RJNMSR
Review Journal of Neurological & Medical Sciences Review

Volume 4, Issue 2, 2026

DIETARY FIBER AND ITS ROLE IN PREVENTION OF OBESITY AND CHRONIC DISEASES

Zainab Saaed[*1], Areeba Shahid[1], Maham Shakeel[2], Hifsa Noor[1], Muhammad Hassan Tahir[1], Laiba Iftikhar[1], Hafiza Ayesha Azhar[2], Khadija Iqbal[1]

*[*1,2,4,5,6,8]Department of Human Nutrition and Dietetics, Nishtar Medical University, Multan, Pakistan.*
[3,7]Department of Human Nutrition and Dietetics, Muhammad Nawaz Sharif University of Agriculture, Multan, Pakistan

[*1]zaibimnsuam@gmail.com

Corresponding Author: *
Zainab Saaed
DOI: https://doi.org/10.5281/zenodo.18884716

Received	Accepted	Published
29 December 2025	13 February 2026	28 February 2026

ABSTRACT

Dietary fiber (DF) is an essential element of factory- grounded foods and exists in answerable and undoable forms. It promotes health through several mechanisms, including the product of short- chain adipose acids by colonic microbiota, regulation of gut hormones, and enhancement of lipid and glucose metabolism. Advanced input of Dietary fiber (DF) is associated with a reduced threat of obesity, type 2 diabetes mellitus, and cardiovascular complaint. Substantiation regarding its part in colorectal cancer and seditious bowel complaint remains limited or inconclusive. Adding the input of fiber-rich foods similar as whole grains, fruits, vegetables, and legumes provides a practical and cost-effective approach to precluding habitual conditions. Obesity is a major global health concern and a well- known threat factor for diabetes, cardiovascular complaint, and certain cancers. Dietary fiber (DF) supports weight operation by decelerating digestion, altering nutrient immersion, and adding malnutrition. Both answerable and undoable filaments have shown salutary goods on weight reduction in fat and fat individualities. Whole grains and high- fiber diets also supply bioactive composites, including vitamins, minerals, antioxidants, and resistant bounce, which contribute to metabolic balance. Epidemiological and interventional studies largely support the part of DF in perfecting insulin perceptivity, regulating blood glucose, and promoting cardiovascular health. Despite these benefits, DF exploration faces limitations similar as short follow- up ages, tone- reported salutary data, and variability in fiber type and source. Nonetheless, adding DF input remains a dependable, substantiation- grounded strategy to reduce obesity and related habitual conditions. Unborn studies should concentrate on specific fiber fragments, mechanisms of action, and long- term issues.

Keywords: *Dietary Fiber, Obesity, Chronic Diseases, Cardiovascular diseases, T2DM, Colorectal Cancer*

INTRODUCTION

The global morbidity and mortality have changed and now, almost three-quarters of the total global deaths are caused by non-communicable diseases (NCDs). Obesity, heart diseases, type 2 diabetes mellitus and some cancers are some of the leading causes of this burden that were on the increase to an alarming rate in both developed and developing countries. Among the many

determinants of these conditions that can be modified, dietary factors are at the center stage. There is growing scientific support that dietary fiber is a key nutritional element with major implications in the area of metabolic wellbeing and prevention of chronic illnesses. Dietary fiber refers to the meal portions of plants or similar carbohydrates which are impervious and non-digestible in the small intestine and ferment partially or fully in the large intestine. It contains cellulose, hemicellulose, pectins, beta-glucans, resistant starch and lignin which are non-starch polysaccharides (Popoola-Akinola et al., 2022). The physicochemical properties of fibers broadly classify fiber as either soluble or insoluble. Soluble fiber dissolves in water to create viscous gels, retards the emptying of the gastric tract and slows down nutrient absorption, whereas insoluble fiber enlarges bowel movements and improves intestinal motility (Chutkan et al., 2012). In addition to these mechanical influences, fermentation of fiber by gut microbiota generates short-chain fatty acids (SCFAs), such as acetate, propionate, and butyrate that have a positive impact on glucose metabolism, lipid regulation, immune modulation, and systemic inflammation (Mazhar et al., 2023). Consumers of healthy food are advised by international health regulators to take enough amounts of dietary fiber to form part of a healthy diet. The world health organization and other international authorities suggest that adults should take at least 25-30 grams of fiber per day to minimize the risk of heart diseases and type 2 diabetes as well as colorectal cancer. Nevertheless, in spite of the apparent recommendations and the well-defined benefits, the real fiber intake is significantly lower than these figures in numerous population groups. Average adult fiber consumption in a number of high-income countries based on national dietary surveys is between 15-20 grams per adult daily, which indicates that there is a considerable gap in fiber intake (Kucharska et al., 2024). This difference between recommended and actual intake is a significant nutrition issue that has direct consequences related to health in the long run. Inadequate level of dietary fiber has been cited as a major dietary risk factor causing the global burden of disease. According to data provided by Global Burden of Disease 2019 study, lack of fiber intake is connected to the higher mortality and disability-adjusted life years (DALYs) rates, especially related to cardiovascular diseases and diabetes. Such findings indicate the significance of dietary fiber as a nutritional constituent and a high priority in the health of the population (Zhuo et al., 2023). With the changing global dietary trends and an increased intake of high calorie ultra-processed foods and reduced intake of whole grains, fruits, vegetables and legumes, fiber deficiency has become a common phenomenon (Liu, 2025). Obesity is a multifactorial complex metabolic disorder which has increased prominence in the causation of most chronic diseases. The strong relationship of excess body weight is connected with insulin resistance, dyslipidemia, hypertension, and systemic inflammation (Jung and Choi, 2014). The benefit of dietary fiber in weight control is many-fold. Foods with high fiber content are generally dense in less energy and they take longer to chew, which increases the feeling of fullness and lowers the total food intake. Soluble fiber postpones gastric emptying and also increases the release of satiating hormones including glucagon-like peptide-1 (GLP-1) and peptide YY (PYY) thus helping to regulate appetite (Akhlaghi, 2024). In prospective cohort studies and systematic reviews, body weight, body mass index (BMI) and central adiposity are always reported to be inversely related to fiber intake (Kim and Je, 2014). Cardiovascular disease is the highest cause of mortality in the world and dietary fiber has shown to have protective measures against the occurrence of the disease. Soluble fiber also decreases serum low-density lipoprotein (LDL) cholesterol since it binds bile acids and enhances their excretion, stimulating the use of hepatic cholesterol. Besides, SCFA production leads to better lipid metabolism and vascular activity (Surampudi et al., 2016). The findings of large-scale meta-analyses have indicated that an increase in the consumption of fiber is related to decreased coronary heart disease, stroke, and cardiovascular mortality risks (Zhang et al., 2025). These cardioprotective effects make fiber an easily available and affordable dietary intervention strategy in reducing the risk. Another chronic disease that has a direct relationship with dietary

habits is type 2 diabetes mellitus. Fiber retards digestion and absorption of carbohydrates resulting in better glycemic postprandial regulation and increased insulin sensitivity. Prospective research has particularly linked the reduction of diabetes incidences with the intake of whole-grain and cereal fibers (Giuntini et al., 2022). The Global Burden of Disease analysis also confirms low fiber intake as a contributing factor to mortality and morbidity of diabetes in the whole world. These epidemiological observations can be explained biologically by metabolic effects of fiber by way of gut microbiota modulation and SCFA production (Makki et al., 2018). Besides, dietary fiber has been linked closely to the low risk of colorectal cancer. It has been proposed that this may be caused by dilution of carcinogens, shorter intestinal transit time, larger stool bulk and positive changes in the composition of the gut microbes (Procházková et al., 2023). Dietary guidelines in the international community are always keen on the intake of foods that contain high amounts of fiber as part of the cancer prevention measures. These preventive effects are not limited to gastrointestinal health and give indications of the overall health benefits of a sufficient amount of fiber in the body. Even with all these evidences on the positive health effects of fiber, the dietary disparities in terms of fiber intake are still observed amongst the various age groups, socioeconomic backgrounds and geographical distribution (O'Keefe, 2019). Such factors as intensifying urbanization, alterations in food conditions, and the growing popularity of refined grains and processed foods have led to decreasing fiber intake on the global scale (Hawkes et al., 2017). To handle these trends, there has to be concerted efforts of public health addressing issues such as nutrition education, food reformulation regulations and enhanced access to whole plant-based food. Dietary fiber consumption is a subject of great concern because of its critical role in the epidemiology of obesity and chronic diseases that increase more around the globe (Waddell and Orfila, 2023). This review will focus on analyzing the trends in the dietary fiber intake and determine the influence of dietary fiber in obesity and other common chronic diseases. It is hoped that with this synthesis of the existing evidence, the role of dietary fiber as an essential choice in preventive nutrition and long-term approaches to the health of the population is strengthened.

TYPES, CLASSIFICATION, AND SOURCES OF DIETARY FIBERS

The proper definition of dietary fibers has been a burning issue in the past decade. Still following the Guidelines on Nutrition Labelling (amended in 2009), dietary fiber is any carbohydrate polymer containing ten or more monomeric units (which are not hydrolyzed by endogenous enzymes and do not get absorbed in the small intestine of humans), and the controversy concerning oligosaccharides was not eliminated (Alimentarius, 2010). Dietary Fiber is a type of carbohydrate mostly found in vegetable foods like whole grains, legumes, fruits, and vegetables. They are a basic part of the overall diet and remained a part of the human diet since the beginning (Andrews & Johnson, 2020). In the modern era of industrialization, the consumption of dietary fibers has been reduced, posing a great risk to human health (Amato et al., 2019).

Dietary Fibers are ranked as one of the most diversified groups that are involved in various functions of the body, depending on the role, sources, and the purpose they serve. The conventional classification defines dietary fibers to be of 2 types: Soluble Dietary Fiber and Insoluble Dietary Fiber. This classification is known as one of the simplest classifications of carbohydrates. The Soluble Dietary Fibers are soluble in water and form a gel-like substance, and the insoluble dietary fibers form the bulk in the intestines. Cellulose, hemicellulose, and lignin are insoluble in water, but pectin, gums, and mucilage make a slime or gum-like appearance (Chau & Huang, 2003). The most widely accepted classification of dietary fiber is into two categories (Anita FP, 1997): Water-Insoluble/ less fermented fibers and Water Soluble/well-fermented fibers. The major types of dietary fibers, their characteristics, and common food sources are summarized in Table 1.

Table 1. Classification, properties, and common sources of dietary fiber

Type of Dietary Fiber	Major Components	Key Characteristics	Physiological Function	Common Food Sources
Soluble Fiber	Pectin, gums, mucilage, β-glucans	Dissolves in water forming viscous gel	Slows gastric emptying, regulates glucose absorption, reduces LDL cholesterol	Oats, barley, apples, citrus fruits, legumes
Insoluble Fiber	Cellulose, hemicellulose, lignin	Does not dissolve in water, increases stool bulk	Improves intestinal motility, prevents constipation, promotes bowel health	Whole grains, wheat bran, vegetables, nuts
Fermentable Fiber	Inulin, resistant starch, oligosaccharides	Fermented by gut microbiota	Produces short-chain fatty acids (SCFAs) that regulate metabolism and immune function	Bananas, chicory root, garlic, onions
Functional Fiber	Psyllium, methylcellulose, resistant starch	Isolated or synthetic fibers added to foods	Supports digestive health and cholesterol control	Fiber supplements, fortified foods

The predominant part of the plant cell wall is cellulose, which has the β-1,4 glycosidic bonds. It is a polymer of thousands of linear glucose subunits that are linear. The hydrogen bonding that exists between the microfibrils gives the cellulose its strength. The reason why cellulose cannot be digested by humans is that human beings do not possess the enzyme cellulase (Dhingra et al., 2012). It forms the primary part of vegetal fiber, which constitutes nearly one-third of vegetal materials, and the most usual case is Cotton fiber, which has the greatest amount of cellulose, close to 90% (Acharya et al., 2021). Both natural and synthetic sources provide a source of cellulose. The natural sources are the plants, animals, and minerals. Natural sources encompass seed fibers, collected on the seeds of cotton and Kapok, leaf fibers, collected on the leaves of sisal, fique and agave, fibers obtained on the skin which encloses the stems of flax, jute and kenaf, and fibers obtained on the fruits of plants e.g. coconut fiber and the fibers actually the stalk of the plants, e.g. rice, barley, bamboo (Lavanya et al., 2011). The natural sources are the tunicates, bacteria, and algae. The tunicates in the ocean are regarded as a good source of cellulose, and the best bacterium to produce cellulose is the bacterium *Acetobacter xylinum* (Rojas et al., 2015). Many taxonomies of algae, such as Chlorophyta and Rhodophyta, are considered to have cellulose in their cell wali (Poulose et al., 2022). Hemicellulose is the second naturally available polymer of the lignocellulosic biomass, which is also produced at 60 billion tons every year (Gatenholm & Tenkanen, 2003). It is used in the preparation of materials like emulsifiers and films, and chemicals, including xylitol and ethanol, and is used in food, medical, and energy storage purposes (Rao et al., 2023). The source of hemicellulose includes softwoods, hardwoods, and annual plants like grass, herbs, rye, oats, barley, and corn (Ren & Sun, 2010). Lignin is phenolic amorphous polymer and an important as one of the principal constituents of the plant cell wall that forms 15-30 per cent of the dry biomass (Xue et al., 2023). Lignin is inorganic and does not contain carbohydrates, but is a polymer of phenylpropane units that were the products of p-coumaroyl alcohol, coniferyl alcohol, and sinapyl alcohol. The fruits that contain seeds, e.g., strawberries, raspberries, and blackberries (lignin in seeds). The lignin is concentrated in the outer peel of fruits. Mature

legumes and seed casing have a moderate concentration of lignins (Lovegrove et al., 2025). Pectin is a soluble fiber that is found in the cell wall and intracellular layers of the plant cell and is found mostly in the diet. It is a complicated heteropolysaccharide containing at least 17 monomers whose backbone is α-1,4-D-galacturonic acid. It does not possess an accurate structure, and its molecular formation relies on the nature of the source one takes. Fruits, vegetables, tubers, root vegetables, and nuts are sources of pectin (Valladares & Vio, 2025). Pectin is believed to be good in apples, bananas, oranges, and lemons. Apple pomace contains 10-15% of pectin on a dry mass basis, although citrus peels contain 20-30% of pectin. The percentage of pectin in sugar beet pulp is 23%. It is insignificant in terms of grains compared to vegetables and fruits (Chandel et al., 2022). Other sources include carrots, pumpkins, artichokes, and guar seeds (3% highest in legumes) (Kurdil et al., 2025). Hydrocolloids or gums are high molecular, colloidal or suspension-like in nature, long-chain substances, and take the appearance of a gel-like substance in a water-based system. Their main functionality is thickening and gelation, although they have secondary functions in whipping and emulsifying. They are usually polysaccharides (Phillips, 2009). Gum is found in the guar plant, and it is milled from the seed endosperm (Dogra et al., 2025).

Mechanism of Action of Dietary Fiber

Dietary fiber is no longer considered a passive, unresponsive roughage, but a multi-dimensional, active controller of human physiology in the contemporary nutritional science. Recent studies by 2019 to 2023 inform that the action of fiber depends on a complex interaction of biological and chemical mechanisms which start at ingestion and end in the distal colon. Similar to what has been determined in contemporary clinical models (Rejeski et al., 2019), fiber operates under four major pillars: they are able to modulate the rheological properties of the food matrix (Ding et al., 2022) like viscosity, they are able to maintain the structural integrity of the food matrix, they are able to activate biochemical signaling pathways, and they are able to long-term program the colonic microbiota. These processes create a life-or-death loop of feedback that keeps metabolic wellness of the system at a straget and strictly regulated rate of nutrient intake and immunological exposure. The most important aspect of interactions at the center of it lies in the physical behavior of soluble fibers in the gastrointestinal tract (Guan et al., 2021). This is a viscous, water-soluble fiber often referred to as pectins, b-glucans and modern functional gums, which hydrate when in the stomach and small intestine forming a complex semi-solid gel network. This conversion also largely elevates the viscosity of the chyme by introducing a physical barrier to the diffusion of digestive enzymes such as amylase and lipase. Fiber adds bulk to the intestinal contents, which traps nutrients in a viscous structure, which does not allow the nutrients to move quickly to the intestinal epithelia (Andrews et al., 2018). The clinical evidence of this so-called molecular thickening is the attenuated postprandial glucose spikes and a stabilized insulin response, which is the building blocks of metabolic stability (Tani et al., 2023). In addition to that, this condition interferes with the emulsification of dietary fats and reabsorption of bile acids; this causes the liver to use his or her own stocks of cholesterol to produce new bile thus naturally reducing the serum LDL cholesterol. In addition to physical viscosity, fiber essentially reestablishes mechanical and hormonal timing of digestion (Meldrum et al., 2025). Recent longitudinal research highlights the importance of fiber to delay gastric emptying to ensure that food movement out of the stomach to the duodenum takes place at a rate that allows maximum nutrient absorption (Qi et al., 2018). This lag encourages longer gastric distension that activates mechanoreceptors that transmit the signal of satiation to the brain (Iheanacho et al., 2019). The effect however goes further into a complex neurohumoral cascade (MacDonald et al., 2019), whereby, fiber-bound nutrients in the distal small intestine trigger the release of important hormones like cholecystokinin (CCK), glucagon-like peptide-1 (GLP-1) and peptide YY (PYY). This is an ileal brake mechanism (Barreto et al., 2018) that is a physiological stopwatch, and it slows upper GI motility and signals the central nervous system not to eat anymore, to prevent excess eating

a regulatory mechanism that is often disastrously deficient in the diet of fiber-poor ultra-processed foods. The large intestine provides the most transformative stage in the physiological pathway of the dietary fiber through anaerobic fermentation. Since human enzymes do not have the ability to decompose complex glycosidic bonds, fiber enters the colon in the form of a strong energy source to the gut microbiota (Knirel et al., 2019). This has been demonstrated in the year 2020-2023 with research indicating the resultant short-chain fatty acids (SCFA) which are mainly acetate, propionate, and butyrate as critical signaling molecules and not a mere byproduct of metabolism. Butyrate is the main nutrient of the intestinal cells, which strengthens the integrity of the gut barrier to avoid metabolic endotoxemia (Mohammad et al., 2021). Propionate is mainly directed to the liver where it affects gluconeogenesis and lipid production and acetate gains access to peripheral circulation and creates a central effect on control of lipid metabolism in the body and control of central appetite (Hatting et al., 2018). The workflow basically transforms the colon into a bioreactor which produces anti-inflammatory products and provides a hostile environment to the presence of pathogenic organisms due to the low pH (Rajapaksha et al., 2019). The incorporation of fiber into the immune system is also so deep through the Gut-Associated Lymphoid Tissue (GALT) which accommodates about 70 percent of immune cells (Mörbe et al., 2021). Fiber-rich diets enhance the differentiation of regulatory T-cells (T-regs) that are primary to ensure immune tolerance and avert chronic systemic inflammation. Moreover, certain types of fibers directly communicate with mucosal receptors, and thus, they can train the immune system to differentiate between the harmless food antigens and harmful pathogens. This defense priming is why there is a consistent relationship between the consumption of high fiber intake and a low risk of inflammatory diseases and colorectal malignancies (Halamkova et al., 2021). Lastly, there is the food matrix effect which offers metabolic protection in general (Aguilera, 2019). Fiber does not occur in a free state but is part of the structure of the walls of plant cells which provides physical cages around the starch and other macronutrients. Biological needs of breaking these cell structures give rise to natural speed limit on the release of nutrients. This standpoint is removed through the modern refinement process that removes these husks to produce "white" or "instant-foods" and results in the sudden nutrient overload and the resultant metabolic imbalance of the modern world. Dietary fiber is an essential protective measure to metabolic and immunological health in an ever more sedentary world by restoring these natural regulating systems (Venter et al., 2022). The biological mechanisms through which dietary fiber influences metabolic health are illustrated in Figure 1.

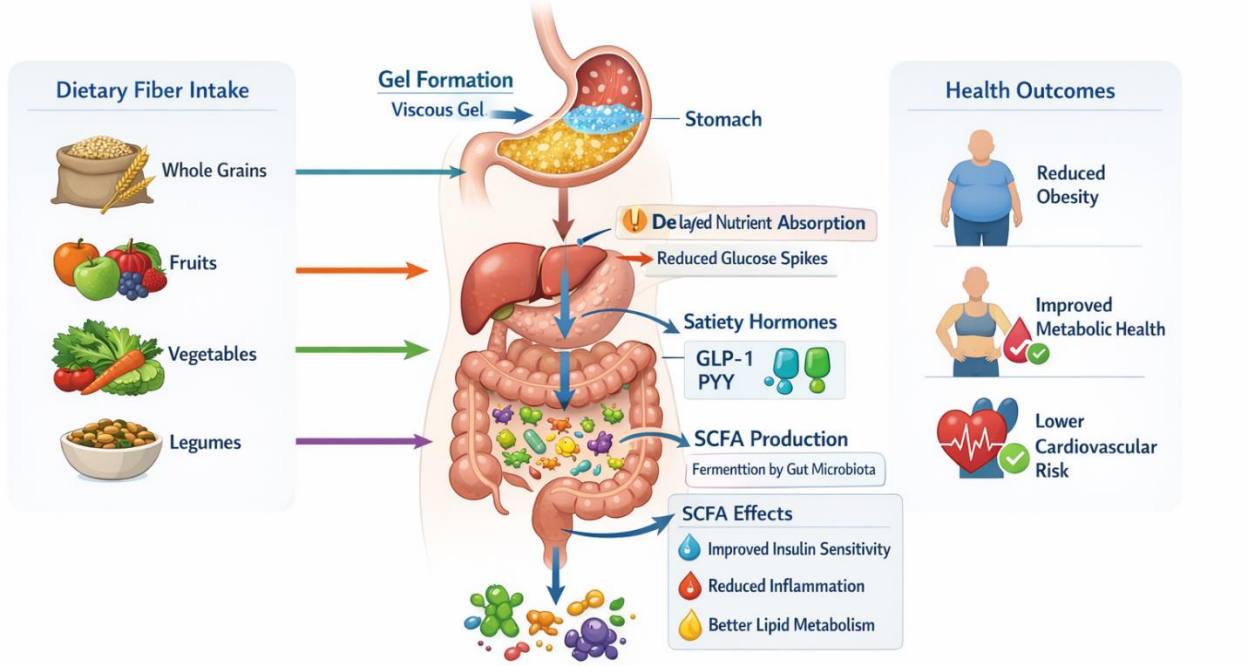

Figure 1. Mechanisms of Dietary Fiber in Metabolic Regulation

Role of dietary fiber in obesity prevention

Researchers have found over the past three decades that biopsychosocial factors determine weight gain much more than responsibility and personal choices (Masood and Moorthy, 2023).

Some decades ago, as of its mechanism of action and health, dietary fiber was established as a key dietary constituent (Pérez-Jiménez and Jara, 2024). It is believed that dairy fiber provides important health benefits and it has different physiochemical properties such as oil holding capacity, cholesterol absorption capacity, water holding capacity and viscosity. On the basis of consulting related databases, Dietary Fiber has very good effect on the treatment and prevention of obesity (He et al., 2022). In recent years it is observed that obese patients have been increasing day by day. Increase in number of obese patients poses a threat to human health worldwide, it also increases the global burden and it becomes a challenge for humans. It is an urgent problem for obese patients. Proper adequate intake of dietary fiber plays important role in preventing obesity. Dietary fiber reduces the risk of obesity by regulating digestion, food intake, metabolism and absorption. All in all, dietary fiber plays important role in prevention of obesity with the help of physiochemical properties such as WSC, CAC, OHC and WHC (He et al., 2022). Diet plays a major role in the prevention of obesity. There are many evidences from epidemiology to clinical intervention trials that teaches us dietary fiber plays important role in lowering the risk of obesity and its related non communicable diseases. The etiology of obesity is complex because obesity develops due to unhealthy dietary intake and low physical activity (Waddell and Orfila, 2023). Dietary fiber reduces hunger and prolongation of satiety. Dietary fiber can't digest easily in the gut. They need more time and more effort for mastication. Because it allows satiety signals to be evoked. In this way they help in lowers the intake of food that helps in prevention of obesity (Akhlaghi, 2024). Through complex interactions between neural hormonal and metabolic pathways body weight is regulated. You know that in fibers heterogeneity existed in terms of their physical and chemical structures that helps in determination of the effects of fiber on the gut microbiota, GIT and energy homeostasis. By increasing the intake of dietary fibers, we can induce structural, physiochemical and git site specific benefits that

helps in the metabolic syndrome and obesity treatment (Deehan et al., 2024). Dietary fiber plays an important role by reducing the calorie density of foods, this helps in reduce the risk of obesity and it also slower the rate of food ingestion (Kimm, 1995). Obesity causes so many complications that include dyslipidemia, diabetes mellitus type two and hypertension. These diseases represent many challenges to the health of people. To prevent obesity, dietary interventions play important role by increasing the intake of food that is rich in fiber. Obese patients should take lots of vegetables that are high in fiber, fruits that are low in sugar and whole grains because whole grains are also rich in fiber (Alahmari, 2024). Intake of high dietary fiber diet by pregnant woman reduces the risk of excessive weight gain and GDM (Zhang et al., 2022). Dietary fiber is characterized as the components of plant foods that cannot be digested or absorbed in the small intestine but allow the complete or partial fermentation occurring in the large intestine (Du et al., 2010). Coffee skins contain large amount of dietary fiber and antioxidant that plays important role in preventing obesity. There are several parts of coffee skin that include parchment, silver skin and pulp. Coffee skin is made up of coffee berries or coffee cherries that under go through the process of wet, dry and semi wet stages that helps in prevention from obesity (Sia et al., 2024). In the past four decades, researchers have examined traditional dietary methods as a way to different chronic diseases such as obesity. Alongside high fiber diets other dietary instruments like the glycemic index have been established which also associate carbohydrate metabolism with chronic diseases. The existing scientific research becks the idea that high fiber diets play a crucial role in the prevention and management of obesity (Kendall et al., 2010).

Role of Dietary Fiber in Chronic Diseases

Dietary fiber, as described by the FDA (US Food and Drug Administration), is known to have biological responses that are beneficial to human health: "an indigestible carbohydrate that is fundamental and complete; dissoluble and indissoluble with multiple structural units and lignin, separated and man-made with several subunits." High dietary fiber consumption has lowered the risk of obesity, type 2 diabetes, cardiovascular diseases, colorectal cancer, and premenopausal disorders, which have been illustrated in epidemiological studies (Waddell & Orfila, 2023). Factors like modification in food pattern, unusual hunger, and low energy expenditure can cause a difference between caloric intake and energy expenditure. To get systemic, physiological, and digestive system localized advantages, maximum intake of dietary fiber has possibilities that are linked with the treatment of obesity and metabolic diseases (Deehan et al., 2024). Supplementation with soluble dietary fiber has known to decrease weight (Huwiler et al., 2022). Fibers and their cultured products extend to parts of the brain, various involuntary and hormonal signals from the alimentary tract are aroused, which are associated with adjustment in appetite, and eventually reduce food uptake. The specific energy of food consumption will be affected by a switch in the meal to more fibrous food. The effects, like low caloric diet, are innate results of dietary fiber, and thus are complicated to modify between outcomes on body mass. Good gut bacteria may have a lowering influence on blood pressure because they lessen inflammation. Some studies suggest that the effects of low-calorie, low-fat, low-carb, and vegetarian diet but dietary fiber is most promising among them because of their ability to support gut flora (Nepali et al., 2022). In older people with hypertension, high dietary fiber utilization was considerably linked with decreased cardiovascular diseases and all-cause mortality. For older persons, decreasing dietary fiber intake may improve their outlook for the future (Zhang et al., 2022). The major mechanisms and clinical outcomes of dietary fiber in chronic disease prevention are summarized in Table 2.

Table 2. Protective role of dietary fiber against major chronic diseases

Disease	Mechanisms of Action	Key Health Effects
Obesity	Increased satiety, delayed gastric emptying, reduced energy density of foods	Lower body weight, reduced BMI, improved appetite regulation
Type 2 Diabetes Mellitus	Slower carbohydrate digestion, improved insulin sensitivity, SCFA production	Improved glycemic control and reduced postprandial glucose spikes
Cardiovascular Disease	Binding of bile acids, reduction of LDL cholesterol, anti-inflammatory effects	Lower cholesterol levels and reduced risk of coronary heart disease
Colorectal Cancer	Increased stool bulk, reduced intestinal transit time, microbial fermentation producing butyrate	Reduced exposure to carcinogens and improved gut health
Metabolic Syndrome	Regulation of gut microbiota, reduction in systemic inflammation	Improved lipid profile, glucose metabolism, and metabolic stability

The data presented suggests that individuals with hypertension should eat a maximum of 28g of dietary fiber per day for women and 38g per day for men. This would encourage a balanced microbiota in the gut and the formation of substances called short-chain fatty acids (SCFA) that produce from the gut bacteria that lowers blood pressure (Jama et al., 2024). Numerous systemic advantages of health, like improved glycemic control, lower insulin spikes, diminished high insulin levels, enhanced plasma cholesterol levels, and improved management of weight. In Type 2 diabetes, fiber rich diet is usually recommended because it prevents and manages it (Saboo et al., 2022). High intake of whole grains, low-fat dairy products such as yogurt, oil from olive trees, cacao dietary fiber, flavonoids, and magnesium in particular, along with dietary guidelines like Mediterranean diet and Dietary Approaches To Stop Hypertension(DASH) diet, greatly reduces the risk of diabetes, especially Diabetes, Type 2 diabetes, as shown by the results of the study. The great risk of having type 2 diabetes is associated with excessive consumption of red meat, refined sweeteners, or drinks enriched with synthesized sugars, alongside diets high in both glycemic index and glycemic burden (Toi et al., 2020). Through the mechanism of controlling biological, Immune-mediated, and autoimmune responses, the usage of dietary fiber impacts the gut microbiome constitution and metabolism. It has beneficial effects on the function of the kidneys, lowers uremic toxin generation, and slows the course of chronic kidney disease (Ranganathan & Anteyi, 2022). Improved gut barrier function, a reduction in inflammation, enhanced bowel production, increased proliferation of beneficial bacteria, and decreased formation of uremic toxicity are the advantages of increased fiber intake. In particular, SCFA blocks carcinogenic routes, defends against heart disease, diabetes, weight management and improves gut flora. It initially exerts important impacts on the metabolism of glucose and lipids, thereby minimizing inflammation (Su et al., 2022). Approximately a third of the human population worldwide is affected by Non Alcoholic Fatty Liver Disorders (NAFLD), which is characterized by a specific degree of obesity that arises without substantial intake of alcohol, alongside other known causes of liver problems. All things taken into account, we theorized that the dietary fiber intake lessened the probability of NAFLD and that overweight and obesity might function as an immediate variable in casual connection between dietary fiber and NAFLD (Zhu et al., 2023). A comprehensive review of qualitative investigation to examine the most current information concerning the influence of fiber and consumption of whole grain on the worldwide incidence of chronic liver disease. When contrasted, the greatest and the least total daily

consumption and the chance ratio in consuming whole grain and the entire risk of long-term liver disease were 0.90, and the OR between fiber intake and the entire risk for chronic liver disease was 0.65, both suggesting a substantial negative relationship (Zhang et al., 2024). Colorectal cancer have high mortality rate worldwide (Kumar et al., 2023). The chronic inadequate consumption of fiber might be a contributing cause to an increase in the prevalence of colorectal cancer. In reality, a variety of epidemiological investigations found a negative correlation with dietary fiber ingestion and risk of colorectal cancer. Dietary fibers are crucial for long-term prospects of CRC survival. Various pathogenic causes could be postulated. Bile acid metabolism, which might facilitate the proliferation of colon cancer. In addition to vegetables, which in turn incorporate a significant amount of beneficial substances such as resveratrol and other synthetic polyphenols or phytoestrogens, frequently contain fiber. Further commensal bacteria may destroy fibers and release substances, including butyrate, which have an antioxidant impact (Celiberto et al., 2023). The significance of developing techniques that modify the gut (GIT) microbiota with the aim of improving people's health is made apparent by the complicated link between the GI bacteria and the rise of non-communicable and chronic illnesses. One effective technique that improves the number of healthy bacteria in the lumen of the gut after ingestion, and human health is benefited by the probiotics and prebiotics. Furthermore, those that live in the colon and the cecum use food fibers as the source of energy. Increased motility in the gut, colon activity, and decreased risk of intestinal cancers (CRC) have been connected to increased fiber-rich food supplementation (Munteanu & Schwartz, 2024). Dietary fiber exerts protective effects against several chronic diseases including obesity, type 2 diabetes, cardiovascular disease, and colorectal cancer through multiple metabolic and physiological mechanisms (Figure 2).

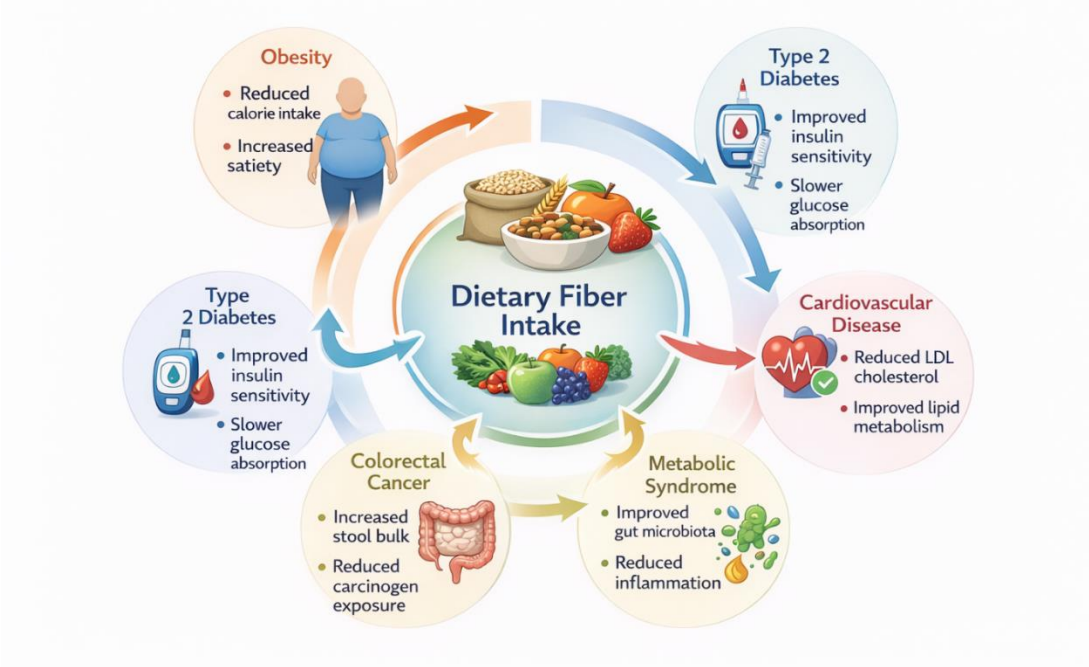

Figure 2. Protective Effects of Dietary Fiber Against Chronic Diseases

Recommended intake of Dietary Fiber

The intake of dietary fiber during childhood is linked to significant health advantages, particularly in facilitating regular bowel movements. We advise that children over the age of 2 should have a minimum dietary fiber intake of their age plus 5 grams per day. It is recommended that a safe dietary fiber intake for children falls between their age plus 5 and age plus

10 grams per day (Williams et al.,1995). Adults with hypertension should aim for a daily dietary fiber intake of over 28 g for women and over 38 g for men. Each additional 5 g of fiber consumed per day is projected to lower systolic blood pressure by 2.8 mm Hg and diastolic blood pressure by 2.1 mm Hg (Jama et al., 2024). Dietary fiber is generally understood as carbohydrates (CHOs) that are not digested or absorbed in the small intestine, and it also includes lignin, which is not a carbohydrate. According to the Nordic Nutrition Recommendations 2012 (NNR2012), the suggested daily intake is 25 grams for women and 35 grams for men. However, actual consumption falls short, averaging between 16 to 22 grams daily for women and 18 to 26 grams for men. Recent studies since the publication of NNR2012 reinforce the belief that dietary fiber is beneficial for health and suggest a minimum intake of 25 grams per day (Carlsen & Pajari, 2023). For excellent digestion, a normal body weight and a low risk of developing cardiovascular diseases, at least 50% of all cereals consumed should be unprocessed. Most nutritionists recommend an intake of 18–38 g of fiber/day for adults, which is around 8–20 g per 1000 kcal. The WHO/FAO and EFSA recommend an average daily intake of 25 g of fiber per adult (Ioniță-Mîndrican et al., 2022). Aging poses a global challenge concerning health, associated with diminished cognitive functions. In the U.S., many senior citizens (50 years and older) do not meet the recommended daily fiber consumption. Nevertheless, preliminary evidence suggests that an increased intake of dietary fiber could benefit cognitive capabilities. We investigated the connection between fiber consumption and cognitive abilities in older individuals, revealing an average daily fiber intake of 17.3 grams (Lepping et al., 2022). Dietary fiber assessment was conducted utilizing the Block 2005 Food Frequency Questionnaire (FFQ), which consists of 110 food items that are frequently eaten by African Americans, focusing on typical consumption and eating habits. Data was gathered on the total fiber, soluble fiber, and insoluble fiber consumed each day, with daily intake figures categorized as both absolute intake (in grams per day) and nutrient density (grams per 1000 kcal daily). Furthermore, the overall fiber intake for participants in the study was divided into two distinct variables depending on compliance with dietary guidelines regarding total fiber consumption (≥21 grams daily) and energy-adjusted fiber consumption (14g per 1000 kcal daily) (Lepping et al., 2022).

Epidemiology of Dietary Fiber Intake

The distribution and determinants of health-related behaviors and consequences within populations are investigated by epidemiology. Dietary fiber epidemiological research focuses on differences in intake by demographic and geographic factors, actual intake levels among communities, and the detrimental public health impacts of insufficient consumption. The intake of dietary fiber at the population level is chronically insufficient across the globe, and therefore, although there is an overwhelming amount of scientific evidence regarding the benefits of dietary fiber, fiber deficiency is a serious nutritional community health risk. The global health experts recommend an adequate consumption of dietary fiber to minimize cases of obesity and chronic illnesses. According to the world health organization (WHO), the recommended amount of dietary fiber that should be taken by any adult who is above the age of 10 is at least 25 grams of the naturally occurring type of dietary fiber every day. Likewise, dietary guidelines in most countries suggest that people need to take 25-38 g of food per day depending on their age and sex (U.S. Department of Agriculture [USDA], 2020). These suggestions are supported by a wealth of data that shows a positive correlation between fiber consumption and better cardiovascular and metabolic health. The difference between recommended and actual fiber consumption is continually significant, according to epidemiological surveys, even in spite of established standards. According to data from the UK National Diet and Nutrition Survey (NDNS, 2019–2023), adults aged ≥19 years had mean daily fiber intakes ranging from 16.4 to 16.9 g/day, which is significantly less than the recommended amount. Remarkably, just about 4% of persons consumed enough, indicating pervasive insufficiency even in wealthy nations with a variety

of food sources. Around the world, similar trends are noted. A population based study that involved a cross-sectional population study found that the average consumption of dietary fiber was 12.8 +/- 7.1 g/day, although over 90% of the study population had a low intake of dietary fibers as compared to the recommended levels. Data on national survey carried out in Iran showed that on an average, the daily consumption was about 23 g but even then 64% of women and 78% of men did not comply with dietary guidelines (Alfawaz et al., 2020). This inclination is further proven by Swiss studies that reveal that 87 percent of the population did not reach the recommended 30g/day and more. A combination of these findings proves that the problem of the absence of dietary fiber intake is a global concern, which affects a broad population, irrespective of financial status. Epidemiological studies have suggested that intake of dietary fibers is a lifestyle and demographic dependent aspect. The participants that consumed the most fiber had better metabolic, obesity, and nutritious dietary behaviors; this is based on the data provided by National Health and Nutrition Examination Survey (NHANES) (Miketinas et al., 2021). An increased intake of fiber has also been observed to be linked to certain demographic classes, including sex and race, and this fact highlights the cultural and lifestyle effects on fiber intake. Obesity is a significant health problem in the world and a significant predisposing factor to various chronic diseases. Epidemiological statistics indicate that there is a negative correlation between the intake of dietary fibres and prevalence of obesity. This association is evident when comparing countries. Ghanaians had the lowest prevalence of obesity (~10%), and highest intake of fiber (~24.9 g/day) whereas Americans had the highest prevalence of obesity (~52) and lowest fiber intake (~14.2 g/day) in a multi-country study that comprised of Ghana, Jamaica, Seychelles, and United States (Lie et al., 2018). Based on further NHANES data, despite the adjustment of confounding variables, individuals who took in 20.8g/day or more of dietary fiber recorded a 26% lower rate of obesity as compared to those within the least consuming group. These results at the level of the population suggest that the deficiency in the intake of fiber plays a significant role in the risk of excess body weight and obesity. To a great extent, epidemiological research has as well credited the lower incidence of type 2 diabetic mellitus (T2DM) to increased consumption of dietary fiber. The meta-analyses and cohort studies prove that the total and soluble fiber intake enhances insulin sensitivity, lowers postprandial glucose, and decreases the likelihood of developing diabetes (Mao et al., 2021). The findings contribute to the protective effect of the fiber in T2DM prevention and treatment. Poor fiber intake is a preventable cause of cardiovascular disease (CVD). According to the Global Burden of Disease (GBD) Study 2019, fiber intake was a major cause of CVD-related morbidity and mortality especially among the aged (Dong et al., 2022). The intake of dietary fiber has been long linked with reduced risk of colorectal cancer, and more recent research indicates that it has protective properties in regards to many other sites of cancers as well. The aggregate risk of cancer contracting has been found to decrease by 10 percent with increased intake of fiber, based on the body of evidence of large prospective cohorts like the UK Biobank (Bradbury et al., 2020). Also, systematic reviews and meta-analyses have demonstrated that people with higher intake of fiber are 23% less likely to die of any cause and 26% less likely to die of cardiovascular causes compared to people with low-fiber diets (Tejani et al., 2023). One of the common ways through which obesity is associated with cardiometabolic disorders is through chronic low-grade inflammation. According to the epidemiological investigations, the dietary fiber consumption is negatively correlated with other inflammatory cues including interleukin-6 and C-reactive protein (Clemente-Suárez et al., 2023). Importantly, emerging studies in adolescents have shown a relationship between a healthier metabolic profile and increased fiber intake with of interest that preventive effects of fiber may begin at early age (Reynolds et al., 2020). The Global Burden of Disease is a system of measurement of the impact of low intake of fiber on mortality and disability-adjusted life years (DALYs), providing important background epidemiological information (Zhuo et al., 2023). Poor fiber diets are contributing

considerably to the global burden of ischemic heart disease, stroke, type 2 diabetes and colon cancer. These trends remains relevant and up to 2023 and affect the public health targets, although the latest comprehensive GBD estimates reach the year 2019 (Shu and Jin, 2023). There are a number of methodological limitations despite consistent associations. Self-reported evaluations, which are vulnerable to recall bias and misclassification, are the primary source of food consumption data (Ravelli and Schoeller, 2020). Comparisons between research are made more difficult by differences in the definitions, kinds (soluble vs. Insoluble), and food sources of fiber. Observed relationships may also be impacted by residual confounding caused by socioeconomic and lifestyle factors.

Conclusion

High salutary fiber input shows a strong inverse association with obesity and cardiovascular complaint. Experimental substantiation also suggests a possible defensive part against seditious bowel complaint, particularly Crohn's complaint flares, while findings related to colorectal cancer remain inconsistent. Promoting salutary fiber input through patient comforting and educational coffers may give long- term preventative benefits. Still, numerous studies are limited by lack of randomization, variation in fiber types, and inconsistent control of food sources, pressing the need for farther exploration. Different factors of salutary fiber, including pectin, bran, β- glucan, inulin, arabinoxylan, and resistant bounce, contribute uniquely to health issues. High fiber input has been associated with bettered metabolic labels, reduced obesity frequence, and lower all-cause mortality in fat individualities. These benefits are intermediated through increased malnutrition, reduced nutrient immersion, lower energy viscosity, and enhanced short- chain adipose acid product. Encouraging consumption of fiber-rich foods remains an effective public health strategy for perfecting metabolic health and precluding habitual complaint.

REFERENCES

Aguilera, J. M. (2019). The food matrix: implications in processing, nutrition and health. Critical reviews in food science and nutrition, 59(22), 3612-3629.

Akhlaghi, M. (2024). The role of dietary fibers in regulating appetite, an overview of mechanisms and weight consequences. Critical Reviews in Food Science and Nutrition, 64(10), 3139-3150.

Alahmari, L. A. (2024). Dietary fiber influence on overall health, with an emphasis on CVD, diabetes, obesity, colon cancer, and inflammation. Frontiers in nutrition, 11, 1510564.

Alfawaz, H., Khan, N., Alhuthayli, H., Wani, K., Aljumah, M. A., Khattak, M. N. K., ... & Al-Daghri, N. M. (2020). Awareness and knowledge regarding the consumption of dietary fiber and its relation to self-reported health status in an adult arab population: a cross-sectional study. International Journal of Environmental Research and Public Health, 17(12), 4226.

Alimentarius, C. (2010). Guidelines on nutrition labelling CAC/GL 2-1985 as last amended 2010. Joint FAO/WHO Food Standards Programme, Secretariat of the Codex Alimentarius Commission, FAO, Rome.

AlimentariusAcharya, S., Liyanage, S., Parajuli, P., Rumi, S. S., Shamshina, J. L., & Abidi, N. (2021). Utilization of Cellulose to Its Full Potential: A Review on Cellulose Dissolution, Regeneration, and Applications. Polymers, 13(24), 4344.

Amato, K. R., Jeyakumar, T., Poinar, H., & Gros, P. (2019). Shifting climates, foods, and diseases: the human microbiome through evolution. Bioessays, 41(10), 1900034.

Andrews, C., McLean, M. H., & Durum, S. K. (2018). Cytokine tuning of intestinal epithelial function. Frontiers in immunology, 9, 1270.

Andrews, P., & Johnson, R. (2020). Evolutionary basis for the human diet: consequences for human health. Journal of internal medicine, 287(3), 226–237.

Anita FP, A. P. (1997). Clinical dietetics and nutrition. Delhi Oxford University Press.

Barreto, S. G., Soenen, S., Chisholm, J., Chapman, I., & Kow, L. (2018). Does the ileal brake mechanism contribute to sustained weight loss after bariatric surgery?. ANZ journal of surgery, 88(1-2), 20-25.

Bradbury, K. E., Murphy, N., & Key, T. J. (2020). Diet and colorectal cancer in UK Biobank: a prospective study. International journal of epidemiology, 49(1), 246-258.

Carlsen, H., & Pajari, A. M. (2023). Dietary fiber–a scoping review for Nordic Nutrition Recommendations 2023. Food & nutrition research, 67, 10-29219.

Celiberto, F., Aloisio, A., Girardi, B., Pricci, M., Iannone, A., Russo, F., Riezzo, G., D'Attoma, B., Ierardi, E., & Losurdo, G. (2023). Fibres and colorectal cancer: clinical and molecular evidence. International journal of molecular sciences, 24(17), 13501.

Chandel, V., Biswas, D., Roy, S., Vaidya, D., Verma, A., & Gupta, A. (2022). Current Advancements in Pectin: Extraction, Properties and Multifunctional Applications. Foods, 11(17). https://doi.org/10.3390/foods11172683

Chau, C. F., & Huang, Y. L. (2003). Comparison of the chemical composition and physicochemical properties of different fibers prepared from the peel of Citrus sinensis L. Cv. Liucheng. J Agric Food Chem, 51(9), 2615–2618. https://doi.org/10.1021/jf025919b

Chutkan, R., Fahey, G., Wright, W. L., & McRorie, J. (2012). Viscous versus nonviscous soluble fiber supplements: mechanisms and evidence for fiber-specific health benefits. Journal of the American Association of Nurse Practitioners, 24(8), 476-487.

Clemente-Suárez, V. J., Beltrán-Velasco, A. I., Redondo-Flórez, L., Martín-Rodríguez, A., & Tornero-Aguilera, J. F. (2023). Global impacts of western diet and its effects on metabolism and health: A narrative review. Nutrients, 15(12), 2749.

Deehan, E. C., Mocanu, V., & Madsen, K. L. (2024). Effects of dietary fiber on metabolic health and obesity. Nature reviews Gastroenterology & hepatology, 21(5), 301-318.

Deehan, E. C., Mocanu, V., & Madsen, K. L. (2024). Effects of dietary fibre on metabolic health and obesity. Nature reviews Gastroenterology & hepatology, 21(5), 301–318.

Dhingra, D., Michael, M., Rajput, H., & Patil, R. T. (2012). Dietary fibre in foods: a review. J Food Sci Technol, 49(3), 255–266. https://doi.org/10.1007/s13197-011-0365-5

Ding, M., Huang, Z., Jin, Z., Zhou, C., Wu, J., Zhao, D., ... & Li, C. (2022). The effect of fat content in food matrix on the structure, rheological properties and digestive properties of protein. Food Hydrocolloids, 126, 107464.

Dogra, S., Yadav, D., Koul, B., & Rabbee, M. F. (2025). Plant-Based Polysaccharide Gums as Sustainable Bio-Polymers: Focus on Tragacanth Gum and Its Emerging Applications. Polymers (Basel), 17(23). https://doi.org/10.3390/polym17233163

Dong, C., Bu, X., Liu, J., Wei, L., Ma, A., & Wang, T. (2022). Cardiovascular disease burden attributable to dietary risk factors from 1990 to 2019: A systematic analysis of the Global Burden of Disease study. Nutrition, Metabolism and Cardiovascular Diseases, 32(4), 897-907.

Du, H., van der A, D. L., Boshuizen, H. C., Forouhi, N. G., Wareham, N. J., Halkjær, J., ... & Feskens, E. J. (2010). Dietary fiber and subsequent changes in body weight and waist circumference in European men and women. The American journal of clinical nutrition, 91(2), 329-336.

Gatenholm, P., & Tenkanen, M. (2003). Hemicelluloses: science and technology. ACS Publications.

Giuntini, E. B., Sardá, F. A. H., & de Menezes, E. W. (2022). The effects of soluble dietary fibers on glycemic response: an overview and futures perspectives. Foods, 11(23), 3934.

Guan, Z. W., Yu, E. Z., & Feng, Q. (2021). Soluble dietary fiber, one of the most important nutrients for the gut microbiota. Molecules, 26(22), 6802.

Halamkova, J., Kazda, T., Pehalova, L., Gonec, R., Kozakova, S., Bohovicova, L., ... & Kiss, I. (2021). Second primary malignancies in colorectal cancer patients. Scientific reports, 11(1), 2759.

Hatting, M., Tavares, C. D., Sharabi, K., Rines, A. K., & Puigserver, P. (2018). Insulin regulation of gluconeogenesis. Annals of the New York Academy of Sciences, 1411(1), 21-35.

Hawkes, C., Harris, J., & Gillespie, S. (2017). Urbanization and the nutrition transition. Global food policy report, 4(41), 34.

He, Y., Wang, B., Wen, L., Wang, F., Yu, H., Chen, D., ... & Zhang, C. (2022). Effects of dietary fiber on human health. Food Science and Human Wellness, 11(1), 1-10.

He, Yang, et al. "Effects of dietary fiber on human health." Food Science and Human Wellness 11.1 (2022): 1-10.

Huwiler, V. V., Schönenberger, K. A., Segesser von Brunegg, A., Reber, E., Mühlebach, S., Stanga, Z., & Balmer, M. L. (2022). Prolonged isolated soluble dietary fibre supplementation in overweight and obese patients: a systematic review with meta-analysis of randomised controlled trials. Nutrients, 14(13), 2627.

Iheanacho, F., & Vellipuram, A. R. (2019). Physiology, mechanoreceptors.

Ioniţă-Mîndrican, C. B., Ziani, K., Mititelu, M., Oprea, E., Neacşu, S. M., Moroşan, E., ... & Negrei, C. (2022). Therapeutic benefits and dietary restrictions of fiber intake: A state of the art review. Nutrients, 14(13), 2641.

Jama, H. A., Snelson, M., Schutte, A. E., Muir, J., & Marques, F. Z. (2024). Recommendations for the use of dietary fiber to improve blood pressure control. Hypertension, 81(7), 1450-1459.

Jama, H. A., Snelson, M., Schutte, A. E., Muir, J., & Marques, F. Z. (2024). Recommendations for the use of dietary fiber to improve blood pressure control. Hypertension, 81(7), 1450–1459.

Jung, U. J., & Choi, M. S. (2014). Obesity and its metabolic complications: the role of adipokines and the relationship between obesity, inflammation, insulin resistance, dyslipidemia and nonalcoholic fatty liver disease. International journal of molecular sciences, 15(4), 6184-6223.

Kendall, C. W., Esfahani, A., & Jenkins, D. J. (2010). The link between dietary fiber and human health. Food hydrocolloids, 24(1), 42-48.

Kim, Y., & Je, Y. (2014). Dietary fiber intake and total mortality: a meta-analysis of prospective cohort studies. American journal of epidemiology, 180(6), 565-573.

Kimm, S. Y. (1995). The role of dietary fiber in the development and treatment of childhood obesity. Pediatrics, 96(5), 1010-1014.

Knirel, Y. A., Naumenko, O. I., Senchenkova, S. Y. N., & Perepelov, A. V. (2019). Chemical methods for selective cleavage of glycosidic bonds in the structural analysis of bacterial polysaccharides. Russian Chemical Reviews, 88(4), 406-424.

Kucharska, A., Sińska, B. I., Panczyk, M., Samel-Kowalik, P., Szostak-Węgierek, D., Raciborski, F., ... & Traczyk, I. (2024). Assessing the impact of dietary choices on fiber deficiency: insights from the 2017–2020 polish National Adult Nutrition Survey. Frontiers in Nutrition, 11, 1433406.

Kumar, A., Chinnathambi, S., Kumar, M., & Pandian, G. N. (2023). Food intake and colorectal cancer. Nutrition and Cancer, 75(9), 1710–1742.

Kurdil, N. V., Khudaikulova, O. O., Krapyvnytska, I. O., Omelchuk, Y. O., Shchutska, T. O., Kostyuchenko, T. P., & Palamar, B. I. (2025). Assessment of the complex-forming capacity of pectins obtained from various vegetable and fruit raw materials as a basis for creating special food products. Pol Merkur Lekarski, 53(3), 361–366. https://doi.org/10.36740/Merkur202503110

Lavanya, D., Kulkarni, P., Dixit, M., Raavi, P. K., & Krishna, L. N. V. (2011). Sources of cellulose and their applications- A review. International Journal of Drug Formulation and Research, 2, 19–38.

Lepping, K., Adams-Campbell, L. L., Hicks, J., Mills, M., & Dash, C. (2022). Dietary fiber intake and metabolic syndrome in postmenopausal African American women with obesity. PLoS One, 17(9), e0273911.

Lie, L., Brown, L., Forrester, T. E., Plange-Rhule, J., Bovet, P., Lambert, E. V., ... & Dugas, L. R. (2018). The association of dietary fiber intake with cardiometabolic risk in four countries across the epidemiologic transition. Nutrients, 10(5), 628.

Liu, Z. (2025). Research Progress: The Ultra-Processed Foods Contribute to Micronutrient Deficiencies in Modern Diets. Theoretical and Natural Science, 112, 26-34.

Lovegrove, J. A., Jackson, K. G., Kaimila, Y., Lignou, S., Lovegrove, A., Norton, V., O'Sullivan, D. M., Shewry, P., Tosi, P., & Tindall, M. J. (2025). Importance of dietary fibre, strategies for increasing intake and maintenance of the supply chain in the UK. Philos Trans R Soc Lond B Biol Sci, 380(1935), 20240148. https://doi.org/10.1098/rstb.2024.0148

MacDonald, E. A., Rose, R. A., & Quinn, T. A. (2020). Neurohumoral control of sinoatrial node activity and heart rate: insight from experimental models and findings from humans. Frontiers in physiology, 11, 170.

Makki, K., Deehan, E. C., Walter, J., & Bäckhed, F. (2018). The impact of dietary fiber on gut microbiota in host health and disease. Cell host & microbe, 23(6), 705-715.

Mao, T., Huang, F., Zhu, X., Wei, D., & Chen, L. (2021). Effects of dietary fiber on glycemic control and insulin sensitivity in patients with type 2 diabetes: A systematic review and meta-analysis. Journal of Functional Foods, 82, 104500.

Masood, B., & Moorthy, M. (2023). Causes of obesity: a review. Clinical Medicine, 23(4), 284-291.

Mazhar, M., Zhu, Y., & Qin, L. (2023). The interplay of dietary fibers and intestinal microbiota affects type 2 diabetes by generating short-chain fatty acids. Foods, 12(5), 1023.

Meldrum, O. W., & Yakubov, G. E. (2025). Journey of dietary fiber along the gastrointestinal tract: role of physical interactions, mucus, and biochemical transformations. Critical Reviews in Food Science and Nutrition, 65(22), 4264-4292.

Miketinas, D., Tucker, W., Patterson, M., & Douglas, C. (2021). Usual dietary fiber intake in US adults with diabetes: NHANES 2013–2018. Current Developments in Nutrition, 5, 1061.

Mohammad, S., & Thiemermann, C. (2021). Role of metabolic endotoxemia in systemic inflammation and potential interventions. Frontiers in immunology, 11, 594150.

Mörbe, U. M., Jørgensen, P. B., Fenton, T. M., von Burg, N., Riis, L. B., Spencer, J., & Agace, W. W. (2021). Human gut-associated lymphoid tissues (GALT); diversity, structure, and function. Mucosal immunology, 14(4), 793-802.

Munteanu, C., & Schwartz, B. (2024). Interactions between dietary antioxidants, dietary Fiber and the gut microbiome: their putative role in inflammation and Cancer. International journal of molecular sciences, 25(15), 8250.

Nepali, P., Suresh, S., Pikale, G., Jhaveri, S., Avanthika, C., Bansal, M., Islam, R., & Chanpura, A. (2022). Hypertension and the role of dietary fiber. Current Problems in Cardiology, 47(7), 101203.

O'Keefe, S. J. (2019). The association between dietary fibre deficiency and high-income lifestyle-associated diseases: Burkitt's hypothesis revisited. The lancet Gastroenterology & hepatology, 4(12), 984-996.

Pérez-Jiménez, Jara. "Dietary fiber: Still alive." Food Chemistry 439 (2024): 138076.

Phillips, G. O., & Williams, P. A. (Eds.). (2009). Handbook of hydrocolloids (Vol. 2nd ed.). Woodhead Publishing.

Popoola-Akinola, O. O., Raji, T. J., & Olawoye, B. (2022). Lignocellulose, dietary fibre, inulin and their potential application in food. Heliyon, 8(8).

Poulose, A., Parameswaranpillai, J., George, J. J., Gopi, J. A., Krishnasamy, S., Dominic C. D., M., Hameed, N., Salim, N. V., Radoor, S., & Sienkiewicz, N. (2022). Nanocellulose: A Fundamental Material for Science and Technology Applications. Molecules, 27(22), 8032.

Procházková, N., Falony, G., Dragsted, L. O., Licht, T. R., Raes, J., & Roager, H. M. (2023). Advancing human gut microbiota research by considering gut transit time. Gut, 72(1), 180-191.

Qi, X., Al-Ghazzewi, F. H., & Tester, R. F. (2018). Dietary fiber, gastric emptying, and carbohydrate digestion: A mini-review. Starch-Stärke, 70(9-10), 1700346.

Rajapaksha, P., Elbourne, A., Gangadoo, S., Brown, R., Cozzolino, D., & Chapman, J. (2019). A review of methods for the detection of pathogenic microorganisms. Analyst, 144(2), 396-411.

Ranganathan, N., & Anteyi, E. (2022). The Role of Dietary Fiber and Gut Microbiome Modulation in Progression of Chronic Kidney Disease. Toxins (Basel), 14(3). https://doi.org/10.3390/toxins14030183

Rao, J., Lv, Z., Chen, G., & Peng, F. (2023). Hemicellulose: Structure, chemical modification, and application. Progress in Polymer Science, 140, 101675.

Ravelli, M. N., & Schoeller, D. A. (2020). Traditional self-reported dietary instruments are prone to inaccuracies and new approaches are needed. Frontiers in nutrition, 7, 90.

Rejeski, W. J., & Fanning, J. (2019). Models and theories of health behavior and clinical interventions in aging: a contemporary, integrative approach. Clinical interventions in aging, 1007-1019.

Ren, J.-L., & Sun, R.-C. (2010). Hemicelluloses. Cereal straw as a resource for sustainable biomaterials and biofuels, 1, 73–130.

Reynolds, A. N., Diep Pham, H. T., Montez, J., & Mann, J. (2020). Dietary fibre intake in childhood or adolescence and subsequent health outcomes: a systematic review of prospective observational studies. Diabetes, Obesity and Metabolism, 22(12), 2460-2467.

Rojas, J., Bedoya, M., & Ciro, Y. (2015). of Cellulose Nanoparticles and Nanocomposites for Biomedical Applications. Cellulose: fundamental aspects and current trends, 193.

Saboo, B., Misra, A., Kalra, S., Mohan, V., Aravind, S., Joshi, S., Chowdhury, S., Sahay, R., Kesavadev, J., & John, M. (2022). Role and importance of high fiber in diabetes management in India. Diabetes & Metabolic Syndrome: Clinical Research & Reviews, 16(5), 102480.

Shu, J., & Jin, W. (2023). Prioritizing non-communicable diseases in the post-pandemic era based on a comprehensive analysis of the GBD 2019 from 1990 to 2019. Scientific reports, 13(1), 13325.

Sia, C. E. S., Yuliantar, A., Rizkaprilisa, W., Paramastuti, R., & Hapsari, M. W. (2024). Potential of Dietary Fiber and Antioxidants from Coffee Skin as a Food Product in Preventing Obesity: Systematic Review. Science Technology and Management Journal, 4(1), 16-21.

Su, G., Qin, X., Yang, C., Sabatino, A., Kelly, J. T., Avesani, C. M., & Carrero, J. J. (2022). Fiber intake and health in people with chronic kidney disease. Clinical kidney journal, 15(2), 213–225.

Surampudi, P., Enkhmaa, B., Anuurad, E., & Berglund, L. (2016). Lipid lowering with soluble dietary fiber. Current atherosclerosis reports, 18(12), 75.

Tani, Y., Tokuda, M., Nishimoto, N., Yokoi, H., & Izumori, K. (2023). Allulose for the attenuation of postprandial blood glucose levels in healthy humans: A systematic review and meta-analysis. PLoS One, 18(4), e0281150.

Tejani, V. N., Dhillon, S. S., Damarlapally, N., Usman, N. U. B., Winson, T., Roy, P. B., & Panjiyar, B. K. (2023). The relationship between dietary fiber intake and blood pressure worldwide: a systematic review. Cureus, 15(9).

Toi, P. L., Anothaisintawee, T., Chaikledkaew, U., Briones, J. R., Reutrakul, S., & Thakkinstian, A. (2020). Preventive Role of Diet Interventions and Dietary Factors in Type 2 Diabetes Mellitus: An Umbrella Review. Nutrients, 12(9). https://doi.org/10.3390/nu12092722

U.S. Department of Agriculture and U.S. Department of Health and Human Services.(2020). Dietary Guidelines for Americans, 2020-2025. 9th Edition

Ullrich, I. H., Peters, P. J., & Albrink, M. J. (1985). Effect of low-carbohydrate diets high in either fat or protein on thyroid function, plasma insulin, glucose, and triglycerides in healthy young adults. Journal of the American College of Nutrition, 4(4), 451-459.

Valladares, L., & Vio, F. (2025). Pectin and Its Beneficial Effect on Health: New Contributions in Research and the Need to Increase Fruits and Vegetables Consumption-A Review. Int J Mol Sci, 26(14). https://doi.org/10.3390/ijms26146852

Venter, C., Meyer, R. W., Greenhawt, M., Pali-Schöll, I., Nwaru, B., Roduit, C., ... & O'Mahony, L. (2022). Role of dietary fiber in promoting immune health—An EAACI position paper. Allergy, 77(11), 3185-3198.

Waddell, I. S., & Orfila, C. (2023). Dietary fiber in the prevention of obesity and obesity-related chronic diseases: From epidemiological evidence to potential molecular mechanisms. Critical reviews in food science and nutrition, 63(27), 8752-8767.

Waddell, I. S., & Orfila, C. (2023). Dietary fiber in the prevention of obesity and obesity-related chronic diseases: From epidemiological evidence to potential molecular mechanisms. Critical reviews in food science and nutrition, 63(27), 8752-8767.

Waddell, I. S., & Orfila, C. (2023). Dietary fiber in the prevention of obesity and obesity-related chronic diseases: From epidemiological evidence to potential molecular mechanisms. Critical reviews in food science and nutrition, 63(27), 8752–8767.

Williams, C. L., Bollella, M., & Wynder, E. L. (1995). A new recommendation for dietary fiber in childhood. Pediatrics, 96(5), 985-988.

Xue, J., Wang, D., Li, X., Li, G., Wang, Z., Liu, Y., & Li, X. (2023). A tandem strategy of mild preoxidation-hydrogenolysis for efficient depolymerization of lignin. Molecular Catalysis, 549, 113529. https://doi.org/10.1016/j.mcat.2023.113529

Zhang, H., Yang, Y., Tian, W., & Sun, Y. (2022). Dietary fiber and all-cause and cardiovascular mortality in older adults with hypertension: a cohort study of NHANES. The Journal of nutrition, health and aging, 26(4), 407–414.

Zhang, L., Chen, Y., Yang, Q., Guo, J., Zhou, S., Zhong, T., ... & Wang, L. (2025). The impact of dietary fiber on cardiovascular diseases: a scoping review. Nutrients, 17(3), 444.

Zhang, M., Liu, J., Li, C., Gao, J., Xu, C., Wu, X., ... & Zheng, R. (2022). Functional fiber reduces mice obesity by regulating intestinal microbiota. Nutrients, 14(13), 2676.

Zhang, Y., Sui, J., Xu, Y., Pan, L., Xia, H., & Sun, G. (2024). Effect of whole grain and fiber consumption on chronic liver diseases: a systematic review and meta-analysis. Food & Function.

Zhu, Y., Yang, H., Zhang, Y., Rao, S., Mo, Y., Zhang, H., Liang, S., Zhang, Z., & Yang, W. (2023). Dietary fiber intake and non-alcoholic fatty liver disease: The mediating role of obesity. Frontiers in public health, 10, 1038435.

Zhuo, M., Chen, Z., Zhong, M. L., Liu, Y. M., Lei, F., Qin, J. J., ... & Zeng, Y. (2023). The global disease burden attributable to a diet low in fibre in 204 countries and territories from 1990 to 2019. Public Health Nutrition, 26(4), 854-865.

Zhuo, M., Chen, Z., Zhong, M. L., Liu, Y. M., Lei, F., Qin, J. J., ... & Zeng, Y. (2023). The global disease burden attributable to a diet low in fibre in 204 countries and territories from 1990 to 2019. Public Health Nutrition, 26(4), 854-865.