

# DIETARY FIBRE INTAKE AND INFLUENCES ON RISK FACTORS REDUCTION IN CORONARY HEART DISEASE PATIENT

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## Abstract:

*Coronary heart disease is now one of the most common killer diseases in Bangladesh. . It is estimated that prevalence of the disease in the country is 6.8 million<sup>1</sup> and day by day this alarming statistics is becoming worse. The causes of coronary heart disease is related to multiple risk factors and most common factors are high cholesterol and triglyceride rich food intake, lack of fresh vegetables and fruits in diet, tobacco abuse, obesity, physical inactivity, high blood pressure, diabetes, excessive stress in work etc. Among these risk factors dietary habit is one of the most important modifiable factors that can prevent coronary heart disease in various ways. By making some simple lifestyle intervention like increase the amount of dietary fibre intake can reduce the risk of getting coronary heart disease and as well as can also causes risk reduction for development of major coronary events like heart attacks.*

**Key Words:** Coronary Heart Disease, Dietary fibre, Diabetes Melitus, Cholesterol.

## Introduction:

Dietary fibre is the indigestible portion of plant foods having soluble and insoluble portion. Soluble fibre dissolves in water to form a gel-like material which can help lower blood cholesterol<sup>2</sup> and glucose levels. Soluble fiber is found in oats, peas, beans, apples, citrus fruits, carrots, barley and psyllium but insoluble fibre promotes the movement of material through the digestive system and increases stool bulk, so it can be of benefit to those who struggle with constipation or irregular bowel habit.

## Chemical structure of dietary fibre:

Chemically, dietary fiber consists of non starch polysaccharides such as arabinoxylans, cellulose and many other plant components such as dextrans, inulin, lignin, waxes, chitins, pectins, beta glucans and oligosaccharides.<sup>3</sup> A novel position has been adopted by the US Department of Agriculture to include functional fibres as isolated fiber sources that may be included in the diet.<sup>3</sup>

## Observational findings:

An increasing number of observational findings have reported a lower incidence of coronary heart disease

in subjects who consume diets high in fiber. Dietary fiber is thought to affect several cardiovascular disease (CVD) risk factors. Soluble fiber decreases serum total and low-density lipoprotein cholesterol concentrations and improves insulin resistance. The effect of fiber on inflammatory markers and coagulation is not yet well established. While soluble, gel-forming fiber has beneficially affected CVD risk factors, food sources of mainly insoluble fibers, primarily contributed by cereal products, have been the most consistently associated with lower incidence rates of CVD<sup>4</sup>. Despite the contradiction, the evidence promotes a food-based approach favoring increased intake of whole-grain cereals, fruit, and vegetables providing a mixture of different types of fibers for CVD prevention.

## Risk factors for coronary heart disease:

Scientific position of American Heart Association regarding the major modifiable risk factors of coronary heart disease are tobacco smoking, high blood cholesterol, high blood pressure, physical inactivity, obesity and overweight, diabetes mellitus etc<sup>(3)</sup>. The Framingham Heart Study results demonstrated that the higher the cholesterol level, the greater the risk

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of coronary artery disease; alternatively, coronary artery disease was uncommon in people with cholesterol levels below 150 mg/dL. In 1984, the Lipid Research Clinics-Coronary Primary Prevention Trial revealed that lowering total and low density lipoprotein (LDL) or bad cholesterol levels significantly reduced coronary artery disease. More recent series of clinical trials using statin drugs have provided conclusive evidence that lowering LDL cholesterol reduces- (1) the rate of myocardial infarction, (2) the need for percutaneous coronary intervention, and (3) the mortality rate associated with coronary artery disease-related causes<sup>5</sup>.

#### **Dietary fibre for elderly people:**

People older than 65 years are the fastest-growing segment of the population and account for the majority of cardiovascular disease (CVD) morbidity, mortality, and health care expenditures. Additionally, the influence of dietary habits on risk may be less pronounced in elderly persons, when atherosclerosis is more advanced. A study conducted on elderly people showed that higher cereal fiber intake was associated with lower risk of total stroke and ischemic stroke and a trend towards lower risk of ischemic heart disease death. In a post hoc analysis, dark breads such as soya bean, wheat, rye, or pumpernickel were associated with a lower risk of CVD incident rather than cereal fiber from other sources. Cereal fiber consumption late in life is associated with lower risk of CVD<sup>6</sup> supporting recommendations for elderly individuals to increase consumption of dietary cereal fibre.

#### **Daily requirements:**

American Dietetic Association recommends that public should consume adequate amounts of dietary fiber from a variety of plant foods and intake should be 20-35 g/day for healthy adults and age plus and 5 g/day for children. These requirements are not always fulfilled because intakes of good sources of dietary fiber, fruits, vegetables, whole and high-fiber grain products, and legumes are low. Consumption of dietary fibers that are viscous lowers blood cholesterol levels<sup>7</sup> and helps to normalize blood glucose and insulin levels, making these kinds of fibers part of the dietary plans to treat cardiovascular disease and type 2 diabetes. North Americans consume less than 50% of the dietary fiber levels recommended for good health. In the preferred food choices of today's youth, this value may be as low as 20%, a factor considered by experts as contributing to the obesity crisis seen in many developed countries.<sup>8,9</sup>

#### **Mechanism of action of dietary fibre:**

When soluble fiber is fermented, short-chain fatty acids (SCFA) are produced. SCFA are involved in numerous physiological processes promoting health, stabilize blood glucose levels by acting on pancreatic insulin release and liver control of glycogen breakdown. SCFA can also stimulate gene expression of glucose transporters in the intestinal mucosa, regulating glucose absorption and thus can prevent diabetes progression.<sup>10</sup> It can also suppress cholesterol synthesis by the liver and reduce blood levels of LDL cholesterol and triglycerides responsible for atherosclerosis.<sup>11</sup> A pooled analysis of cohort studies<sup>12</sup> suggest that dietary fibre can reduce the risk of coronary heart disease (CHD) through a variety of mechanisms, such as improving blood lipid profiles,<sup>13,14,15</sup> lowering blood pressure,<sup>16,17</sup> and improving insulin sensitivity<sup>18,19</sup> and fibrinolytic activity<sup>20</sup>. Dietary fiber has been found to be inversely associated with the with risk factors for CHD in observational studies.<sup>21,22,23,24</sup> The association between dietary fiber and CHD incidence has been examined in at least 10 prospective cohort studies.<sup>21,25-33</sup> All but one<sup>30</sup> of these studies reported an inverse association. with risk of CHD in both men and women. The associations were stronger for coronary mortality (27% reduction in risk for each 10-g/d increment in total dietary fiber) than for all events (14% reduction in risk). Although cereal and fruit fiber had strong inverse associations with CHD risk, no such associations were observed for vegetable fiber. These associations seemed to be independent of other dietary factors, sex, age, and baseline body mass index, and smoking, history of hypertension, diabetes, and hypercholesterolemia.

#### **Dietary fibre and Obesity:**

Obesity is another important risk factor when we think about the prevention of coronary heart disease. Fiber intake is inversely associated with weight and waist circumference change<sup>34</sup>. In a prospective cohort study with 89,432 European participants, aged 20-78 year, who were free of cancer, cardiovascular disease, and diabetes at baseline and who were followed for an average of 6.5 year showed that for a 10gm/day higher total fiber intake can significantly changed weight and waist circumference. Fruit and vegetable fiber was not associated with weight change but had a similar association with waist circumference change when compared with intake of total dietary fiber and cereal fiber.

#### **Dietary fibre and Diabetes:**

Diabetes is a potential risk factor for dyslipidemia and generalized atherosclerotic plaque forming

metabolic disease, which control remains the main step for preventing coronary heart disease. According to a number of observational studies, consumption of foods containing fiber has been associated with a reduced risk of type 2 diabetes<sup>35</sup>. Dietary fiber is thought to play an important role in the reducing the risk of diabetes and nutritionally managing the disease by helping to normalize the glucose response and decrease insulin concentration and requirements. Higher intake (between 13-16 grams per day or greater) of dietary fiber, especially cereal fiber, has been consistently associated with lower risk of type 2 diabetes and improved insulin sensitivity<sup>36-39</sup>. While the exact mechanism for these effects related to nonviscous fibers are unclear, viscous fiber from oats, legumes, gums, and pectins has been found to significantly reduce the glycemic response by delaying gastric emptying and glucose absorption<sup>40,41</sup>. Yet, studies support a stronger link between non-viscous fiber, mainly from whole grain foods, and reduced risk of developing insulin resistance and type 2 diabetes. One explanation for this difference is that the quantity of viscous fiber consumed in the average diet is insufficient to observe a significant effect on glycemic control<sup>42</sup>. In addition to fiber, other components of whole grains, including magnesium, vitamin E, phytic acids, and phenolic compounds, also may contribute to the decreased risk of type 2 diabetes<sup>43,44</sup>. Approximate intake of different types of fibre for risk factor reduction in coronary heart disease is an established fact. The studies conducted to date have found reduced coronary heart disease rates in individuals consuming certain sources of dietary fiber (cereal foods) and certain viscous fibers (gums such as oatmeal and barley and pectins such as apples, berries, and citrus fruits). This benefit is believed to be primarily a result of fiber's effects on interfering with cholesterol and bile acid absorption<sup>45</sup>, thus lowering blood levels of total cholesterol and low-density lipoprotein (LDL) cholesterol. Another proposed mechanism is the delayed absorption of fat and carbohydrate, which leads to increased insulin sensitivity and decreased levels of circulating triglycerides<sup>35</sup>.

#### **Observational findings:**

An increasing number of observational findings have reported a lower incidence of coronary heart disease in subjects who consume diets high in fiber. Dietary fiber is thought to affect several cardiovascular disease (CVD) risk factors. Soluble fiber decreases serum total and low-density lipoprotein cholesterol concentrations and improves insulin resistance. The effect of fiber on inflammatory markers and

coagulation is not yet well established. While soluble, gel-forming fiber has beneficially affected CVD risk factors, food sources of mainly insoluble fibers, primarily contributed by cereal products, have been the most consistently associated with lower incidence rates of CVD<sup>5</sup>. Despite the contradiction, the evidence promotes a food-based approach favoring increased intake of whole-grain cereals, fruit, and vegetables providing a mixture of different types of fibers for CVD prevention.

#### **Dietary fibre and high blood pressure:**

A recent American Dietetic Association position paper on dietary fiber and health also suggests other mechanisms, including fiber's affect on blood pressure and C-reactive protein, which are also biomarkers for cardiovascular disease risk<sup>46</sup>. Several studies have examined the effects of various fiber types (cereal, fruit, and vegetable) on the risk of coronary heart disease. Three large prospective studies, which were instrumental in setting current intake recommendations, found a strong relationship between cereal fibers and a weak or no relationship between vegetable and fruit fibers<sup>26-28</sup>.

#### **Dietary fibre and blood cholesterol level:**

More recently, a pooled analysis of research confirmed that CVD risk was 10 to 30 percent lower for both men and women for each 10 gram per day increment of total, cereal or fruit fiber<sup>47</sup>. Further investigation has revealed that the viscous fibers, including oat bran (betaglucan), psyllium, pectins, and guar gum, are most effective in reducing blood cholesterol levels. Two of these fibers, beta-glucan (from oats or barley) and psyllium have been sufficiently researched for the FDA to issue an approved health claim for soluble fiber and risk of coronary heart disease<sup>(48,49)</sup>. Furthermore, soluble fiber sources from oats, barley, and pectin-rich fruits and vegetables provide lipid lowering benefits beyond those achieved by reducing intake of saturated fat and total fat alone<sup>50</sup>. The American Heart Association's 2006 Diet and Lifestyle Recommendations emphasize high-fiber foods, especially whole-grain products, legumes, fruits and vegetables, as part of an overall dietary pattern to reduce the risk of heart disease in the general population.<sup>51</sup> An added benefit observed with increasing fiber intake from whole grains, fruits and vegetables is preventing the rise in blood levels of triglycerides, a consequence often associated with a low fat, high carbohydrate diet<sup>52</sup>.

#### **Conclusion:**

In summary, we can say that dietary fibre has been inversely associated with the cardiovascular risk

factors, atherosclerosis, and incident of cardiovascular disease. In light of the above evidences, policymakers, scientists, and clinicians should redouble efforts to incorporate clear messages on the beneficial effects of dietary fibre into public health and clinical practice endeavors.

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