



## A REVIEW OF DIETARY FIBER IN THE DIABETIC DIET

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### Abstract

*Dietary fibers are a type of carbohydrates that are found in plant-based foods. They are not absorbed or digested by the body, but play an important role in maintaining good health. There are two types of dietary fiber – soluble and insoluble. Most foods contain both types, but are usually richer in one type than the other.*

*Current evidence suggests that high-fiber diets, especially of the soluble variety, may offer some improvement in weight management, in carbohydrate metabolism, lower total and LDL cholesterol, and have other positive effects in patients diagnosed with diabetes (improvement of insulin sensitivity, modulation of the secretion of certain gut hormones, improvement of various metabolic and inflammatory markers associated with the metabolic syndrome), thus reducing the risk of cardio-metabolic diseases. The aim of our review is to reinforce the role of dietary fiber in the improvement of diabetes management*

**key words:** *dietary fiber, diabetes, food*

### Introduction

Dietary fibers are defined as polysaccharidic components of vegetables, which cannot be digested in the small intestine (except for a certain limited degradation of pectin). Some of them can be digested in the colon.

A part of the dietary fibers carry on a structural role within the vegetable sources they derive from, at the same time being insoluble in water. They are represented by cellulose, hemicellulose and lignin. They are mostly found in whole grain, bran and wholemeal bread. Another part of dietary fibers have a restorative role for injured segments of plants and are soluble in water. They are represented by pectins, gums, mucilage and certain hemicellulose. They are mostly found in

legumes, lentils, beans and peas, fruits (especially apples and citrus fruits), oats, barleycorn, root crop and green vegetables [1,2].

The first division of dietary fibers normalizes the bowel movements by softening the stool, as well as having a minimal role on blood glucose, insulin and lipid levels.

The second division of dietary fibers forms gels which partially impound nutrients (carbohydrates, lipids, mineral salts) and reduce their absorption rate. At the same time, the soluble fibers extend the gastric emptying time, thus retarding evacuation of the high quantity of carbohydrate supply to the intestinal lumen, for absorption. This way, they generate a reduction in the amplitude of postprandial glycemic response. From this point of view, the most efficient fibers are the ones with high viscosity,

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which, apart from delaying gastric emptying, also limit the diffusion of digested food, extending the digestion of complex carbohydrates [3].

Besides the effects mentioned above, dietary fibers reduce the post-prandial glycemic ascent by several mechanisms: increased insulin sensitivity, the elaboration (by means of colonic fermentation of dietary fibers) of certain agents which reduce gluconeogenesis, the decreased activity of pancreatic amylase and its delayed entrance through the intestinal gel towards carbohydrate sources. Due to these properties, the degree of carbohydrates can increase in the diabetic diet up to 50 – 60 %, without inducing negative disturbances upon the glycemic curve. For the same amount of carbohydrates, the addition of dietary fibers can reduce the level of blood glucose up to 10 – 20 % [4].

By means of their healthy effect upon the metabolic control of diabetes, it is expected that an increase in the proportion of dietary fibers in the diet of these patients could have positive effects. There are studies which point out a higher rate of diabetes amongst populations who consume a diet deficient in dietary fiber [5].

### **Dietary fiber intake recommendations**

It is recommended to use at most 35 – 40 grams of dietary fibers in the diabetic diet because, otherwise, phenomenon of digestive intolerance can occur. In order to avoid dyspeptic disorders such as abdominal pain, flatulence, etc., we begin with a low quantity of dietary fibers, which is subsequently progressively increased.

As a general rule, it is advised to avoid the addition of commercial dietary fibers, and, as much as possible, to resort to vegetable fibers included as part of diet.

Beside the beneficial effect upon the carbohydrate metabolism, the presence of dietary

fibers in amounts of 40 grams per day can decrease total and LDL cholesterol and triglycerides level. The lipid profile tends to normalize, correlated to the decrease of blood glucose level, which favors the reduction of risk regarding diabetic macroangiopathy [4,5].

In order to facilitate the selection of foods rich in vegetable fibers, especially the non cellulose ones (involved the most in the reduction of intestinal absorption of carbohydrates and lipids), we describe in [Table 1](#) the main categories of foods rich in fibers [6].

As general information on increasing the dietary fiber intake, it is recommended eating wholemeal bread instead of white bread, whole grains instead of refined grains, unpeeled fruits with seeds instead of fruit juice, the addition of vegetables, beans and peas, etc. [7].

In order for the intestinal gelling process to optimally unfold, the intake of dietary fibers must be associated to an adequate fluid intake increase. Fluid intake should be administered in amounts dictated by thirst, except for cases of advanced kidney failure not receiving hemodialysis. In the latter situation, fluid restriction is applied considering water balance. Water should not be ingested with meals, because it exaggerates postprandial glucose increase following the rapid evacuation of stomach content.

The intake of large amounts of fibers can delay or reduce the maximum response to carbohydrate intake, thus predisposing patients who receive antidiabetic drugs to hypoglycemia, if the drug dose is not adjusted so as to compensate for this effect [8].

It should be noted that for people at risk of mineral deficiency (postmenopausal women, elderly and children during growth), given the chelator effect of dietary fibers, it is recommended to provide additional intake of calcium, magnesium, phosphorus and trace elements.

**Table 1.** The content of dietary fibers in foods (grams/100 grams of product) (Adapted after [6]).

The name of the product	The total amount of vegetable fibers	Non cellulosic polysaccharides	Cellulose	Lignin
<i>Cereals and derivatives</i>				
white flour	3.15	2.52	0.6	0.03
wholemeal	9.51	6.25	2.46	0.8
bran	44	32.7	8.05	3.23
white bread	2.72	2.01	0.71	traces
wholemeal bread	8.5	5.95	1.31	1.24
cornflakes	11	7.26	2.42	1.32
Swiss breakfast	7.41	5.31	1.36	0.74
rye crackers	11.73	8.33	1.66	1.74
wheat crackers	4.83	3.34	0.94	0.55
oat cake	4	3.16	0.4	0.44
<i>Vegetables</i>				
boiled broccoli	4.1	2.92	0.85	0.03
boiled Brussels sprouts	2.86	1.99	0.8	0.07
boiled cabbage	2.83	1.76	0.69	0.38
boiled cauliflower	1.80	0.67	1.13	traces
lettuce	1.53	0.47	1.06	traces
raw onion	2.1	1.55	0.55	traces
canned beans	7.27	5.67	1.41	0.19
boiled green beans	3.35	1.85	1.29	0.21
frozen peas	7.75	5.48	2.09	0.18
cooked corn	4.74	4.31	0.31	0.12
boiled baby carrots	3.7	2.22	1.48	traces
raw parsnip	4.9	3.77	1.13	traces
raw Turkish turnips	2.2	1.5	0.7	traces
raw potatoes	3.51	2.49	1.02	traces
<i>Fruits</i>				
peeled apples	1.42	0.94	0.48	0.01
apple peel	3.71	2.21	1.01	0.49
bananas	1.75	1.12	0.37	0.26
cherries	1.24	0.92	0.25	0.07
canned grapefruit	0.44	0.34	0.04	0.55
canned oranges and tangerines	0.29	0.22	0.04	0.03
canned mango	1	0.65	0.32	0.03
peaches	2.28	1.46	0.2	0.62
peeled pears	2.44	1.32	0.67	0.45
pear peel	8.59	3.72	2.18	2.67
plums	1.52	0.99	0.23	0.3
strawberries	2.12	0.98	0.33	0.81
raisins	4.4	2.4	0.83	1.17
Brazil nuts	7.73	3.6	2.17	1.96
peanuts	9.3	6.4	1.69	1.21
peanut butter	7.55	5.64	1.91	traces

## Conclusions

Dietary habits are major contributors to diabetes. Dietary fibers represent a heterogeneous category, and there is still much to understand as to which foods should be preferred to maximize the metabolic effects of fibers, including influences on the gut microbiota. A promising

factor contributing to the beneficial effects of insoluble dietary fiber consumption could be increased insulin sensitivity. There are indications that only water-soluble fibers are active on plasma glucose and lipoprotein metabolism in humans. All these factors require further research in future studies.

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