake of Chinese Residents in the Past Three Decades

3.1. Existing Problems

From the development and change of the quantity and quality of nutrient intake of Chinese residents in the past three decades, we can see that there are mainly the following problems in the nutrient intake of Chinese residents:

3.1.1. Insufficient Overall Intake of Nutrients

In addition to productive nutrients, other nutrients are generally insufficient:

(1)The intake of important micro-nutrients is insufficient. In terms of mineral intake, most mineral intakes are insufficient. The deficiency of calcium and selenium intake is particularly serious: in 1992, 2002, 2012 and 2015-2017, the daily average calcium intake of Chinese residents was 405.4mg/d, 388.8mg/d, 366.1mg/d and 356.3mg/d respectively, accounting for 50.7%, 48.6%, 45.8% and 44.5% of the recommended intake of 800mg/d respectively, and the proportion of insufficient calcium intake of Chinese residents reached 97.2% in 2017. The daily average selenium intake was 42.0ug/d, 39.9ug/d, 44.6ug/d and 41.6ug/d respectively, accounting for 70.0%, 66.5%, 74.3% and 69.3% of the recommended intake of 60ug/d. In 2017, the proportion of insufficient selenium intake of residents reached 85%. In terms of daily average intake of calcium and selenium, in 2017, the United States was 1078 mg/d, 127.5 ug/d, and the Netherlands was 993 mg/d, 50 ug/d, both significantly higher than China. In terms of vitamin intake, the intake of vitamin A, vitamin B1 and vitamin B2 are obviously insufficient. In 1992, 2002, 2012 and 2015-2017, the average daily intake of vitamin A was 476.0ug/d, 469.2ug/d, 443.5ug/d and 432.9ug/d respectively, accounting for 59.5%, 58.7%, 55.4% and 54.1% of the recommended intake of 800ug/d, with a gap of about 45%. In 2017, the proportion of insufficient intake of vitamin A among residents reached 73.3%. The intake of vitamin B1 was 1.2mg/d, 1.0mg/d, 0.9mg/d and 0.8mg/d respectively, accounting for 85.7%, 71.4%, 64.3% and 57.1% of the recommended intake of 1.4mg/d respectively. In 2017, the proportion of insufficient intake of vitamin B1 among residents reached 72.1%; the intake of vitamin B2 was 0.8mg/d, 0.8mg/d, 0.8mg/d and 0.7mg/d respectively, accounting for 57.1%, 57.1%, 57.1% and 50.0% of the recommended intake of 1.4mg/d respectively. The intake gap was about 45%. In 2017, the proportion of residents with insufficient intake of vitamin B2 reached 87.1%. In terms of daily average intakes of vitamin A, vitamin B1 and vitamin B2, in 2017, the United States was 479 ug/d, 2.34 mg/d and 1.81 mg/d, and the Netherlands was 858 ug/d, 2.6 mg/d and 2.3 mg/d, all higher than the Chinese level.

(2)Dietary fiber intake is insufficient. In 1992, 2002, 2012 and 2015-2017, the average daily intake of dietary fiber of Chinese residents accounted for 53.2%, 48.0%, 43.2% and 41.6% of the recommended daily intake of 25g respectively. The average daily intake was about 53.5%, and the residents who could reach the appropriate intake were less than 5%.

(3)The intake of water nutrients faces a double test. For many years, the average daily

recommended drinking water consumption of Chinese residents is 1.2 liters in 2007 and 1.5 liters (female)/1.7 liters (male) proposed in 2017. The actual daily average intake is still lower than the above recommended standard, which is far from the actual demand of about 2.5 liters of normal adults, including about 0.35 liters of daily respiratory consumption, about 0.5 liters of skin evaporation, about 0.15 liters of fecal drainage, and about 1.5 liters of urine. At the same time, this data is far lower than the 2.2-2.9L daily intake proposed by the World Health Organization in 2003, and Dr. F. Batman, an American medical doctor who has devoted his life to treating chronic diseases with water, put forward in his monograph "Water is the best medicine" that the human body needs about 4L per day in total. The Mayo Medical Education and Research Foundation of the United States pointed out in "Nutrition and Healthy Diet" that the recommended daily water supplement is 3.7L for men and 2.7L for women. Dr. A-J Montgomery, from the Hospital of San Antonio in the Netherlands, found that adults lose about 2.8 liters of water intake per day; at the same time, the joint survey results of the China Center for Disease Control and Prevention and the China Nutrition Society showed that 74.9% of people drank less than 6 times a day. Even at the recommended drinking water volume of 1.2L/d, one third of China's residents still drank less than this standard per day, including tea and beverages [6]. In addition, due to the relatively serious water pollution in China, the water quality is a great challenge to the residents' intake, and the residents' intake of water nutrients faces the double test of intake and water quality.

3.1.2. Partial Excess of Nutrient Intake

In addition to the insufficient intake of most nutrients, there is also the problem of excessive intake of some nutrients. The main performance is:

(1) Excessive fat intake. In 1992, 2002, 2012 and 2015-2017, the fat intake of Chinese residents was 58.3 g/d, 76.3 g/d, 79.9 g/d and 79.1 g/d respectively, which exceeded 16.6%, 52.6%, 59.8% and 58.2% of the recommended daily average intake of 50g in the Chinese Dietary Nutrient Reference Intake (DRIs) (2013 Edition). The energy supply continued to increase and the fat intake was seriously excessive.

(2) Sodium intake seriously exceeded the standard. In 1992, 2002, 2012 and 2015-2017, the daily average sodium intake of Chinese residents was 6750.6mg/d, 6268.2mg/d, 5702.7mg/d and 6046.0mg/d, which exceeded 350.0%, 317.9%, 280.1% and 303.1% of the recommended daily average intake (RNI) of 1500mg/d in the Chinese Dietary Nutrients Reference Intake (DRIs) (2013 Edition), and exceeds 237.5%, 213.4%, 185.1% and 202.3% of the recommended intake (PI) of 2000mg/d of DRIs (2013 version) for the prevention of non-infectious chronic diseases, and the sodium intake seriously exceeds the standard. In 2017, the average daily sodium intake of residents in the United States and the Netherlands was 3895mg/d and 2924mg/d respectively, which were far lower than that of China.

3.1.3. Overall Imbalance of Nutrient Intake

In addition to the overall insufficient intake and partial excess intake in quantity, there is also an obvious imbalance in nutrition intake in quality. The main performance is as follows:

(1) The overall intake of seven major nutrients is uneven. The main performance is that the intake proportion of the seven major nutrients is not clear enough, and the relationship and function of the intake coordination mechanism between them are not clear, resulting in the inability to accurately quantify the intake proportion. In particular, the intake of water nutrients, which accounts for 60% - 70% of the body weight, lacks a fundamental understanding of the nature and function of water, and the practices directly related to water intake, such as what kind of water and how much water intake, cannot be implemented fundamentally, resulting in more than 85% of the population drinking water

shortage.

(2)The uneven intake of productive nutrients. According to the requirements of the Reference Intake of Dietary Nutrients for Chinese Residents (DRIs) (2013), in terms of energy supply ratio, the acceptable range of macro-nutrients (ADMR) of protein, fat and carbohydrate should be within the range of 10% - 15%, 20% - 30% and 50% - 65% respectively, which is of great importance for maintaining human health and preventing chronic diseases. In terms of intake quantity, protein and carbohydrate basically meet the requirements of the acceptable range of macro-nutrients (ADMR), while the intake quantity of fat has been far higher than the recommended value. In terms of energy supply ratio, since 1992, the energy supply ratio of protein and carbohydrate has met the requirements of the acceptable range of macro-nutrients (ADMR), while the energy supply ratio of fat has been rising continuously except 1992, and its value is higher than the normal range of the acceptable range of macro-nutrients (ADMR), resulting in unreasonable and unbalanced intake quantity and energy supply ratio structure of the three major productive nutrients.

To sum up, in the past three decades, the main problems in the nutrient intake of Chinese residents have changed fundamentally from the malnutrition caused by insufficient energy-protein intake before the 1990s to the structural nutrient imbalance of insufficient overall nutrient intake, partial excess nutrient intake and unbalanced nutrient intake. Structural nutrition imbalance is mainly manifested as "more than two and less than four", unbalanced refers to the unbalanced proportion of intake among the seven major nutrients and the internal intake of various nutrients, more than two refers to the high intake of fat and sodium, and less than four refers to the low intake of minerals, water, vitamins and dietary fiber.

3.2. Adverse Consequences and Impacts of Nutrient Intake Imbalance

3.2.1. Adverse Consequences and Effects of Excessive Fat Intake

In the past three decades, the daily average intake and energy supply ratio of the two types of energy-supplying nutrients, protein and carbohydrate, of Chinese residents have met the requirements of the reference intake (RNI) and the acceptable range of macro-nutrients (ADMR) in the Reference Intake of Dietary Nutrients (DRIs) for Chinese Residents (2013), which shows that the majority of Chinese residents have relatively adequate intake of protein and carbohydrate. However, the daily average intake of fat and the energy supply ratio both exceed the reference intake (RNI) and the acceptable range of macro-nutrients (ADMR), which may lead to an increase in the risk of essential nutrients deficiency or non-communicable chronic disease (NCD).The existing medical research and clinical practice have proved that the lack of essential nutrients such as minerals and vitamins will lead to the emergence of cancer, organ aging disease, diabetes, cardiovascular disease and other incurable diseases in human life. In addition, from the perspective of nutritional medicine, the direct result of excessive fat intake is overweight and obesity, which is often accompanied by a variety of metabolic abnormalities, and is one of the important risk factors for chronic diseases such as cardiovascular and cerebrovascular diseases, diabetes, kidney disease, and a variety of cancers [7,8], This is highly consistent with the results of non-communicable chronic disease (NCD) risk caused by fat intake exceeding the acceptable range of macro-nutrients (ADMR). The above two situations fully demonstrate that the continuous rise of long-term fat energy supply ratio will lead to chronic diseases, and there is a high correlation between the two.

3.2.2. Adverse Consequences and Effects of Unbalanced Intake of Micro-nutrients

3.2.2.1. Hazards and Consequences of Insufficient and Unbalanced Mineral Intake

In the past three decades, the calcium intake of Chinese residents is seriously deficient, and the

daily average intake only reaches the level of 40% - 50% of the recommended standard. The selenium intake is relatively insufficient, and the daily average intake only reaches about 70% of the recommended standard. The sodium intake seriously exceeded the standard, and the daily average intake exceeded the recommended standard by about 3 times. The unbalanced intake of calcium, selenium and sodium will cause the following hazards.

(1) The harm and influence of calcium deficiency. As an important component of bones and teeth, calcium plays an important role in blood coagulation, nerve transmission, muscle contraction or relaxation, vasoconstriction and expansion, and prevention of aging [9, 10]. According to the survey of the Chinese Medical Association in 2017, the number of calcium deficiency in China is as high as 900 million, and the number of serious calcium deficiency is about 200 million. Long term calcium deficiency can cause rickets, stunting, tooth loss, neuralgia, fractures, osteoporosis and other diseases [11], and is also the main factor inducing diabetes, hypertension, Alzheimer's disease and a variety of chronic diseases [12]. At the same time, calcium deficiency often results in the lack of natural nutrient minerals such as magnesium, strontium, selenium and silicon associated with calcium, resulting in the lack of necessary materials for cells, which leads to the dysfunction of cell functions and the occurrence of chronic diseases such as cancer.

(2) Hazards and effects of selenium deficiency. Selenium is an essential element in the process of thyroid hormone's synthesis and metabolism. Its production and formation depend on the special soil, water source and crop types. It is honored as the "kindling of life" by the medical and nutritional circles at home and abroad, and enjoys the reputation of "longevity element", "king of anti-cancer", etc. It has the functions of improving human immunity, anti-oxidation, delaying aging, protecting and repairing cells, preventing cancer and anti-cancer, preventing cardiovascular and cerebrovascular diseases, protecting the liver Promote sugar metabolism, enhance fertility and other functions. Lack of selenium will lead to premature senility, cardiomyopathy and myocardial failure, Keshan disease and Kashin-Beck disease, mental depression and other symptoms. Long term lack of selenium will lead to cardiovascular disease, diabetes, chronic inflammation, cancer, cerebral arteriosclerosis, myocardial damage, fertility decline and so on [13,14], seriously threatening human health.

(3) Hazards and effects of excessive sodium intake. Sodium is a large amount of constant mineral element in the human body, and is the main component of pancreatic juice, bile, sweat and tears. It has important physiological functions such as maintaining the constant pH of body fluid, maintaining the osmotic pressure of body fluid, ensuring the water balance in the body, and maintaining the normal blood pressure balance. It plays an extremely important role in the production and utilization of ATP, muscle movement, cardiovascular function, energy metabolism, and oxygen utilization. Inadequate or excessive sodium intake will be accompanied by clinical symptoms of dehydration or metabolic acidosis [15]. Persistent sodium deficiency will affect the water content, osmotic pressure, stress, secretion and excretion of cells and the absorption of amino acids and glucose by cells, reduce the secretion of gastric acid, and even endanger life in serious cases. Excessive sodium intake is an important influencing factor for the high incidence of hypertension and cardiovascular disease, which will lead to the risk of coronary heart disease, myocardial infarction, stroke, renal failure, stomach disease, osteoporosis, hypertension, hyperlipidemia, diabetes, obesity, gout, atherosclerosis, fatty liver and other chronic diseases [1,16].

3.2.2.2. Hazards and Consequences of Insufficient Vitamin Intake

In the past three decades, the intake of vitamin A and vitamin B2 in Chinese residents is seriously deficient, and the daily average intake only reaches 50% - 60% of the recommended standard. The intake of vitamin B1 and vitamin C is relatively insufficient, and the daily average intake only reaches 70% - 80% of the recommended standard; inadequate intake of the above

vitamins will cause the following hazards.

(1) The harm caused by serious insufficient intake of vitamin A. Vitamin A has many physiological functions, such as maintaining vision, promoting growth and development, maintaining the integrity and integrity of epithelial structure, strengthening immune capacity, clearing free radicals, regulating cardiovascular diseases [17] and preventing precancerous lesions to protect embryo growth. Vitamin A deficiency can lead to the reduction of blood lymphocyte count and natural killer cells and the weakening of specific antibody response. Long-term insufficient intake can cause night blindness, dry eye disease, visual abnormalities, keratinization of hair follicle, growth arrest and abnormal cellular immune function, and is prone to infection with various diseases, bringing great harm to human health.

(2) The harm caused by serious insufficient intake of vitamin B2. Vitamin B2 can effectively promote the metabolism of carbohydrates, fats and proteins, promote the growth and development of the human body and the regeneration of cells, improve vision, have the function of decomposing drugs and detoxifying, and can effectively prevent the occurrence of oral ulcers, angular stomatitis, glossitis, cleft lip disease and keratitis, and its insufficient intake will lead to headache, insomnia, mental fatigue, greasy skin and other adverse effects [18].

(3) The harm caused by insufficient intake of vitamin B1. Vitamin B1 has the role and function of maintaining normal metabolism, promoting appetite, maintaining normal nerve activity, promoting the metabolism of sugar in the body, and inhibiting the activity of cholinesterase. Its deficiency or insufficiency can lead to beriberi, obstructive pulmonary disease, neurodermatitis, anorexia, dyspepsia, poor color, limb edema and other diseases and disorders [19].

3.2.3. Adverse Consequences and Effects of Insufficient Dietary Fiber Intake

Dietary fiber can prevent constipation, eliminate intestinal toxins, enhance digestion, reduce fat absorption, excrete cholesterol, maintain normal sugar metabolism, delay aging, enhance immunity, promote calcium absorption, reduce blood lipids, prevent coronary heart disease and other functions. Adequate intake of dietary fiber can effectively prevent cardiovascular disease, colorectal cancer, diabetes, liver disease and other diseases [20]. Insufficient dietary fiber intake is one of the reasons why the incidence rate of chronic diseases such as obesity, constipation, diabetes, hypertension, hyperlipidemia, high cholesterol, cardiovascular disease, diverticulitis, colon cancer, varicose veins and so on has increased significantly [21,22].

3.2.4. Adverse Consequences and Effects of Insufficient Intake of Water Nutrients

As an important component of cells and body fluids, water nutrients have important functions and functions such as regulating body temperature, promoting metabolism, transporting nutrients, lubricating joints and body, promoting blood circulation and digestion, maintaining energy metabolism, removing waste, and improving immunity. In daily life, if the intake is insufficient or the intake of water with poor quality for a long time, it will bring great harm to human health.

(1) Insufficient intake will cause excessive re-absorption. Because human urine comes from blood, blood continuously flows into the kidney to secrete original urine. Normal people have about 180L of blood primary urine filtered by the kidney every day, but 99% of the primary urine will be reabsorbed through the renal tubules and medullary loops and returned to the blood for continuous circulation, and only about 1% of the primary urine will be turned into final urine and discharged out of the body. If drinking water is insufficient for a long time, it will lead to the main way for human body to excrete waste - too little urine; too little urination for a long time will lead to too much accumulated metabolic waste in the blood. The blood containing too much metabolic waste will be continuously re-absorbed through the kidney, and the circulation will not stop. Over a long

time, it will lead to excessive re-absorption between the kidney and the blood, which will lead to the continuous accumulation of metabolic waste and toxins in the body and poor digestion and absorption, resulting in too much cellular waste and physiological dysfunction, and lead to human metabolic disorders and secretion disorders, Then it will cause the corresponding tissue and organ dysfunction and pathological changes, and eventually lead to the emergence of a variety of chronic diseases.

(2) Poor water quality will lead to many diseases. Investigation of World Health Organization shows that 80% of the world's diseases and 50% of the world's children's deaths are related to the poor quality of drinking water. As a result of drinking contaminated water, more than 50 kinds of diseases, such as urinary system diseases, cardiovascular system diseases, digestive system diseases, respiratory system diseases, endocrine system diseases, lymphatic system diseases, nerve, bone, reproductive and other diseases, are caused by human cell physiological dysfunction, endocrine disorders, excessive body fluid toxins and waste, and metabolic disorders. In addition, if you drink water that lacks the minerals needed by the human body for a long time, it will not supplement the human body with appropriate mineral nutrients, but will accelerate the loss of human minerals.

4. Countermeasures for Nutrient Intake of Chinese Residents

In view of the fact that over the past three decades, the main problem of Chinese residents' nutrient intake is the unbalanced structural nutrient imbalance of "two more and four less" caused by the overall insufficient, partial excess and uneven nutrient intake. The long-term structural nutrient intake imbalance increases the risk of Chinese residents suffering from various chronic diseases. How to deal with and prevent chronic diseases to the greatest extent, most efficiently and pertinently, we can take effective measures in the quality control of nutrient intake, the quantity balance of nutrient intake, the formation of good daily eating habits, and the improvement of the general public's overall understanding of nutrients, so as to achieve the fundamental goal of both treating symptoms and treating the root cause.

4.1. Comprehensive Prevention and Control to Ensure the Quality of Nutrients or Ingredients

Generally, people eat food to provide basic guarantee for human metabolism. The quality and texture of food intake directly determine and affect the effective intake, absorption and utilization of nutrients. Therefore, effective measures must be taken to ensure the quality of food materials at the source:

(1) Strengthen comprehensive environmental control. Healthy water, clean air and safe food are important guarantees for people to obtain health, and the above achievements cannot be achieved without comprehensive control of the development environment. The state should further improve the laws and regulations system on food safety and food quality, ensure the safety and quality of the source and supply of food materials, further strengthen the comprehensive environmental control at the legislative and law enforcement levels, and implement effective measures to effectively monitor, prevent and combat air pollution, water pollution, resource development pollution, chemical pollution, etc. which directly affect the texture and quality of soil, so as to fundamentally protect soil quality, This is the root of ensuring the quality and safety of food materials at the source.

(2) Carry out organic treatment, remediation and improvement of soil. The texture and fertility of the soil directly determine the quality of the food materials. In view of the problems of soil degradation caused by the long-term use of inorganic fertilizers, pesticides, antibiotics, herbicides, hormones, etc. for decades, such as the massive loss of soil trace elements, soil hardening, increased soil toxins, decreased soil fertility, etc., it is urgent to adopt the latest agricultural technology, biotechnology, genetic technology, etc. to repair, control and improve the damaged and deteriorated

soil, Restoring the soil texture and fertility to their normal level and adopting organic planting methods are the fundamental methods to ensure the quality of food materials at the source.

(3) Effective processing of food materials. According to the attribute characteristics of different ingredients, targeted and effective processing methods are adopted in the links of storage, cleaning, cutting and washing, processing, cooking, eating, seasoning, and making to ensure that its nutrients will not be lost to the maximum extent.

4.2. Implement Precise Policies to Promote Balanced Nutrient Intake and Improve Residents' Independent Health Management Ability

Under the premise of ensuring the quality of food materials as much as possible, aiming at the main cause of chronic disease prevention and treatment faced by Chinese residents - unbalanced structural nutritional imbalance, guiding Chinese residents to take a balanced diet, and promote the dietary assistance plan according to the differences and needs of individual nutrient intake of residents.

(1) Advocate a balanced diet. Relevant national departments and industrial organizations should take effective measures to solve or alleviate the problem of "more than two and less than four" faced by Chinese residents in the past three decades as soon as possible, and guide residents to have a reasonable and balanced diet. At the level of policies and regulations, special documents on "balanced nutrition and healthy diet" should be issued, and training and publicity should be strengthened in the aspects of food safety, nutrition balance, healthy diet, etc., to advocate reasonable and balanced diet. At the specific implementation level, we should pay special attention to the main problem of "two more and four less", guide the majority of residents to carry out the daily action plan of "replenishing less and suppressing more", that is, focus on inhibiting or reducing fat and sodium salt, increasing or supplementing daily intake of minerals, water, vitamins, dietary fiber, etc., especially on the intake of nutrients such as water, minerals, which people do not pay much attention to, and give high attention and guidance on the broad-spectrum. In terms of popularity, spectrum and rate, the problem of "more than two and less than four" should be restrained or alleviated, and the goal of balanced diet should be achieved as soon as possible.

(2) Improve residents' active health management ability. In view of the severe situation of high frequency and high incidence of chronic diseases in China at present, through the guidance of government policies, give full play to the professional guidance role of relevant medical institutions, medical institutions and institutions and personnel at the level of professional doctors, health managers, nutrition managers, etc., and provide targeted and systematic education and training for the general population, especially for people with chronic diseases, so as to continuously improve their ability and level of self-independent health management, and form a good development situation of self-help, self-health management and self-balanced diet in the whole society.

4.3. Based on Daily Life and Form Reasonable Living and Eating Habits

The lack and deficiency of human nutrients is a relatively long time manifestation, which is closely related to individual dietary structure, dietary habits and living habits.

(1) Build a reasonable dietary structure. In terms of food structure, the quantity and structure of food should be prepared according to the recommendations and requirements of the dietary guide, especially whether the whole grain, vegetables and fruits, milk, beans and other foods meet the requirements. In terms of energy sources, the energy supply ratio of protein, fat and carbohydrate should meet the distribution requirements of 15% - 20%, 20% - 30% and 50% - 65%, and whether the food sources match the reference of dietary guidelines. In terms of protein sources, whether the proportion of high-quality protein sources is more than half; In terms of nutrient supply, whether the

intake of the seven major nutrients meets the basic requirements of the dietary reference intake of Chinese residents, especially whether the source and intake of water and minerals are appropriate, and so on.

(2) Form good eating habits. The World Health Organization attributed 60% of human health to lifestyle, of which diet is the main part. In the process of nutrient intake, we should do the following: first, control the intake of sodium. Adhere to the daily sodium intake of no more than 5 grams, especially try to reduce and control the intake of uncontrollable salt such as pickled vegetables, soy bean curd, oil consumption, soy sauce, brine juice cooking salt, food additives such as sodium glutamate, sodium carbonate, sodium benzoate and other hidden salt such as instant noodles, jelly, sports drinks, barbecue and other foods; Second, ensure adequate intake of dietary fiber. We should standardize and quantify the traditional staple food "cereals" and include it into the scope of daily food intake norms to ensure the adequate intake of dietary fiber.

(3) Develop good living habits. Good living habits are conducive to the intake and absorption of nutrients. For example, regular exposure to the sun plays an extremely important role in the production of vitamin D and the absorption of calcium, regular exercise is conducive to the utilization of calcium by bones, active and sufficient drinking water is conducive to activating the human body's perception system and promoting the effective development of human metabolism, and so on.

4.4. Improve Cognition and Establish a Comprehensive and Balanced View of Nutrition

(1) Comprehensively improve the cognition level of nutrients. In the past three decades, affected by the scientific principles and clinical effects of existing medicine, especially bio-medicine, as well as daily living habits, most people have become accustomed to relying on the treatment methods and means of existing medicine, but generally ignore the role of nutrients on human health, and there is a serious lack of understanding of the role and function of nutrients. The main performance is as follow. The first aspect is insufficient understanding of the role and status of nutrients. For example, most people generally attach importance to the promotion of health products, supplements and drugs on the human body, while generally ignoring the source and effective intake of minerals and vitamins in natural organic foods, resulting in insufficient intake of effective micro-nutrients. In terms of water nutrient intake, about 90% of people think that water can be dispensed with, more can be dispensed with, and there is no difference between different water, so little is known about what water to drink, how much water to drink every day, and the effect of water on human body. "Drink water when thirsty" has become the norm of most people's life, and so on. The second aspect is cognitive misunderstandings about nutrients. For example someone think that Western food is better than Chinese food in terms of nutrient ratio, a large amount of food is sufficient for nutrition, drinking more bone soup made by animals can effectively supplement calcium, the purer water is the more beneficial it is to health, drinking hard water will lead to stones, drinks can replace drinking water. Drinking more water will lead to water poisoning and kidney damage. Drinking boiling water and overnight water will cause cancer, etc. In view of people's insufficient understanding of nutrients as a whole, it is necessary to improve residents' understanding of nutrients in terms of the popularization of basic knowledge of nutrients, the role and status of nutrients, the value mining of nutrients, and the application scenarios of nutrients, so as to reshape the important status of nutrients in people's daily life.

(2) Establish a comprehensive and balanced concept of nutrition. In different stages of historical development, people's focus on different nutrients shows significant differences. In the era of agricultural economy, people are mainly faced with the problem of food and clothing, so they pay more attention to the intake of productive nutrients. In the era of industrial economy, people's living

standards and quality have been greatly improved. In addition to paying attention to productive nutrients, people also pay special attention to the intake of vitamins and cellulose. After entering the era of information economy, people are generally faced with the problem of high incidence of chronic diseases caused by unbalanced nutrition imbalance due to the long-term changes in crop cultivation methods, secondary destruction of food processing links, deterioration of environmental pollution and other factors. The main reason is that people have not paid enough attention to the two nutrients of minerals and water, and have not put the seven nutrients in a balanced and systematic perspective to consider their effects and impacts on human health. The main performance is as follow: The first aspect is theoretical research, people pay more attention to the correlation research of the effects of productive nutrients and vitamins on human health, at the level of basic theoretical research, little attention and research are paid to minerals and water, and the importance of minerals and water to human health is generally ignored. The second aspect is daily application of nutrients. Relevant research results have specifically quantified the daily average intake of productive nutrients, vitamins and dietary fiber, which has reached a very precise and precise level. However, the daily average intake of minerals and water is relatively vague, especially the drinking standards and requirements of what kind of water to drink, how much to drink every day, how much temperature to drink, and when to drink water are obviously insufficient, which does not fully reflect the status of water nutrients. Therefore, it is necessary to establish a balanced concept of nutrition ideologically and fundamentally and implement it in our daily life, so as to prevent and control the occurrence of chronic diseases.

5. Conclusions

Nutrients play an extremely important role in human nutrition supply, metabolism, energy conversion and other aspects. Reasonable and balanced nutrient intake is an important guarantee to ensure human health. In this paper, the time series analysis method is used to comprehensively and systematically analyze the nutrient intake, existing problems and adverse consequences of Chinese residents in the past three decades. The research results show that the structural imbalance of nutrient intake caused by the overall insufficient intake of nutrients, partial excess intake of nutrients, and overall imbalance of nutrient intake of Chinese residents for a long time is the main problem of nutrient intake of Chinese residents, which is mainly manifested in "two more and four less", that is, "two more" refers to more fat intake, more sodium intake, and "four less" refers to less mineral intake, less water intake, and less vitamin intake Low dietary fiber intake. The long-term structural imbalance of nutrient intake has brought serious adverse effects and consequences to Chinese residents, which has greatly increased the risk of various chronic diseases for our residents. Therefore, effective measures should be taken to ensure the quality of nutrients or ingredients, promote balanced intake of nutrients, improve the ability of residents to manage their own health, develop reasonable living and eating habits, and establish a balanced view of nutrition, so as to achieve the fundamental goal of effective prevention and treatment of chronic diseases at the source.

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References

- [1] Fan Daiming. *HIM, the only way for medical development in a new era*. *Medical Contention*, 2017, 8 (03): 4-10. DOI: 10.13276/j.issn 1674-8913.2017.03.001.
- [2] Wei Yujuan. *The application of nutrients in treating chronic diseases*. *World's Latest Medical Information Abstract*, 2018, 18 (41): 170-172.
- [3] Micha Renata, Shulkin Masha L, Peñalvo Jose L, Khatibzadeh Shahab, Singh Gitanjali M, Rao Mayuree, Fahimi Saman, Powles John, Mozaffarian Dariush. *Etiologic effects and optimal intakes of foods and nutrients for risk of cardiovascular diseases and diabetes: Systematic reviews and meta-analyses from the Nutrition and Chronic Diseases Expert Group (NutriCoDE)*. *PLoS one*, 2017, 12(4): 202-205.
- [4] Li Hanchao, Ryu Ho Kyung. *Study on Relevance of Nutritional Status, Nutrient Intake, and Chronic Disease Risk based on Mini Nutritional Assessment (MNA) of Elderly People in Shandong Province of China*. *The Korean Journal of Community Living Science*, 2017, 28(1):305-307.
- Chao H L , Kyung H R . *Study on Relevance of Nutritional Status, Nutrient Intake, and Chronic Disease Risk based on Mini Nutritional Assessment (MNA) of Elderly People in Shandong Province of China*. *The Korean Journal of Community Living Science*, 2017, 28(1).
- [5] Rice Beth H, Quann Erin E, Miller Gregory D. *Meeting and exceeding dairy recommendations: effects of dairy consumption on nutrient intakes and risk of chronic disease*. *Nutrition reviews*, 2013, 71(4):38-40.
- [6] Zhang Qian, Hu Xiaoqi, Zou Shurong, Zuo Jiaolei, Liu Zhenhua, Ma Guansheng, et al. *Summer water consumption of adult residents in four cities of China*. *Chinese Journal of Preventive Medicine*, 2011 (08): 677-682.
- [7] Liu Yuejiao. *Report on the Nutrition and Chronic Disease Status of Chinese Residents (2020) [J]*. *China Food and Nutrition*, 2020, 26 (12): 2. DOI: 10.19870/j.cnki.11-3716/ts.2020.12.01.
- [8] Chae Jisuk, Kim Minjoo, Lee Jong Ho, Yoo Hye Jin. *Body Fat Composition Enhances the Predictive Ability of Changes in White Blood Cell Levels Associated with the Risk of Chronic Disease Development*. *Journal of immunology (Baltimore, Md.: 1950)*, 2021.
- [9] S Reddy Dr Malireddy. *Importance of Bioavailable Calcium and Other Minerals to Reduce the Calcium Deficiency Symptoms, Aging, and Other Pertinent Diseases*. *Clinical Pharmacology & Biopharmaceutics*, 2017, 06(03).
- [10] Wood R.J. *Calcium and phosphorus*. In: *Stipanuck MH, ed. Biochemical and physiological aspects of human nutrition*. Philadelphia: WB Saunders Company, 2000:643:670.
- [11] Michael J. Gonzalez. *Severe Symptoms of Hypocalcemia: A Calcium Deficiency Disease*. *Vitamins & Minerals*, 2021, 10(11).
- [12] Muhammad Nadeem Aslam, James Varani. *The Western-Style Diet, Calcium Deficiency and Chronic Disease*. *Nutrition & Food Sciences*, 2016, 6(3).
- [13] Hu Wenli, Zhao Chong, Hu Hongbo, Yin Shutao. *Food Sources of Selenium and Its Relationship with Chronic Diseases*. *Nutrients*, 2021, 13(5).
- [14] Qi Qiwan, Shi Chengyu, Cheng Dongxu. *Association between Selenium in Soil and Diabetes in Chinese Residents Aged 35–74 Years: Results from the 2010 National Survey of Chronic Diseases and Behavioral Risk Factors Surveillance*. *Biomedical and Environmental Sciences*, 2020, 33(4).
- [15] Rose BD, Post D, Rose B, Narins R. *Clinical physiology of acid-base and electrolyte disorders*. New York, NY: McGraw-Hill Companies, 2000.
- [16] Ma Grace X, Bhimla Aisha, Zhu Lin, Beeber Maayan, Aczon Ferdinand, Tan Yin, Quinn Sally Boyle, Khan Omar, Gadegbeku Crystal A. *Development of an Intervention to Promote Physical Activity and Reduce Dietary Sodium Intake for Preventing Hypertension and Chronic Disease in Filipino Americans*. *Journal of racial and ethnic health disparities*, 2020, 8 (prepublish).
- [17] Leigh Robert S., Kaynak Bogac L. *Vitamin A as a Transcriptional Regulator of Cardiovascular Disease*. *Hearts*, 2020, 1(2).
- [18] Chinese Medical Association. *Clinical application of vitamin and mineral supplements in disease prevention and treatment: expert consensus vitamin B2*. *Chinese Journal of Clinical Nutrition*, 2014, 22 (04): 258.
- [19] Hu Bin, Huang Yunping, Mao Junjie, Guan Chao, Yu Ronghuan, Yang Haihua, Ke Zunji. *Study on the correlation between vitamin B1 deficiency and chronic obstructive pulmonary disease in the elderly*. *Gerontology and Health Care*, 2015, 21 (01): 46-49.
- [20] Liu Xing, Yang Wanshui, Petrick Jessica L. *Higher intake of whole grains and dietary fiber are associated with lower risk of liver cancer and chronic liver disease mortality*. *Nature Communications*, 2021, 12(1).
- [21] Li Miao, Liu Kun, Zheng Lixian, Dai Yinan, Sun Kejuan, Gao Ting, et al. *Research progress on dietary fiber, intestinal microbes and related diseases*. *Journal of Food Safety and Quality Inspection*, 2021, 12 (01): 249-254. DOI: 10.19812/j.cnki.jfsq11-5956/ts. 2021.01.049.
- [22] Feng Yan, Wei Siang, Wang Lei, Feng Jianghao. *Meta-analysis of the correlation between dietary fiber intake and cardiovascular disease risk*. *China Food and Nutrition*, 2021, 27 (09): 10-12.