

# N · I TODAY™

Nutritional Immunology Magazine: Volume 4

## DIETARY FIBER / 膳食纖維

It's not your grandmother's roughage any more!  
Current research into dietary fiber is discovering many different kinds of fibers and many different ways in which they interact with the digestive system, particularly the colon, to promote good health.

如今,膳食纖維再也不是您祖母口中的“粗糧”了!  
現代科學在膳食纖維的領域發現了許多不同種類的纖維,同時發現它們對消化系統--尤其是結腸--有著許多不同的影響,而這些纖維的影響可提昇健康水平。

**W**elcome to *NI Today*, which focuses on the science of Nutritional Immunology. This exciting edition concentrates on the benefits of dietary fiber—the scientific basis for how and why the various types of fiber in your diet can help shore up your defenses against disease. The latest scientific discoveries cited will increase your knowledge of the impact of a fiber-rich diet on your overall health. We also spotlight two prominent sources of dietary fiber—oats and apples—in this issue.

Fiber also assists the body with beneficial cleansing effects. Just as our physical environment benefits from a good cleaning, Nutritional Immunology teaches that our biological environment needs to be regularly cleansed of toxins and wastes. If allowed to build up in the body, these toxins and wastes can overpower the immune system and adversely affect the body's ability to defend against illness and heal itself.

Please feel free to share this magazine with others who are interested in improving their health, so that they, too, can become familiar with the benefits of Nutritional Immunology.

**歡**迎您閱讀第四期 *NI Today*，此雜誌專門研討有關營養免疫的科學理念。此期內容精彩，主要闡述膳食纖維的益處，並特別說明您飲食中的各種纖維，為什麼能夠幫助您以及為您提升防禦系統以對抗疾病的基本科學理念。這裡所引用的最新的科學報導，將會增進您的知識，幫助您了解富含纖維的飲食對您整體健康的重大影響。我們在本期還特別向您介紹兩種食品－燕麥和蘋果，它們是纖維極為豐富的來源。

纖維同時還具備協助清理身體內部的功能。就如同我們生活的外部環境需要有良好的清潔一樣，營養免疫學教導我們身體的內部也需要定期清理，以去除毒素和雜質。假如任由這些毒素和雜質囤積於我們的體內，它們將會擊垮我們的免疫系統，對人體防禦抵抗疾病和自我修復的能力造成負面的影響。

請與那些有興趣改善健康的人們分享此刊物，如此，他們也可以對營養免疫學的益處更加有所認知。

# Start *Roughing It!*

開始嘗試食用高纖的飲食吧!

Some simple changes can add more fiber to your diet.

Instead of...  
取代...



**0.7g** fiber<sup>†</sup>  
Iceberg Lettuce  
1 Cup



**1.2g** fiber<sup>†</sup>  
Romaine or Cos Lettuce  
1 Cup



**3.8g** fiber<sup>†</sup>  
Chicken Noodle Soup  
1 Cup



**11.2g** fiber<sup>†</sup>  
Ham and Bean Soup  
1 Cup



**2.3g** fiber<sup>†</sup>  
Baked Potato  
without Skin



**6.9g** fiber<sup>†</sup>  
Baked Potato with Skin



**1.8g** fiber<sup>†</sup>  
Egg noodles, enriched  
1 Cup



**3.7g** fiber<sup>†</sup>  
Spinach Egg noodles,  
enriched 1 Cup



**0.7g** fiber<sup>†</sup>  
Long-grain, White Rice  
1 Cup



**3.5g** fiber<sup>†</sup>  
Long-grain, Brown Rice  
1 Cup



**0g** fiber<sup>†</sup>  
Milk  
1 Cup



**2.0g** fiber<sup>†</sup>  
Chocolate Milk (commercial)  
1 Cup



**0.6g**  
White Bread  
1 Slice



**1.9/1.1g** fiber<sup>†</sup>  
Rye Bread/  
Whole Wheat Bread  
1 Slice



**1.3g** fiber<sup>†</sup>  
Potato Chips  
1 oz



**3.3/2.9/2.7g** fiber<sup>†</sup>  
Almonds/Pistachos/Filberts  
or Pecans, 1 oz



**0.3g** fiber<sup>†</sup>  
Vanilla Shake, fast food  
16 fl oz



**6.3g** fiber<sup>†</sup>  
Chocolate Shake, fast food  
16 fl oz

And if you  
really **MUST**...  
假如您真的必需...

<sup>†</sup>USDA National Nutrient Database for Standard Reference, Release 17, 2002 revision  
[<http://www.nal.usda.gov/fnic/foodcomp/Data/SR17/wtrank/sr17a291.pdf>].

# DIETARY FIBER

## 膳食纖維

In the last twenty years or so, a significant number of studies have been done on the value of dietary fiber; exactly what it is and does for the human body. Fiber, which used to be simply dismissed as that part of the diet the body didn't digest (and therefore was only useful for dealing with such problems as constipation and diarrhea), has taken on whole new aspects. Instead, we now know that several types of dietary fiber exist that all provide a variety of vital functions for healthy living, including appearing to regulate cholesterol and blood glucose levels, help with weight control, and reduce cancer risks.

Roughly speaking—and we do mean “rough”ly—dietary fiber is what your grandmother used to refer to as “roughage,” that part of all plant foods that the human body does not fully digest and that provides the bulk eliminated from the body in the stool. But recent studies have distinguished various kinds of dietary fibers, leaving the single designation “dietary fiber” in a state of flux.

Currently, for the purpose of labeling food products in the United States, dietary fiber is defined as “the material isolated by analytical methods approved by the Association of Official Analytical Chemists (AOAC).”<sup>1</sup> However,

food scientists have developed a variety of low-molecular weight carbohydrates (sugar alcohols such as sorbitol and mannitol, polydextroses, and various fructo- and galactooligosaccharides) that are not digested by human digestive enzymes, but are digested by friendly bacteria in the human digestive tract, and are not measured by the AOAC's methods. Processed foods increasingly use these carbohydrates because people demand satisfaction for their sweet tooth without adding calories to their diet.

The Institute of Medicine at the National Academy of Sciences has proposed a new definition that differentiates between dietary fiber and added fiber. This definition describes dietary fiber as nondigestible carbohydrates and lignin that are intrinsic and intact in plants, and added fiber as isolated nondigestible carbohydrates added to foods during food processing that have proven beneficial physiological effects in humans.<sup>2</sup> The Institute of Medicine would define total fiber as the sum of dietary fiber and added fiber.

By changing the definition of dietary fiber, these groups want to recognize the physiological actions of fiber and its effects on health, and reduce the emphasis on simply quantifying total dietary fiber. They hope to reinforce the idea that more than one kind of dietary fiber exists, and that adequate human nutrition requires fiber from a variety

<sup>1</sup> Marlett, Judith A., and others. 2002. “Health implications of dietary fiber” *Journal of the American Dietetic Association* 102:993-1000.

<sup>2</sup> “Dietary Reference Intakes: Proposed Definition of Dietary Fiber,” Institute of Medicine, 2001.

近二十年來，極多的科學研究針對膳食纖維的價值進行了探討，考證它究竟為何物，以及它對人體有何作用。

纖維，曾經一直被認為是飲食中所不能被人體吸收的那一部分，而被輕易地忽略了(因此它僅限於對處理便秘和腹瀉這類問題有所助益)，現在人們對它卻具有了一個全新的觀點。取而代之，我們現在已知許多種膳食纖維對健康養生能夠產生多種關鍵性的作用，包括調解膽固醇和血糖水平，協助控制體重，以及降低罹患癌症的風險等功能。

大略地說一就“粗淺”地來說一膳食纖維就是我們祖母那一代人通常所稱的「粗糧」，那一部分的植物性食品，因不能夠被人體完全消化，那些粗糙物就隨人體的排泄物排掉。但是，最近的研究已將飲食中的纖維分出多種類別，如今已演變為現在所統稱的「膳食纖維」。

目前，美國出於要對食品進行標籤的規定，膳食纖維被定義為「按國際分析化學家協會(AOAC)批准的分析法分離而出的材料」<sup>1</sup>。然而，食品科學家發現了很多種低分子量碳水化合物(有醣醇-比如山梨醣醇和甘露醣醇，聚葡萄糖，還有多種果糖以及寡乳糖)，均不能被人體的消化酶所消化分解，但卻能夠被人體消化道中的有益細菌所消化分解，然而它們卻不經由AOAC的方法檢定。為了迎合人們對甜味的滿足感，同時又不增加他們飲食中的卡路里，加工食品因此就愈來愈多地使用上述這類的碳水化合物。

美國國家科學學會醫療協會，曾經提出過另一個鑒別膳食纖維和添加性纖維的新定義。據此定義描述，膳食纖維是植物本身固有的、完整的、不可被人體消化的木質素和碳水化合物；而添加性纖維則是在食品加工過程中，添加進食品內的被證實對人體具有良好的生理效應的分離性的、不可被人體消化的碳水化合物。<sup>2</sup>該醫療協會將膳食纖維和添加性纖維歸納在一起包含於纖維總的定義中。

經由對膳食纖維的定義的修改，這些組織進一步想要識別纖維在生理學上的作用和它對健康的效應，而減低僅對總膳食纖維數量的偏重。他們希望能夠強調食用多種膳食纖維的觀念，並闡明，人體所需的適當營養，每





of plant sources each day, not just a single fiber supplement that matches the required number of fiber grams recommended.

## FIBER RECOMMENDATIONS

Today, the Food and Nutrition Board of the National Academy of Sciences recommends that adults consume from 20 to 35 grams of fiber per day. Some health professionals recommend that dietary fiber intake should be based on energy intake—10 to 13 grams of dietary fiber per 1,000 calories consumed. American nutrition facts on food labels use 25 grams of dietary fiber per day for a 2,000 calorie-per-day diet or 30 grams per day for a 2,500 calorie-per-day diet.

In much of the industrialized world, however, people do not get as much fiber as recommended. In the United States, for instance, the average adult gets only 14 to 15 grams of fiber per day, even though 73% of these people say their fiber intake is “about right.”<sup>3</sup>

This could be due to consumption of too many processed foods. While many foods contain more than five grams of fiber in their whole,

unprocessed form, most or all of this fiber is often lost when processed. For example, the process used to produce most bread flours in the United States retains only 60% of the original wheat grain in the flour. The remaining 40%, which includes the bran and the germ, is discarded. The bran and the germ, however, contain virtually all of wheat’s fiber. As a result, 60% extraction wheat flour (white flour) contains almost no fiber, while whole wheat flours contain an ample amount. Other examples can include fruit juices and vegetable juices which may start out high in fiber in their whole, unprocessed state but end up with virtually no fiber after processing.

## TOO MUCH OF A GOOD THING

While an adequate amount of fiber is a dietary necessity, excessive amounts of fiber—generally more than 50 grams daily—can promote constipation, diarrhea, or spastic bowel disorder, especially if you don’t drink enough water. Providing your body with enough water is essential because fiber attracts and absorbs water as it progresses through the digestive tract.

Although fiber can bind minerals and prevent their absorption by the body, this property does not appear to interfere with mineral balances because most sources of fiber provide enough minerals to compensate for any binding that occurs. In addition, beneficial bacteria in the digestive tract feed on some types of fiber, aiding the release of necessary minerals, such as calcium, which can be absorbed in the colon.

Increasing your fiber intake too quickly may cause gastrointestinal problems, such as cramps, bloating, and flatulence, because your body is not used to handling that much fiber. To reduce the amount of GI distress, increase fiber intake slowly, and be sure to increase your fluids as well, since fiber absorbs large amounts of water. Your body will adjust to the increase in fiber, and the GI problems will subside as you continue to eat the fiber you need.

<sup>3</sup> Marlett, Judith A., and others. 2002. “Health implications of dietary fiber,” *Journal of the American Dietetic Association* 102:993-1000.

日必須包含有來自多種多樣植物的纖維成分，而不是僅靠攝取單一種的纖維補充，去滿足所建議的纖維量。

## 膳食纖維的建議攝取量

目前，美國國家科學院食品與營養委員會建議，成年人每日攝取膳食纖維的份量應在20至35克之間。有些健康專業人士建議，膳食纖維的攝取量應以熱量攝取為基礎—每攝入1000卡的熱量，就應攝取10至13克的膳食纖維。美國在食品營養標籤上標示，每日飲食2000卡的熱量以每日攝取25克的膳食纖維為準，或每日飲食2500卡的熱量則以每日攝取30克的膳食纖維為準。

然而在大多數的工業化國家，人們一般都未能攝入所建議的纖維量。例如在美國，成年人每日平均攝入的纖維量僅為14至15克，儘管如此，竟有73%的人說他們攝取的纖維量“大約足夠”。<sup>3</sup>

這種情形可能是由於人們食用過多的加工食品所造成的。雖然很多食品在完整的、未經加工的狀態下含有5克以上的纖維，但是其

大部或全部的纖維通常在食品加工的過程中就失去了。比如，美國大部分製造麵粉的過程，僅能保存原麥粒中60%的成份，剩餘的40%包含麥麩和麥芽的成份則被去除，而麥麩和麥芽幾乎就包含了小麥中全部的纖維成份。結果顯示，60%精製麵粉(白麵粉)幾乎不含任何纖維，而全麥麵粉卻富含大量的纖維。另一個例證是水果和蔬菜的汁液，在完整的、未經加工的狀態下，水果和蔬菜可能都含有很高量的纖維，但是在加工之後則幾乎不含有任何的纖維了。

## 適量攝取最為上策

適量的纖維是飲食中所必需的，而過量攝取纖維—通常指每日超過50克的攝取量—則會造成便秘，腹瀉或者痙攣性的排便失調的情形，尤其是在飲水不足的情況下更為嚴重。為您的身體提供充足的水份是非常必要的，因為纖維在通過消化道的過程中會汲取和吸收水份。

儘管纖維會黏結礦物質並防止其被身體所吸收，但這一特性並不會導致人體礦物質的失





## TYPES OF FIBER

Dietary fiber can be separated into two basic types: soluble and insoluble. Soluble fibers, which include gums, pectins, and mucilages, dissolve and thicken in water to form a gel. Because it slows the passage of food through the digestive system making you feel full longer, this type of fiber may help with weight loss. Research also indicates that this type of fiber may help lower blood cholesterol and regulate blood glucose levels by affecting the rate at which nutrients are absorbed. Good sources of soluble fiber include dried beans and legumes, psyllium, oats, barley, citrus fruits, apples and bananas.

Insoluble fibers include cellulose, hemicellulose, and lignin, which are found in the woody or structural parts of plants, such as fruit and vegetable skins, wheat bran, and whole grains. This type of fiber tends to speed up the passage of material through the digestive tract and may reduce the risk of colon cancer, as well as diverticular disease. Good sources of insoluble fiber include apples, pears, bananas and whole grains.

Polysaccharides are also fibers. They contain many glucose units combined into a long complex of several hundred to several thousand sugar

(glucose) molecules. Most natural carbohydrates occur as polysaccharides, such as starches, glycogen and cellulose—the complex carbohydrates. The polysaccharides found in mushrooms, in particular, have been reported by scientists to lower blood pressure, cholesterol, and blood sugar concentrations, and have shown anti-tumor activity.

Both types of fiber—soluble and insoluble—are beneficial to the body. Nature usually provides whole plant foods complete with both types of fiber, which is why you will see apples, bananas, several of the whole grains and other foods listed as good sources of both soluble and insoluble fibers. The body needs a healthy balance of both. Each provides a different set of benefits for continued health.

## HOW FIBER WORKS

Scientists want to know exactly how dietary fiber is used by the body to maintain health. Their research so far has indicated two aspects of fiber that appear to have significant impact on health: viscosity<sup>4</sup> and fermentation.

### VISCOSITY

Viscosity refers to soluble fiber and the gel it forms when dissolved in water. Different types of soluble fibers have different degrees of viscosity, and there appears to be some correlation between the degree of viscosity and the benefit derived from the fiber—the more viscous the fiber, the more benefit to the body.

<sup>4</sup> The condition or property of having a relatively high resistance to flow. The American Heritage® Dictionary of the English Language: Fourth Edition. 2000.

衡，因為絕大多數的含纖維食品，一般都能提供足夠的礦物質，以彌補任何由於黏結而遺失的礦物質。此外，消化道中的有益細菌以某些纖維為食物，能夠幫助釋放出一些人體所需的礦物質，比如，鈣成分即被釋放並被結腸所吸收。

過快地增加您纖維的攝取量可能會引起腸胃問題，比如腹部痙攣，飽脹和脹氣，這是因為您的身體尚未適應存留那麼多的纖維。為了減輕腸胃的負擔，請緩慢地增加纖維的攝取量，同時因為纖維會吸收大量的水份，您也要確保增加您液體食品的攝取量。您的身體將隨著纖維量的增加而漸漸調適，而您的腸胃不適問題也將隨著您持續攝取所需的纖維而逐漸緩解。

## 纖維的種類

膳食纖維可被分為基本的兩類：可溶性纖維和不可溶性纖維。可溶性纖維包括樹膠、果膠、和黏液，它們可溶解和稠化於水中而呈膠糊狀。由於它可以減緩食物通過消化道的速度，讓您得以保持較長時間的飽脹感，所以這種纖維有助於減輕體重。科學研究也指出，通過影響其吸收營養的速度，這種纖維有助降低膽固醇及調解血糖水平。可溶性纖維豐富的來源包括乾豆類及豆類、洋車前子、燕麥、大麥、柑桔類，蘋果和香蕉。

不可溶性纖維包括纖維素、半纖維素、和木質素，可在木本植物或植物的某些部位中找到，比如水果和蔬菜的外皮、麥麩和全麥。此類纖維會加快食物在消化道中的行進速度，降低罹患結腸癌以及大腸憩室症的風險。不可溶性纖維豐富的來源包括有蘋果、梨、香蕉、和全麥。

多糖體也是纖維，它們含有許多葡萄糖體，由幾百至幾千個長鏈複合醣分子結合而成。

大多天然碳水化合物以多糖體的形式存在，比如澱粉、肝糖和纖維素等複合碳水化合物。科學家報告指出，存在於菇類中的多糖體，尤其可以降低血壓、膽固醇和血糖濃度，並顯示出具有抗腫瘤的活動力。

無論是可溶性還是不可溶性纖維，二者都對身體有益。自然界一般提供的均為完整性植物食品，兩種纖維兼備，這就是為什麼您會見到蘋果、香蕉、以及一些全穀類和其它一些食物，同時被歸為可溶性纖維和不可溶性纖維二者的最佳來源，人體需要取得二者的均衡來維持健康。每一種纖維都為持久的健康帶來不同的效益。

## 纖維的功能

科學家想要準確地了解人體是如何運用纖維以維持健康的。迄今為止，他們的研究指出纖維特別在兩個方面對健康有著重要的影響：黏結作用<sup>4</sup>和發酵作用。



A daily intake of more than three grams of soluble fiber, along with a total fiber intake of more than 25 grams, appears to result in

- Reduction in blood cholesterol levels;
- Stimulation of appetite regulating hormones for an increased feeling of fullness;
- Stabilization of blood sugar and insulin levels; and
- Protection against gastrointestinal diseases such as diverticulitis.

### FERMENTATION

Insoluble fibers, like cellulose, hemicellulose, and lignins, combine with soluble fibers like pectin to make up plant cell walls. These compounds do not break down easily; otherwise, the plants would not be able to survive.

Animals need simple sugars for energy, but they cannot break the complex plant fiber compounds into simple sugars. However, microbes living in their digestive tracts can. The digestive systems of ruminants, like cattle, sheep and goats, act like fermentation vats where microbes break down complex plant fibers into simple sugars

and fatty acids, which the animal absorbs and uses for energy. Human digestive systems aren't that good; however, with our own healthy intestinal microbes, we can use the fiber from whole grains, fruits, and vegetables to provide important health benefits.

While intestinal microbes may ferment both soluble and insoluble fiber, soluble fiber usually has a higher rate of fermentation. These microorganisms also metabolize potentially carcinogenic nitrogenous wastes in the fermentation process that otherwise would accumulate in the colon. Fermentation produces propionate, butyrate, and acetate, which are absorbed by cells in the colon. The body uses butyrate as a fuel source for colon cells, while propionate is transported to skeletal muscles, and acetate is transported to the liver where it helps inhibit the synthesis of cholesterol.

Dietary fibers also bind bile acids, which ferment in the colon to short-chain fatty acids. Cells in the colon absorb these fatty acids, which help in the absorption of sodium and water and improve the body's fluid balance. These fatty acids also lower colonic pH and inhibit the conversion of primary bile acids to secondary bile acids, which are thought to be carcinogenic.



## 黏結作用

所謂黏結作用即是可溶性纖維溶入水中時，凝結形成膠質而顯現出的特性。不同種類的可溶性纖維具有不同的黏結度，而研究顯示纖維的黏結度和纖維所帶來的效益具有某種相關性—那即是，更具有黏性的纖維對人體更有效益。

每日攝取3克以上的可溶性纖維，同時其總纖維攝取量達25克以上，即可顯示出以下的效果：

- 降低血膽固醇水平；
- 刺激調整食慾的荷爾蒙，以增加飽脹感；
- 穩定血糖和胰島素水平；
- 避免如憩室炎這類腸胃疾病的形成。

## 發酵作用

不可溶性纖維，如纖維素、半纖維素、和木質素，與可溶性纖維如果膠，結合形成植物的細胞壁。這些複合體不易被分解，否則，植物本身就無法生存。

動物需要攝入單糖以產生能量，但是，它們卻無法分解植物纖維複合體使之轉變為單糖，然而寄生於動物消化道中的微生物卻可以做到。如牛、綿羊、山羊這些反芻類動物的消化系統，其功能如同一個發酵的容器，微生物在其內部分解複合的植物纖維成為單糖和脂肪酸，使動物能夠吸收並用以製造能量。人類的消化系統功能雖然不如此類反芻動物，但是，藉由人體所擁有的健康的腸內微生物，我們可以利用全穀物、水果、和蔬菜中的纖維，為自身提供有利健康的重要效益。

腸內微生物或許可以促成可溶性纖維和不可溶性纖維的發酵，可溶性纖維的發酵速度一



般比較快。在發酵的過程中，這些微生物也會代謝掉潛在的致癌性含氮雜質，否則，這些雜質就會囤積在結腸中，危害人體的健康。發酵會產生丙酸、丁酸、和醋酸，這些都會被結腸內的細胞所吸收。我們的身體使用丁酸作為結腸細胞的養份來源，而丙酸被運送到骨骼肌，醋酸則被傳送到肝臟，幫助抑制膽固醇的合成。

膳食纖維也可凝結膽汁酸，這是在結腸內發酵形成的短鏈脂肪酸。細胞在結腸內吸收這些脂肪酸，以協助吸收鹽分和水分，促進體液的平衡。這些脂肪酸還會降低結腸的酸鹼度(PH值)，並抑制主要膽汁酸轉化成次要膽汁酸—次要膽汁酸被認為是一種致癌性物質。

## 纖維的益處

美國食品及藥物管理局認為，僅含少量飽和脂肪及膽固醇，而富含大量纖維的水果、蔬菜、與穀物的飲食，特別是含可溶性纖維的飲食，會降低罹患冠心病的風險。此外，最

## BENEFITS OF FIBER

The United States Food and Drug Administration believes that a diet low in saturated fat and cholesterol and high in fruits, vegetables, and grain products containing fiber, particularly soluble fiber, reduces the risk of coronary heart disease. In addition, recent research shows a possible correlation between dietary fiber intake and colorectal cancers and diabetes.

However, studies also suggest that whole foods offer more protection against chronic diseases than dietary fiber, antioxidants, or other biologically active components alone. Associations between

dietary fiber and disease may actually reflect a synergy between dietary fiber and other substances in the whole foods, which suggests that adding purified dietary fiber may be less beneficial than changing your diet to include whole foods. A varied diet of whole foods takes advantage of this possible synergy to improve overall health.

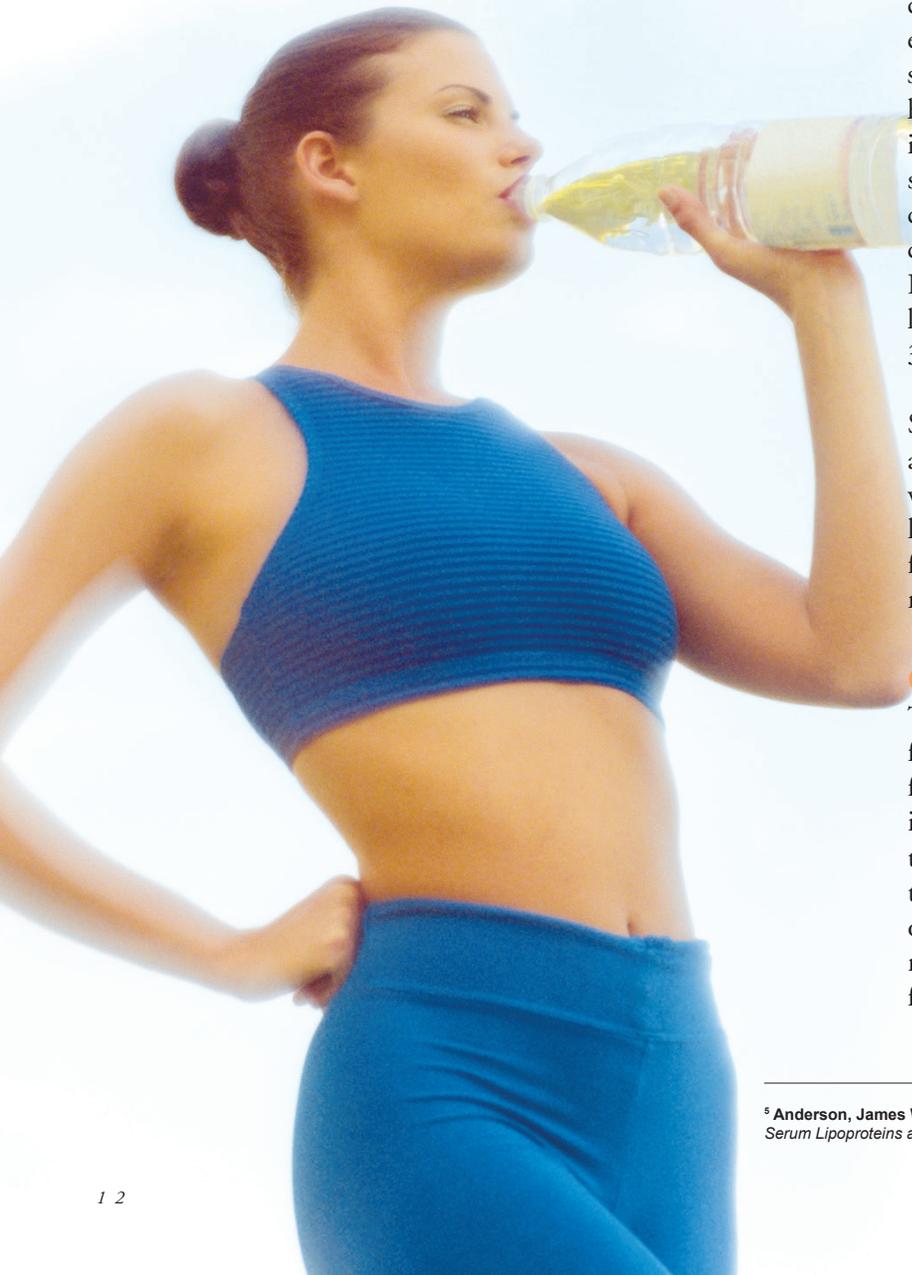
## THE CARDIOVASCULAR SYSTEM

Studies seem to indicate that dietary fiber's primary benefit to the cardiovascular system is its ability to decrease serum cholesterol and LDL cholesterol concentrations. Fibers with the greatest effects on blood cholesterol are highly viscous, soluble fibers, such as oats and buckwheat. Oats have been associated with a lower body mass index (BMI), lower blood pressure, and lower serum cholesterol. Lower serum cholesterol, LDL cholesterol, and a higher ratio of HDL to total cholesterol have been associated with buckwheat. Psyllium has shown the largest cholesterol-lowering effect, decreasing serum cholesterol by 32% and liver cholesterol by 52% in one study.<sup>5</sup>

Secondary benefits may come from the lower fat and simple sugar contents of fiber-rich foods, which help alleviate obesity and high triglyceride levels in the blood. In addition, antioxidants found in the bran and germ of some cereal grains may also have health benefits.

## CANCERS

The current belief is that dietary fiber and dietary fat are the most significantly associated dietary factors in colorectal cancer. However, since the initial studies in the 1990s that seemed to show this correlation, further research has led many to question the protective effect of dietary fiber on colorectal cancer. The protective effects may not be based solely on the balance of fiber and fat in the overall diet, but also on the interaction



<sup>5</sup> Anderson, James W., and Tammy J. Hanna. 1999. "Impact of Nondigestible Carbohydrates on Serum Lipoproteins and Risk for Cardiovascular Disease," *Journal of Nutrition*. 129:1457S-1466S.

近的研究顯示，膳食纖維的攝取與結腸直腸癌和糖尿病之間可能有所關聯。

無論如何，科學研究還建議，與單一的膳食纖維、抗氧化劑、或其他的生物活化成分相比，完整性食物能夠提供我們更強的防禦能力，能更有效地抵抗慢性病。膳食纖維和疾病之間的關係，或許正反映了膳食纖維和完整性食物中的其它物質具有“協同作用”的結果，此結果向我們建議，僅增加攝入提取的膳食纖維，不如改變一個人的飲食為食用完整性食物對人體的健康更有益。多樣化的完整性食物，更益於相互協同的作用，能夠改善您整體的健康狀況。

### 心血管系統

科學研究似乎指出，膳食纖維帶給心血管系統的主要益處，在於它能夠降低血膽固醇(serum cholesterol)和低密度脂蛋白膽固醇(LDL cholesterol)的濃度。對血膽固醇影響最大的纖維是高黏度的可溶性纖維，比如燕麥和蕎麥。燕麥與降低體重指數(BMI)、降低血壓、和降低血膽固醇之間有所關聯。而蕎麥則與降低血膽固醇、低密度脂蛋白膽固醇，和高密度脂蛋白與總膽固醇的比例較高有所關聯。在一項科學研究中，洋車前子更顯示出對降低膽固醇最具效用，可降低血膽固醇達32%，降低肝膽固醇達52%。<sup>5</sup>膳食纖維的

另一益處，或許來自富含纖維的食品中所含的低脂和單糖，這二種成分皆有助於控制肥胖和降低血液中的三酸甘油脂。此外，在一些雜糧穀物中所含的麥麩和麥芽也含有抗氧化劑，對健康也有益處。

### 癌症

現在一般認為：膳食纖維和膳食脂肪是與直腸癌最具相關性的飲食因素。無論如何，自1990年代最早的研究報告至今，幾乎所有的研究都指出它們之間具有此相關性，而更深入的研究更引起許多人對膳食纖維在直腸癌的防禦作用上提出問。這種防禦作用或許不僅只取決於全面飲食中的膳食纖維與脂肪的平衡，也取決於特定的飲食成分之間的相互作用，比如纖維的種類、相關的養分、和其他食物之間的相互作用。

在最近的研究中，有73%的案例顯示，由於膳食纖維的總攝取量提高，而使得直腸癌的發病率降低了。將膳食纖維的總攝取量再加以細分，77%的研究中發現，水果纖維具有防禦作用，在66%的研究中顯示蔬菜纖維具有防禦效益，而36%的研究中指出穀類纖維也具有同樣的防禦功能。因此，這些研究幾乎就顯示出，增加水果纖維、蔬菜纖維和膳食纖維的總攝取量，就會防禦直腸癌的生成。

of specific dietary components, such as the type of fiber, associated nutrients, and other food interactions.

In 73% of recent studies, as total dietary fiber intake increased, the incidence of colorectal cancers decreased. When the total dietary fiber intake was broken down, fruit fiber was found to be protective in 77% of the studies, vegetable fiber in 66% of the studies, and grain fiber in 36% of the studies. Therefore, these studies seem to indicate that increasing fruit fiber, vegetable fiber, and total dietary fiber appears to protect against the development of colorectal cancers.

Fruit, vegetable, and grain fibers probably work together with other substances in fruits and vegetables to affect such things as bacterial flora, bile acid composition, pH, and fecal bulk to help protect against cancer.

### DIABETES MELLITUS

The mechanisms by which fiber may affect insulin requirements or insulin sensitivity are not clear, but dietary fiber, particularly grain fiber, appears to decrease the risk for developing type II diabetes. In particular, eating fiber with a higher degree of fermentability—such as the soluble fiber in oats—may reduce gastric emptying rates, promote glucose uptake, enhance insulin-dependent glucose disposal, inhibit the body's secretion of glucagons<sup>6</sup>, and reduce the liver's output of glucose in both animals and humans.

Considerable experimental evidence indicates that soluble fibers slow gastric emptying rates, digestion and the absorption of glucose to help immediate glucose metabolism after eating, and long-term glucose control for those with diabetes. In studies, eating high amounts of dietary fiber per day for 24 weeks significantly improved glycemic control and reduced the number of times people with type I diabetes experienced low blood sugar. Among pregnant women with type I diabetes, a higher fiber intake lowered daily insulin requirements. Other studies with type II diabetics also suggest that high fiber intake diminishes the demand for insulin.

Multiple effects of fiber on the digestive tract may reduce the amount of external insulin required by individuals with either type I or type II diabetes when consuming a high fiber diet.



<sup>6</sup> A hormone produced by the pancreas that stimulates an increase in blood sugar levels, thus opposing the action of insulin. The American Heritage® Dictionary of the English Language: Fourth Edition, 2000.

水果纖維、蔬菜纖維和穀類纖維或許需要與其它在水果蔬菜中的物質共同協調，以影響細菌叢、膽汁酸成分、酸鹼值(pH)、和排泄物，以幫助防禦癌症的產生。

### 糖尿病

雖然纖維是否會對胰島素的需求量或胰島素的敏感度產生作用我們尚不清楚，但是，膳食纖維，尤其是穀物中的膳食纖維，卻顯示出能夠降低二型糖尿病形成之風險的特性。

特別是食用發酵程度較高的纖維—如燕麥中的可溶性纖維—可以減輕胃部的飢餓程度，增進葡萄糖的攝取，加強胰島素依賴型的葡萄糖的轉換，抑制人體高血糖素(glucagons)的分泌，並降低人類或動物肝臟所輸出的葡萄糖。

大量的實驗證據指出，可溶性纖維可減緩胃部飢餓感；在進食後，可減緩葡萄糖的消化和吸收，隨即協助葡萄糖的新陳代謝作用，以及幫助糖尿病患者長期地控制血糖水平。研究報告顯示，持續24個星期每日大量食用

Dietary Fiber		Example Sources*	Benefits
Insoluble Fibers	Cellulose	apples, beets, Brazil nuts, broccoli, carrots, celery, green beans, lima beans, pears, peas and whole grains	<ul style="list-style-type: none"> <li>Adds bulk to stool to reduce constipation</li> </ul>
	Hemicellulose	apples, bananas, beans, beets, cabbage, corn, green leafy vegetables, pears, peppers and whole grain cereals	<ul style="list-style-type: none"> <li>May help control blood sugar</li> <li>Helps weight loss by displacing calories</li> </ul>
	Lignins	Brazil nuts, carrots, green beans, peaches, peas, potatoes, strawberries, bananas, tomatoes and whole grains	<ul style="list-style-type: none"> <li>Enhance transit time through the colon</li> </ul>
Soluble Fibers	Gums	guar gum, psyllium, oatmeal, oat bran, sesame seeds, dried beans and glucomannan (derived from amorphophallis konjak tubers)	<ul style="list-style-type: none"> <li>Adds bulk to stool to reduce constipation</li> <li>May lower blood cholesterol;</li> </ul>
	Pectin	apples, bananas, beets, cabbage, carrots, citrus fruits, dried peas and okra	<ul style="list-style-type: none"> <li>Helps control blood sugar;</li> <li>Helps weight loss by displacing calories</li> </ul>
	Mucilage	oatmeal, oat bran, sesame seeds, dried beans, slippery elm, and glucomannan (derived from amorphophallis konjak tubers)	<ul style="list-style-type: none"> <li>Important for the mucous lining of the gastrointestinal track</li> </ul>

\*Natural plant foods may contain both soluble and insoluble fibers of all types. Those shown here may have a higher percentage of the particular type of fiber under which they are listed; however, you will note that several, such as oats, apples, bananas, and beans, are shown in several categories as sources.

\*天然植物食物也許同時含有各種可溶性和不可溶性纖維。以上列舉的是特定種類纖維含量百分比比較高的食品。然而，您會注意到，以上所示的某些食品，如燕麥、蘋果、香蕉、和豆類，常含有多種營養成份。

## TAKING FIBER OUT OF FOOD

Two basic problems exist with taking fiber out of food. In the first place, overly-refined foods remove most of the fiber before the food is eaten. White flour is a good example. As we have mentioned, bread made from white flour contains significantly less fiber than bread made from whole wheat flour, which includes the germ and bran—the highest concentrations of fiber in grains. So, even though you may be eating grain products, you may not be getting the fiber you think you are.

The second problem with taking fiber out of food comes from isolating fiber in order to create fiber supplements. Although fiber-rich foods seem to offer significant protection from a variety of diseases, these effects may be minimized when purified fibers are used. For example, studies show that guar gum, a dietary fiber obtained from the Indian cluster bean, has significant cholesterol-lowering effects, but that hydrolyzed<sup>7</sup> guar gum lacks these effects.<sup>8</sup> This seems to indicate that extracting fibers for use as supplements may alter their effectiveness.

Therefore, to get the most nutritional benefit from your food, choose less refined food products that contain more of the nutritional elements the body needs, including fiber. Many nutrients in foods are only available to the body through the actions of fiber in the system. When fiber is processed out of the food, the body often cannot effectively use the nutrients that remain or have been added.

Obviously, science has more to learn about the interactions of dietary fiber, other nutrients, digestive processes, and disease pathology. What is evident, however, is that a diet rich in a variety of whole foods provides the necessary vitamins, minerals, phytonutrients and fiber the body needs for optimal health and wellness.

<sup>7</sup> Hydrolysis: a chemical reaction in which water reacts with a compound to produce other compounds; involves the splitting of a bond and the addition of the hydrogen positively-charged ion and the hydroxide negatively-charged ion from the water.

<sup>8</sup> Anderson, James W., and Tammy J. Hanna. 1999. "Impact of Nondigestible Carbohydrates on Serum Lipoproteins and Risk for Cardiovascular Disease," *Journal of Nutrition*. 129:1457S-1466S.



膳食纖維，可以明顯地改進血糖值的控制，並減少一型糖尿病患者出現低血糖症狀的次數。在患有一型糖尿病的懷孕女性中，較高的纖維攝取量使她們降低了每日對胰島素的需求量。另外一些有關二型糖尿病的研究也建議，應大量攝取纖維以降低身體對胰島素的需求。

不論是一型糖尿病還是二型糖尿病的患者，當其食用大量的纖維時，纖維對消化道的多方面影響都會降低從外部補充的胰島素的需求量。

### 從食物中提取纖維

從食物中提取纖維存有兩個基本的問題。第一，過於精製的食品在被食用之前就已被去除了大部分的纖維。白麵粉就是一個很好的例證，正如我們之前所談到的，白麵包的纖維含量明顯地少於全麥麵包，因為全麥含有麥麩和麥芽-穀物中最富含纖維的部份。所以，即使您也許食用穀物食品，您也不一定真正攝取到您以為已得到的纖維量。

從食物中提取纖維的第二個問題，是為了製造纖維補充品而分離纖維。雖然富含纖維的

食品似乎對於預防多種疾病產生了顯著的影響，但當它們是使用提取出的纖維時，這些效益可能就被減到最低程度。比如，研究顯示，瓜爾豆膠—一種從印度瓜爾豆中獲取的膳食纖維，具有降低膽固醇的顯著效果，但是，經過水解<sup>7</sup>的瓜爾豆膠就缺少這些效果<sup>8</sup>。這幾乎就說明了使用提取出的纖維而製成的補充品，它們的效果已經變質了。

因此，要從您所攝取的食物中獲取最高的營養效益，就應選擇少含提取出的精製品而多含身體所需之營養元素的食物，其中包括纖維。食物中的許多營養素只能藉由人體系統中纖維的作用才能提供給身體。當纖維經加工從食物中提出後，身體通常不能有效地利用其它所剩餘的或添加的養分。

顯然，科學有待於進一步研究膳食纖維、其它營養素、消化過程、和疾病病理之間的相互作用。但是顯而易見的是，那種富含多種完整性食物的飲食，即可為身體達到理想的健康狀態提供所必需的維生素、礦物質、植物性營養素、和纖維。

## AN APPLE A DAY

When it comes to apples, fresh is better, say two Cornell University food researchers who have added scientific weight to that old saying: An apple a day keeps the doctor away.

Writing in the journal *Nature*, Rui Hai Liu and Chang Yong “Cy” Lee report that trace chemicals in apples help protect against cancer. Liu, an

assistant professor of food science, used extracts from 25 varieties of apples to suppress liver and colon cancer cells in laboratory tissue samples. An extract from apple skins, the most nutritionally dense part of the fruit, inhibited colon cancer cells by 43 percent and liver cancer cells by 57 percent. Fuji, Spartan and Red Delicious performed better than other varieties in these tests.

Lee said Americans should eat about five times as many apples as the 19.7 pounds a year they now consume—which comes out to.... You guessed it! An apple a day!

The Cornell researchers found that just one average apple (about 150 grams or 5 ounces) has more antioxidant activity than 1,500 milligrams of Vitamin C. Antioxidants neutralize, the tissue-damaging molecules that may contribute to cancer.

### FIVE REASONS TO EAT AN APPLE A DAY:

- **Diet** - Apples taste great, boost energy, and are fat free—and designed for portability.
- **Heart** - The antioxidants found in apples help fight the damaging effects of LDL cholesterol.
- **Digestion** - Just one apple provides as much dietary fiber as a serving of cereal—or about one-eighth of the recommended daily intake of fiber!
- **Lungs** - An apple a day strengthens lung function and may lower the incidence of lung cancer.
- **Bones** - Apples contain boron, an essential trace element that has been shown to strengthen bones—a good defense against osteoporosis.



## 每日一個蘋果

當我們談到蘋果的時候，新鮮的當然最好。常言說得好：“一日一蘋果，醫生遠離我”，兩位來自康奈爾大學的食品科研人員，為這一俗語更增添了科學上的佐證。

Rui Hai Liu和 Chang Yong "Cy" Lee 在「自然」雜誌上發表的報告指出，蘋果中微量的化學物質可幫助抵禦癌症。身為食品科學助理教授，Liu從實驗室的組織樣本中，利用從25種蘋果中提取出的物質來抑制肝和結腸的癌細胞。蘋果皮是蘋果營養最密集的部份，它的提取物可抑制43%的結腸癌細胞，可抑制57%的肝癌細胞。在這些實驗中，富士(Fuji)、斯巴達(Spartan)、和紅美味(Red Delicious)蘋果的效果好於其它種類的蘋果。

而研究人員Lee說，美國人需要食取的蘋果量，應該是目前每年食用蘋果量19.7磅的五倍—那就相當於，每日一個蘋果！

康奈爾大學的這二位科研人員發現，一個中等大小的蘋果(大約150克或5盎司重)，其抗氧化能力還要勝過1500毫克的維生素C。氧化物質乃是損害細胞組織的分子，可以引發癌症，而蘋果中的抗氧化劑卻能吸收並中和這些氧化物質。

### 每日食用一個蘋果的五大理由：

- 飲食 - 蘋果又好吃，又不含脂肪，並可增強體力，又十分便於攜帶。
- 心臟 - 蘋果中所含的抗氧化劑可幫助防禦低密度脂蛋白(LDL)膽固醇造成的損害。
- 消化功能 - 僅一個蘋果就可提供相當於一份穀物食品的食用量中所含的纖維 - 或相當於每日纖維建議攝取量的五分之一。
- 肺臟 - 每日一個蘋果可強化肺部功能，並降低肺癌的發病率。
- 骨骼 - 蘋果含有人體必需的微量元素 - 硼，而硼具有強化骨骼的能力，可以抵抗骨質疏鬆症。



## OATS—A GREAT NUTRITIONAL VALUE!

If you're looking for a food with great nutritional impact, you can't beat oats. A prime source of complex carbohydrates for sustained energy, they also contain about 50% more protein than bulgur and twice as much as brown rice; impressive levels of selenium, thiamin, phosphorus, manganese, magnesium and iron; and respectable quantities of calcium, copper, folic acid, vitamin E, and zinc. Plus, of all the cereal grains and pseudo-grains, only buckwheat, barley and common millet contain more antioxidants than oats.

But it is the high soluble fiber content of oats that has captured the attention of many nutritionists in recent years. A cup of cooked oatmeal provides 4 grams of fiber—16% of the total amount of fiber recommended each day. About half of that is soluble fiber, which has been shown to help lower blood cholesterol levels. Bolstering the claims to lower cholesterol, oats also contain tocotrienols, light yellow, fat-soluble, viscous oils in the vitamin E family. Tocotrienols inhibit cholesterol synthesis and have been found to lower serum cholesterol.



Oats also contain more unsaturated fatty acids than other grains, especially the essential fatty acid linoleic acid. The body uses linoleic acid to make prostaglandins, hormone-like chemicals with a wide range of effects, such as regulating inflammation, stimulating uterine contractions during labor and protecting the lining of the stomach. To make it even better, these fatty acids are distributed throughout the oat grain, not concentrated in the germ, as in other grains.

Processing removes the hulls from oats, leaving oat groats, which are then milled into steel-cut oats, rolled flakes, quick and instant flakes, oat flour, and oat bran. Only about 10% of the breakfast cereal market is hot cereals, but two-thirds of that 10 percent is oatmeal-based. Instant oatmeal accounts for over one-half of the market and continues to increase. Ready-to-eat cereals often contain added oat bran, however; and many popular cold cereals use oat flour. Oats, by far, are the most popular grain for breakfast cereals—hot or cold. Breads, muffins and the ever-popular oatmeal-raisin cookies also take advantage of nourishing oat flour, bran and flakes. Who knew that cookies could be good for you?

Oats are a wonderful source of the fiber you need daily, and in addition, they supply trace minerals, protein, and antioxidants that the science of Nutritional Immunology has shown are necessary for the health and strength of the immune system. For a mighty nutritional punch in a mighty small package, you can't beat oats!



## 燕麥—— 富有高度營養價值!

假如您想尋找一種極富營養效益的食品，您找不到比燕麥更好的食物了。燕麥是複合碳水化合物的主要來源，能夠為您充沛精力。它的蛋白質含量比Bulgur麥片高50%，是糙米的兩倍；燕麥富含含量可觀的硒、硫胺素(維生素B1)、磷、錳、鎂和鐵；還有相當含量的鈣、銅、葉酸(維生素B)、維生素E、和鋅。另外，在所有的穀物中，燕麥的抗氧化劑含量僅次於蕎麥、大麥和高粱。

但是，直到最近幾年中，燕麥其含有極豐富可溶性纖維的特點，才引起了許多營養學家的關注。一杯煮熟的燕麥粥可提供4克的纖維，佔每日建議攝取纖維量的16%。其中大約有一半是可溶性纖維，此成份已被證實有助降低血膽固醇的水平。燕麥除了享有能夠降低膽固醇的美譽之外，還含有三烯生育酚，一種淡黃色脂溶性黏油，屬於維生素E家族。它能夠抑制膽固醇的合成，並被發現能夠降低血膽固醇。

與其他的穀物相比，燕麥還含有更多的不飽和脂肪酸，尤其是人體必需的必要脂肪酸—亞麻油酸。人體利用亞麻油酸製造前列腺素，此激素為類似荷爾蒙的化學物質，對人體具有多種作用，比如控制體內發炎症狀，在女性生產過程中刺激子宮收縮，保護胃內膜。更有利的是，這些脂肪酸分佈在整個燕麥顆粒中，而不是像其他穀物那樣，集中在麥芽部分。



加工過程除掉了燕麥的外殼，留下麥粒，再磨制成碎燕麥，燕麥片和方便即食麥片，燕麥粉，還有燕麥麩。僅有大約10%的早餐麥片是熱食用的，而這10%中則有三分之二是燕麥片食品。即食燕麥片佔據整個市場的一半以上，並且還不斷地在繼續成長，然而即食麥片一般也常含有添加的燕麥麩成分在裏頭，而很多常見的冷食用麥片也都以燕麥粉製成。目前，燕麥是被最經常選用的穀物，來作為冷食和熱食用的早點。麵包，早點馬芬蛋糕(muffin),和一直廣受大眾歡迎的葡萄乾燕麥餅乾也都採用了富含營養的燕麥粉，燕麥麩和燕麥片作為食品的原料成分。誰又能想得到餅乾對您的身體居然是有益的呢？

燕麥是您每日所需纖維的極佳來源，此外，它還含有營養免疫學所指出的一些健康和強化免疫系統所必需的微量礦物質、蛋白質和抗氧化劑成分。從極微小的小東西中獲取極高的營養效益，您找不到比燕麥更好的食品了！

\*此刊物的中英文版若有出入,請參閱英文原版為準。

# REFERENCES

## 參考資料

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### DIETARY FIBER ARTICLE

**Aldoori, Walid H., and others. 1998.** "A Prospective Study of Dietary Fiber Types and Symptomatic Diverticular Disease in Men," *The Journal of Nutrition* **128:4** 714-719.

**Anderson, J., and K. Wilken. Feb 2005.** *Dietary Fiber, Colorado State University Cooperative Extension*, [<http://www.ext.colostate.edu/pubs/foodnut/09333.html>].

**Anderson, James W., and Tammy J. Hanna. 1999.** "Impact of Nondigestible Carbohydrates on Serum Lipoproteins and Risk for Cardiovascular Disease," *Journal of Nutrition* **129:1457S-1466S**.

**Boeckner, Linda, Dietary Fiber, Nebraska Cooperative Extension, University of Nebraska-Lincoln**, [<http://ianrpubs.unl.edu/foods/nf62.htm>].

**Boyer, Jeanelle, and Rui Hai Liu. 2004.** "Apple phytochemicals and their health benefits," *Nutrition Journal* **3:5**.

**Burton-Freeman, Britt. 2000.** "Dietary Fiber and Energy Regulation," *Journal of Nutrition* **130:272S-275S**.

**Chen, Jau-Fei, Ph.D. 2000.** *Nutritional Immunology*, Bright Ideas Press, Provo, UT.

**Darwiche, Gassan, and others. 2003.** "The addition of locust bean gum but not water delayed the gastric emptying rate of a nutrient semisolid meal in healthy subjects," *BMC*

*Gastroenterology* **3:12**.

**Davidson, Michael H., and others. 1998.** "A Low-Viscosity Soluble-Fiber Fruit Juice Supplement Fails to Lower Cholesterol in Hypercholesterolemic Men and Women," *The Journal of Nutrition* **128:11** 1927-1932.

**Donaldson, Michael S. 2004.** "Nutrition and cancer: A review of the evidence for an anti-cancer Diet," *Nutrition Journal*, **3:19**.

**Feinberg School of Medicine, Northwestern University. 2003.** *Nutrition Fact Sheet: Dietary Fiber*, [<http://www.feinberg.northwestern.edu/nutrition/factsheets/fiber.html>].

**Harvard School of Public Health, Harvard University. 2005.** *Fiber: Start Roughing It!* 2005. [<http://www.hsph.harvard.edu/nutritionsource/fiber.html>].

**Holloway, HD, C Tasman-Jones and SP Lee,** "Digestion of certain fractions of dietary fiber in humans", *American Journal of Clinical Nutrition*, **31:927-930**.

**Johns Hopkins Bayview Medical Center. 2002.** *Clinical Nutrition, High Fiber Diet*, [<http://www.jhbmc.jhu.edu/NUTRI/fiber.html>].

**Marlett, Judith A., and others. 2002.** "Health implications of dietary fiber," *Journal of the American Dietetic Association* **102:993-1000**.

**McGuire, Nancy. 2004.** "These Carbs Won't Blow Your Diet," *The American Chemical*

Society, [<http://www.chemistry.org>].

**Nakaji, Shigeyuki, and others. 2001.** "Dietary fiber showed no preventive effect against colon and rectal cancers in Japanese with low fat intake: an analysis from the results of nutrition surveys from 23 Japanese prefectures," *BMC Cancer* 1:14.

**Neubauer, Suzanne, PhD, RD, CNSD and Patricia Bebo, MS, RD, Fiber and Colon Cancer, Vegetarian Nutrition,** [[http://www.vegetarian-nutrition.info/vn/fiber\\_colon\\_cancer.html](http://www.vegetarian-nutrition.info/vn/fiber_colon_cancer.html)].

**Panagiotakos, Demosthenes B., and others. 2003.** "Consumption of fruits and vegetables in relation to the risk of developing acute coronary syndromes; the CARDIO2000 case-control study," *Nutrition Journal* 2:2.

**Prentice, Ross L. 2000.** "Future possibilities in the prevention of breast cancer: Fat and fiber and breast cancer research," *Breast Cancer Research* 2:268–276.

**Ross, J. K., C. English, and C. A. Perlmutter. 1985.** "Dietary fiber constituents of selected fruits and vegetables," *Journal of the American Dietetic Association*. 85:9 1111-6.

**Slavin, Joanne, and Mary Darling. 2000.** "Fiber in the Diet," *University of Minnesota Extension Service,* [<http://www.extension.umn.edu/distribution/nutrition/DJ0423.html>].

**USDA National Nutrient Database for Standard Reference, Release 17, 2002 revision** [<http://www.nal.usda.gov/fnic/>]

[foodcomp/Data/SR17/wtrank/sr17a291.pdf](http://www.foodcomp/Data/SR17/wtrank/sr17a291.pdf)].

## APPLE ARTICLE

**Eberhardt, Marian V., Chang Yong Lee, and Rui Hai Liu. 2000.** "Nutrition: Antioxidant activity of fresh apples," *Nature* 405:903 - 904.

*Facts: Five reasons to eat an apple every day,* *VirginiaApples.org,* [<http://www.virginiaapples.org/facts/5reasons.html>].

**Ireland, Corydon,** "Apple a day may hold cancer at bay," *Rochester Democrat & Chronicle,* Rochester NY, June 22, 2000.

## OATS ARTICLE

**Chen, Chung-Yen, Paul E. Milbury, Ho-Kyung Kwak, F. William Collins, Priscilla Samuel and Jeffrey B. Blumberg. 2004.** "Avenanthramides and Phenolic Acids from Oats Are Bioavailable and Act Synergistically with Vitamin C to Enhance Hamster and Human LDL Resistance to Oxidation," *The American Society for Nutritional Sciences Journal of Nutrition* 134:1459-1466.

**Halvorsen, Bente L., et al. 2002.** "A Systematic Screening of Total Antioxidants in Dietary Plants," *The American Society for Nutritional Sciences Journal of Nutrition* 132:461-471.

*Oat Foods: A Smart Choice, North American Miller's Association,* [[http://www.namamillers.org/prd\\_o.html](http://www.namamillers.org/prd_o.html)].



