

Nature's

“Clot Buster”!

The Discovery of Nattokinase

Normal blood clotting – the kind that happens to seal up a cut or to repair a ruptured blood vessel – is vital to survival, as anyone caring for a haemophiliac can tell you. But many people are susceptible to an excess of **thrombosis**, which is a kind of “micro-coagulation” that goes on *inside* your blood vessels all the time – even when you haven’t been injured.

At this very moment, somewhere in your body the enzyme **thrombin** is causing the soluble protein **fibrinogen** to precipitate into microscopic filaments of **fibrin**, the essential protein mesh that weaves the warp of a blood clot. The tiny clots thus formed are normally quickly digested by the counterbalancing enzyme **plasmin**, in a process called **fibrinolysis** (fibrin-o-lysis: the *lysis* (breaking up) of the

thrombus-forming strands of *fibrin*). See **Figure 1**.

For optimal health, the body must balance the tendency to form these mini-clots in the blood (which ensures that the body is ready to quickly patch up damage if you’re hurt), and the factors which support fibrinolytic (thrombus-dissolving) activity, which protects you from the threats to your health posed by these microscopic blood clots. And excessive thrombosis can be deadly, contributing to chronic disease and also triggering acute,

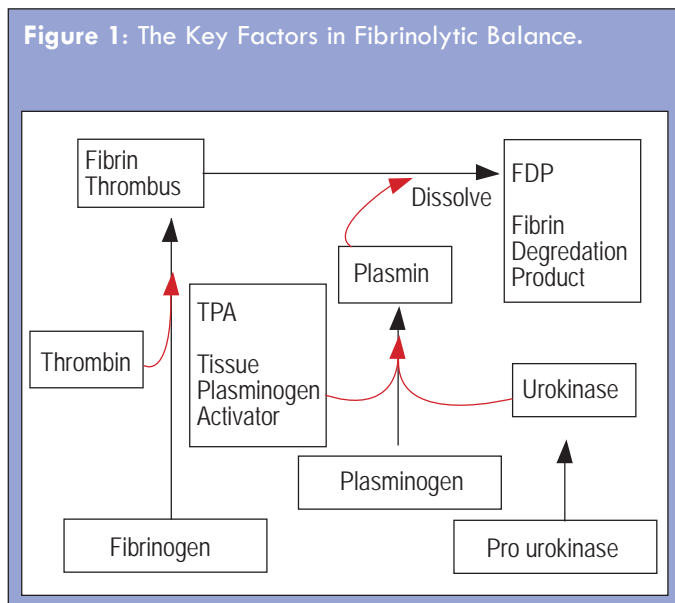
An upset in your body’s fibrinolytic balance is a major player in heart disease

life-threatening crises. Most notably, **an upset in your body’s fibrinolytic balance is a major player in heart disease and other health threats** (see our section on **Killer Clots**).

Doctors have long had access to powerful, fast-acting clot-busting *drugs*. Some of these drugs are actually synthetic versions of the body’s own pro-fibrinolytic enzymes. **Alteplase (Activase®)** and **reteplase (Retavase®)** are actually versions of **tissue plasminogen activator** cooked up in a lab (see **Figure 1**), while **Abbokinase®** is an artificial version of **urokinase**, another plasminogen-activating enzyme derived from the kidney (**Figure 1** again). Others (like **streptokinase**) are not based on bodily enzymes, but are totally artificial. Doctors give patients these drugs during a heart attack, stroke, or episode of unstable angina to break up clots that can otherwise trigger an acute cardiovascular crisis, or accelerate the damage to your heart and brain when you’re in the middle of one.

These drugs are available for use by *injection*, at the zero hour for your heart, your brain – or your life. But if you find yourself in a hospital bed being shot up with streptokinase, **the thrombus that triggers your heart attack or stroke won’t be the first to block the life-giving blood supply from reaching its target – just the first one that you’ve noticed and identified**. When, prior to your rush to the emergency room, smaller thrombi suffocate cells in your heart, brain, lungs, or other organs, you’ll experience pins-and-needles, or a pain in your chest, or get dizzy, or feel a hard, warm spot in your leg – but you probably won’t realize what’s going on. And, as we discussed in the “**Killer Clots**” section, there are other, long-term threats posed by deposits of fibrin itself in your blood vessels and other tissues.

Figure 1: The Key Factors in Fibrinolytic Balance.



Killer Clots

An increased risk of thrombosis can come about in several ways. Some people are just *born* “**hypercoagulable**,” due to deficiencies of key components of the body’s antithrombotic arsenal, such as **proteins S and C**. Others can acquire such imbalances because of a rare autoimmune disorder known as **antiphospholipid antibody syndrome**. More commonly, the problem is either **excessive fibrinogen** – leading to too much fibrin being formed in the first place – or **low fibrinolytic activity**, related to either *low* levels of *pro*-fibrinolytic **plasminogen** or **tissue Plasminogen Activator (tPA)**, or to *high* levels of *anti*-fibrinolytic **Plasminogen Activator-Inhibitor-1 (PAI-1)**. See **Figure 1** for the place of these factors in the body’s fibrinolytic balance. Either way, more fibrin spindles are formed than the body’s fibrinolytic guardians can harmlessly dissolve, and the risk of a deadly clot rises.

Even if your fibrinogen levels are normal and you aren’t otherwise susceptible to hypercoagulable states, you can also be in danger from thrombi when you stay immobile for long periods of time in a hospital bed or on a cramped airplane seat – especially if you’ve recently had surgery or a fracture, or are taking birth control pills or estrogen replacement therapy. Under these conditions, you can develop tiny blood clots which choke off blood flow to the lungs (leading to pain, fainting, and even death) or the heart (leading to a heart attack). This can pose a chronic or acute health threat called **deep vein thrombosis (DVT)**; DVT lies behind the “**economy class syndrome**.”

The Fibrinogen Factor

The consequences of an unbalanced fibrinolytic system can be seen when we look at elevated fibrinogen as a risk factor for disease. Fibrinogen levels can be increased by a variety of unhealthy conditions, including obesity, diabetes, stress, smoking, infection, and systemic inflammation.⁴ Menopause, pregnancy, and the use of the birth control pill also increase fibrinogen levels in women, and levels typically go up during the winter months.⁴ But **even seemingly healthy people become more susceptible to excessive thrombosis as they age**:^{1,4,7} fibrinogen levels climb by 25 milligrams per deciliter for every ten years of life, so that 81% of people over 65 have dangerously high concentrations of 320 mg/dL or more¹ (levels above 286 mg/dL are consistently reported to increase your risk of cardiovascular disease or of suffering a heart attack,^{6,7,2} and optimal levels appear to be lower than 236 mg/dL⁶).

The consequences can be deadly. **Having high levels of fibrinogen is a strong predictor of your risk of suffering a heart attack or stroke**,³ even if you’re otherwise healthy⁴ – and it’s an even *stronger* predictor of a *second* heart attack, or of an acceleration of the atherosclerotic process in people who are already suffering from heart disease.⁴

An imbalance in the fibrinolytic balance is a *double* threat to your heart health. The first threat is posed by fibrinogen’s role in the *development* of heart disease. As strands of fibrin are deposited into the blood vessel wall they act as a kind of Velcro, attracting deposits of **LDL (“bad”) cholesterol**.⁴ Furthermore, when fibrin is degraded in the body, the debris stimulates the growth of **smooth muscle cells** in your arteries – a key step of the development of atherosclerosis.^{3,4}

The second, more obvious threat is one which emerges once a person already *has* heart disease. The formation of a thrombus is usually the fatal last straw that triggers a heart attack or stroke. The “fibrous cap” that holds together an atherosclerotic plaque ruptures, spewing its miasma of necrotic cells, oxidized cholesterol, and calcifications into the bloodstream. This mess triggers a cascade of molecular events leading first to the formation of a “white clot,” as platelets aggregate, and then a “red clot” as fibrinogen is converted to fibrin and red blood cells are attracted to the snowballing mass. The red clot then clogs a blood vessel feeding your heart or your brain, and a heart attack or stroke follows as the vital supply of oxygen and fuel is shut down.

This process is what makes excessive fibrinogen a major player in the **acute coronary syndromes** (unstable angina and myocardial infarction) which are the leading cause of death in the United States.⁵

High fibrinogen keeps bad company: it’s associated with high blood pressure, cholesterol, or triglycerides.⁴ And because of its deadly role in both the development of atherosclerosis and the crisis of heart attack and stroke, excess fibrinogen makes other risk factors – like a **dangerous cholesterol profile, high blood pressure, and C-reactive protein** – all the riskier.^{3,4} In one study,⁶ 2116 healthy men had their levels of fibrinogen and LDL (“bad”) cholesterol tested, after which they were followed over the course of six years. As the researchers had expected, either a high LDL level or a high level of

fibrinogen were each found to put men at risk for a heart attack – and having high fibrinogen levels were found to make a high LDL level even riskier, putting men at *six times* greater risk of suffering that fate than men whose levels of both risk factors were low.

In fact, some evidence suggests that **the loss of fibrinolytic balance caused by elevated fibrinogen may actually be the most important risk factor in determining your odds of suffering a heart attack.**

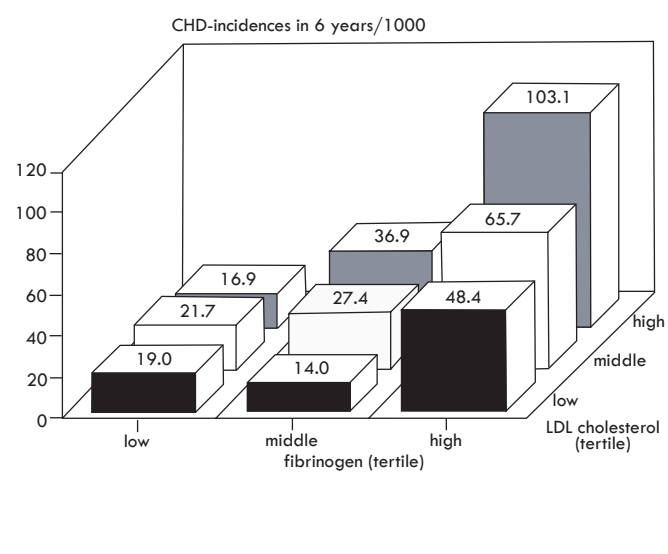
most important risk factor in determining your odds of suffering a heart attack. When researchers looked men with optimal levels of fibrinogen (under 236 mg/dL), they found these men to be at low risk of heart attack, *no matter how high their LDL levels are* (see **Figure 2**)!⁶ A study published the following year in the *New England Journal of Medicine* found the same basic pattern to be true of total cholesterol in patients with angina: if fibrinogen levels are low, then a

man's risk of a heart attack remains low – even in men with the *highest cholesterol levels*.⁷

High fibrinogen levels are also associated with **cancer** – a connection that we've known about for over a century but have only recently begun to understand. Far from being merely a *result of the disease* (as was once believed), it now appears that **an imbalance in thrombotic factors contributes to the growth and spread of cancerous tumors**. Fibrin deposits appear to act as a kind of “scaffolding” on which spreading (**metastasizing**) cancer cells graft on to normal tissues, and to attract chemical signals that stimulate the cancer's growth.⁸

And while far from proven, David Berg, MS, of Hemex Labs in Phoenix has collected some preliminary evidence to support his theory that an unusual form of the hypercoagulation disorder **antiphospholipid antibody syndrome** may underlie **chronic fatigue, fibromyalgia**, and a variety of other chronic illnesses, as smaller thrombi slowly block off the delivery of needed oxygen and nutrients to the body's tissues.⁹

Figure 2: Incidence of heart attacks according to concentration of total cholesterol and fibrinogen. Redrawn from (6).



Why Yuri Kyznetsov Whistles While He Works.

Heavy workloads, a brutal climate, and the constant stress of an uncertain tomorrow have been realities of survival on the Siberian tundra, for traditional communities and “guests” of the Soviet empire alike.

Whether by luck or through Nature's plan, the same extreme environment also freely produces the gift of *Rhodiola rosea*. For centuries, to the peoples of Siberia, Scandinavia, and Iceland have used this powerful adaptogen to master their fates. With *Rhodiola*, Vikings and labor camp workers found that they could thrive in their harsh environment, taking on physical and mental stress, bone-chilling cold, high altitude, and hard work with gusto.

Russian researchers caught on to this use and documented its effects in animals in the 1960s. And after the collapse of the Soviet empire, the word on *Rhodiola* reached the West, where clinical studies have lent further support to its traditional use.

With *Rhodiola*, you can bounce out of bed, eager to take on your next “day in the gulag.”

These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease.



So there's long been a clear need for something that can be used *before* a thrombus blocks a blood vessel, to break down thrombi before they can deny oxygen to your tissues and to prevent excessive fibrin deposits. While on an overseas research project at the Chicago University

Nattokinase – has a fibrinolytic “potency matched by no other enzyme.”

Medical School, Dr. Hiroyuki Sumi of Japan's Miyazaki Medical College threw himself into this challenge in the early '80s, looking to Nature for a way to fill this glaring gap. Over the course of several years, Dr. Sumi and researchers working with him tested 173 different natural products for fibrinolytic activity.

Dr. Sumi initially thought he had found his solution when his team identified **lumbrokinase**, an enzyme extracted from the red earthworm *Lumbricus rubellus*. This enzyme proved to have significant fibrinolytic activity,^{10,11} but after some early investigations Dr. Sumi's team was forced to abandon it. The reason: studies showed that **lumbrokinase damages the intestinal tract**: when lumbrokinase was given to older volunteers, there was evidence of internal bleeding.^{10,12}

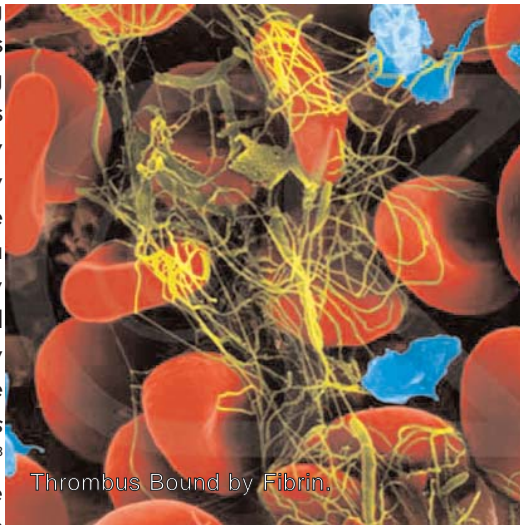
But the solution was not long in coming – although it took nearly two decades before the initial test-tube finding could be confirmed in human studies and a reliable, purified dietary supplement made available. Shortly after the problems with lumbrokinase emerged, Dr. Sumi's team discovered a powerful fibrinolytic enzyme naturally present in *natto*, a traditional Japanese condiment made by fermenting soybeans with the probiotic organism *Bacillus subtilis subsp. natto* (or simply *Bacillus natto*).¹³ As a result of their initial test-tube studies, Dr. Sumi's research team concluded that the enzyme – which he named **Nattokinase – has a fibrinolytic “potency matched by no other enzyme.”**

Nattokinase Enhances Fibrinolysis

But human beings aren't test tubes. So the next – and critical – step was to actually test **Nattokinase's** ability to increase fibrinolysis in living things. Normally, animal experiments would be carried out before human trials would even be contemplated, but because *natto* is already widely consumed in Western Japan, Dr. Sumi's team began studying **Nattokinase's** clot-busting efficacy using the **Nattokinase-rich** food itself. So in a controlled study, Dr. Sumi's team fed a group of twelve volunteers a large (200

gram) serving of *natto*, measuring its effects on two measures of fibrinolytic activity: the **euglobulin lysis time (ELT)** and the Astrup/Müllertz **fibrin plate method**. As a control – and to rule out any fibrinolytic effect of phytonutrients in the soybeans *themselves* – the researchers also tested the effects of plain, cooked soybeans untouched by the **Nattokinase-producing** *Bacillus natto* probiotic.¹²

The results were clear (see **Figure 3**). Eating plain soybeans had no effect on the volunteers' ELT, which measures the time it takes from the initial formation of a thrombus in a fraction of blood until it is fully dissolved. But over the course of the first four hours, **Nattokinase consumption cut the time needed to complete the clot-dissolving cycle in half**, with ELT levels slowly returning to baseline levels a day later. In a separate test (the fibrin plate method), the researchers assessed fibrinolytic activity by applying a fraction of the participants' blood to a standardized quantity of polymerized fibrinogen to see how much of it would be broken up in a defined time period. After the plain soybean control meal, the fraction of the subjects' blood did not break up any of the fibrinogen polymers. Yet **after Nattokinase consumption, total fibrinolytic activity climbed from zero to 15.2 square millimeters** by the four hour mark as measured by fibrin plate method, after which it too slowly returned to its starting low point.¹²



Thrombus Bound by Fibrin.

Having confirmed the short-term safety and efficacy of **Nattokinase** from a large serving of *natto*, Dr. Sumi's team performed a longer-term study using **Nattokinase** tablets made from a simple *natto* concentrate. For eight days, volunteers took the crude **Nattokinase** tablets and had their fibrinolytic activity assessed using both the fibrin plate method described above, and also by measuring **fibrin degradation products (FDP)**, the remains of broken-up fibrin which are left over after fibrinolysis. The researchers also tested the volunteers' tissue plasminogen activator (tPA) levels. tPA, as the name implies, is a substance in the body which activates the pro-fibrinolytic enzyme plasminogen, and is a major contributor to overall fibrinolytic activity in the body (see **Figure 1**).

The results can be seen in **Figure 3**. The EFA-measured **fibrinolytic activity climbed steadily over the course of the first four days of using Nattokinase tablets**, reaching a stable plateau which was maintained for the rest of the week. At the same time, **FDP rose to a rapid peak and then moved toward a steady lower level**. This is as would be expected, as the body cleared up existing fibrin deposits, leaving less fibrin to be degraded and thus FDP to be

Nattokinase Now

Since the early days of Dr. Sumi's first research, **Nattokinase** supplements have come a long way. In the first human studies, the *natto* concentrates were made by hand in the lab, and were so rudimentary that it took three of the 1300 milligram tablets to get results. Later, a more refined extract was produced, whose higher potency (about 3600 fibrinolytic units per gram (FU/g)) allowed for a reasonable dose of 1000 FU from a two-capsule, 276 mg dose. Today, scientists have found ways to perform the fermentation process precisely enough to create remarkably pure **Nattokinase**, so that the most advanced **Nattokinase** supplements boast a remarkable 20 000 FU/g. This means that two tiny capsules, containing just 36 milligrams of very pure **Nattokinase** each, can deliver a full 1440 FU of fibrinolytic activity. Just as important is the fact that with this new technique, the fermentation medium used by the probiotic *Bacillus natto* to produce **Nattokinase** contains no soy, with the result that **the new 20 000 FU/g Nattokinase supplements are 100% soy-free.**

recorded. And perhaps most interestingly, **tPA was boosted in men taking Nattokinase.**

This revealed an important aspect of **Nattokinase's** activity. Some fibrinolytic drugs act primarily by breaking up fibrin directly. While Dr. Sumi had already demonstrated that **Nattokinase** did work in part by direct fibrinolysis,¹³ the fact that **Nattokinase** increases the body's pro-fibrinolytic tPA levels shows us that, additionally, **Nattokinase's fibrinolytic action involves actually boosting the body's own clot-busting capacity**, shifting the regulation of fibrinolytic balance rather than simply imposing its action on the body in a "drug-like" mechanism (for more details, see the sidebar, "**For Biochemistry Geeks Only!**").

Nattokinase Restores Blood Flow

But it's one thing to show that fibrinolytic activity is enhanced, and quite another to prove that there's been a real impact on the functioning of your circulatory system.

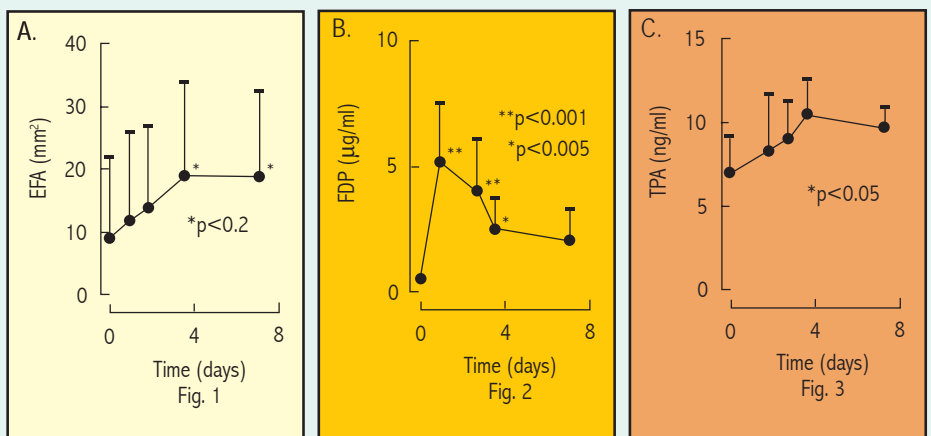
To show that the pro-fibrinolytic action of **Nattokinase** could have a real impact on peoples' health, Dr. Sumi's group performed an experiment which showed that **Nattokinase is potent enough to actually open up blockages in veins.**

The team first induced a thrombus in lab dogs by simultaneously injecting their legs with fibrinogen and the activating factor thrombin (see **Figure 1**). This thrombus led to the complete blockage of the vein in which the mixture of thrombotic factors had been injected, so that the vein

simply disappears from the angiogram at the site of the occlusion (see **Figure 6**). The team then gave one group of dogs the early, crude **Nattokinase** tablets, while feeding the remaining dogs a dummy pill.¹²

When Dr. Sumi's team measured the dogs' fibrinolytic activity using ELT values, they found that there was no change in the fibrinolytic activity of the fraction of blood drawn from dogs fed the placebo tablets. But **Nattokinase supplementation led to a halving of the time needed to break up a standardized amount of polymerized fibrinogen in the first 30 minutes**, after which fibrinolytic activity slowly returned to baseline over the course of the next three hours. More importantly, **Nattokinase is potent enough to actually open up blockages in veins.** While the veins of dogs in the control group remained blocked off a full 18 hours after the beginning of the experiment, **those receiving Nattokinase experienced a complete restoration of normal blood flow within 5 hours.**¹² This could be seen on the dogs' angiograms, with blood vessels appearing again where they had previously been rendered invisible by the choking off of blood flow (see **Figure 6**).

Figure 3: Measures of fibrinolytic balance after ingestion of **Nattokinase** tablets.



a. Astrup/Müllertz fibrin plate method. **b.** Fibrin degradation products (FDP). **c.** Tissue plasminogen activator (tPA). Redrawn from (12).

Similar results were obtained in a second animal experiment,¹⁶ in which a thrombus was induced in the blood vessel that carries blood from the heart to the brain (the **carotid artery**, whose blockage causes a stroke). The researchers then tested the ability of three enzymes to break up the clot and restore blood flow: plasmin (the enzyme in the body that does the direct work of breaking apart fibrin strands – see **Figure 1**), elastase (an enzyme in the same biochemical structural family ("serine proteases") as both plasmin and **Nattokinase**), and **Nattokinase.**



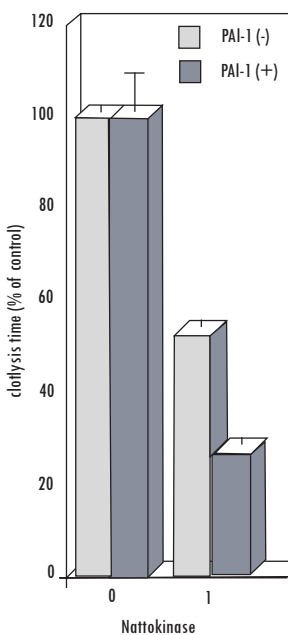
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There are at least three separate mechanisms whereby **Nattokinase** exerts its pro-fibrinolytic effect. Of these three, the *direct* fibrinolytic action of **Nattokinase**, acting as a serine protease to enzymatically degrade fibrin, appears to be the least important. The other two mechanisms are the **cleaving of plasminogen activator-inhibitor type 1 (PAI-1)** and the **upregulation of conversion of prourokinase to urokinase** (see **Figure 4**).

The pro-fibrinolytic tPA enzyme is inhibited by PAI-1 (see **Figure 1**), so reducing PAI-1 levels or activity increases net tPA action. Molecular studies¹⁴ reveal that **Nattokinase** enzymatically cleaves PAI-1, and demonstrate the importance of this contribution to **Nattokinase's** pro-fibrinolytic activity. The contributions made by the direct and indirect mechanisms of action was evaluated by seeing how much **Nattokinase** could lower the time required by tPA to break up a clot under two conditions: when PAI-1 was absent (so that all fibrinolysis would be the result of **Nattokinase's** *direct* fibrinolytic action) and when it was present (such that the acceleration of fibrinolysis would be due to both direct clot-busting *and* the lifting of PAI-1's inhibitory pressure).

Figure 5: Enhancement of tPA activity by **Nattokinase**: Contribution of Direct Fibrinolysis and Cleavage of PAI-1. Redrawn from (14).



As **Figure 5** shows, at its maximum concentration

Nattokinase's direct fibrinolytic activity speeds clot-busting time by about 50%. But its ability to free up tPA from PAI-1's constraint contributes to an even greater enhancement of fibrinolytic activity, bringing times down by an *additional* 50%.¹⁴

There is also evidence that **Nattokinase** **upregulates the formation of urokinase from its precursor, prourokinase** (**Figure 4**).¹⁵

By shifting the balance of key regulators of plasminogen-regulating factors, **Nattokinase** allows the body to rev up its natural fibrinolytic activity, while still maintaining overall regulation of fibrinolytic balance.

Figure 4: Three Mechanisms of Action of **Nattokinase**.

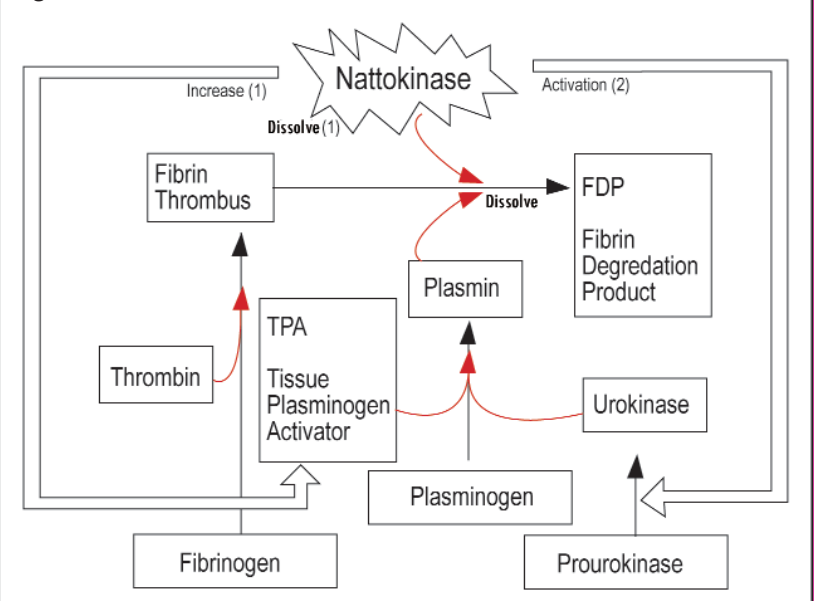
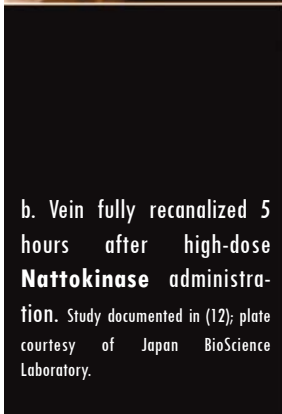




Figure 6: Restoration of Circulation in the Leg by **Nattokinase**.

a. Occluded vein is invisible from the site of thrombus upward.



b. Vein fully recanalized 5 hours after high-dose **Nattokinase** administration. Study documented in (12); plate courtesy of Japan BioScience Laboratory.



Who Should *Not* Take Nattokinase

Nattokinase is not a mere “blood thinner:” it works by breaking down tangled threads of fibrin, not by keeping platelets from clumping together, and thus influences the formation of thrombi at the “red clot” phase, rather than by interfering with normal coagulation. Still, fibrin is an important part of wound healing, and while excessive fibrin formation leading to hypercoagulability is a threat to your health, so is *interfering* with fibrin formation when it’s needed to stop bleeding.

Obviously, then, people with bleeding disorders (**haemophiliacs**, for example, or those suffering a **hemorrhagic diathesis** such as **disseminated intravascular coagulation (DIC)**) should not take **Nattokinase** supplements. But also, **Nattokinase** is not appropriate for people with ongoing bleeding problems, such as **recent surgery, ulcers, haemorrhoids, or trauma**. Likewise, people who have suffered **major trauma in the previous month, ischemic stroke or neurosurgery in previous six months**, or who have ever had an **intracranial bleed** should not use **Nattokinase**. And **uncontrolled high blood pressure** with a systolic blood pressure of 200 mmHg or a diastolic pressure of 110 mmHg also rules out **Nattokinase** supplementation.

And contrary to what some companies are wrongly claiming, **persons taking “blood thinning” drugs**, such as **aspirin, warfarin (Coumadin®), heparin, dipyridamole (Persantine®), and abciximab (Reopro®)** will put some people at greater risk of a bleeding problem if they also take **Nattokinase**. People taking these drugs should only use **Nattokinase** if their prescribing physician specifically advises them to do so, and is prepared to monitor their progress carefully.

An hour after treatment with elastase, the animals’ carotid arteries remained completely blocked. Plasmin had some effect, letting 15.8% of the normal blood flow return within the hour. But **Nattokinase had a far greater activity, restoring 62% of the normal blood flow to the brain** in the same time period!¹⁶

Work in humans has also been reported. In one remarkable case study,¹⁷ a team of researchers decided to test the ability of **Nattokinase** to treat a case of **central retinal vein occlusion**. This disorder occurs when the blood vessels draining out of the eye are blocked by a thrombus, leading to such consequences as oxygen- and nutrient-starvation of the eye tissue; the leakage of fluid into the eye as the blocked vein applies pressure to the eye itself (much as your hand swells when you cut off the flow of blood); and the growth of abnormal new blood vessels, which can lead to secondary **glaucoma** or the **detachment of the retina**. The edema associated with retinal vein occlusion can also cause permanent **damage to the macula** of the eye, leading to blurred or lost vision in areas near the blocked blood vessel.

In 1994, a 58-year-old man came to a hospital associated with the University of Tottori School of Medicine, suffering from central retinal vein occlusion in his right eye. The occlusion had caused edema and bleeding in the eye, as the blocked blood vessels swelled with the blocked blood and tiny vessels burst (see **Figure 7a**). Part of the standard therapy for retinal vein occlusion is to give victims “blood-thinning” drugs like aspirin or warfarin (**Coumadin®**) to dissolve the clot. Instead, the researchers asked the man to eat a moderately large (100 gram) serving of *natto* before going to bed every night as a way of delivering **Nattokinase** to the occlusion site. The man was also prescribed a drug to prevent the bleeding which had been triggered by the blockage.¹⁷

On the tenth day of this study, bleeding from bottom of the eye was stopped. On day twenty, the blockage of the blood vessels in the man’s eye had improved so much that he recovered his vision, and was released from hospital with instructions to continue eating his *natto* two evenings each week. Two months later, **Nattokinase had completely cleared the occlusion** (see **Figure 7b**).

Boosting Fibrinolysis Naturally

But the real point of a supplement like **Nattokinase** is not to deal with future medical crises, but to keep you in good health *now*. Blockages of blood vessels as large as these are, rare and would require hospitalization and physician attendance; only a fool would reach for a **Nattokinase** capsule if there were any signs of a heart attack or stroke. But the ongoing formation and dissolution of clots happens every day in your body, and can impact your health in the

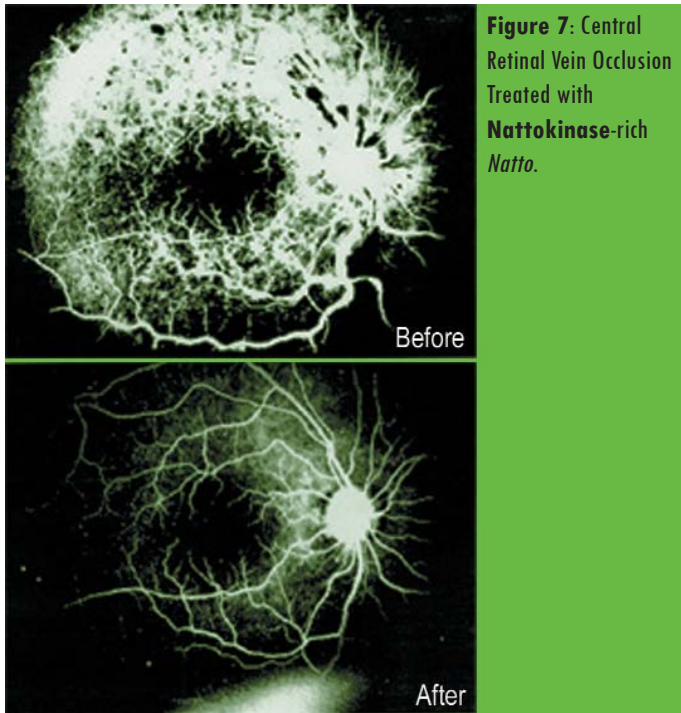


Figure 7: Central Retinal Vein Occlusion Treated with Nattokinase-rich Natto.

that makes this natural food enzyme an unique addition to your supplement armamentarium.

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long term. If you suffer from hypercoagulability, you may be looking to enhance your health by boosting fibrinolytic function in your body.

A variety of lifestyle choices can lower fibrinogen or increase fibrinolysis, including **quitting smoking, losing weight, and getting more exercise**. And you can improve your fibrinolytic balance by practicing the only proven way to slow biological aging and extend maximum lifespan in mammals: **caloric restriction (CR)**, in which you reduce the number of Calories in your diet without compromising your supply of essential nutrients (see “The Road to Aging is Paved With Calories” in *The Holistic Lifestyle 1(5)*). A human trial several years ago¹⁸ found that, even in people who were not overweight, practicing CR reduces the concentration and activity of plasminogen activator-inhibitor 1 (see **Figure 1**), boosting fibrinolysis in the body.

Moderate **alcohol consumption** lowers fibrinogen,⁴ which may be part of the reason why a drink a day is so strongly associated with better heart health. Several supplements have also been shown to reduce fibrinogen levels, including long-chain omega-3 fatty acids (**EPA and DHA**) from fish oil,^{19,20} **curcumin**,²¹ and **niacin** (you may want to use “flush-free” niacin (inositol hexanicotinate) to avoid the uncomfortable itching and burning that regular niacin causes – but don’t confuse this with niacinamide, which is not the same thing and will not give you the same benefits).^{22,23}

But while lowering fibrinogen levels can help prevent excessive thrombus formation, it doesn’t address the other side of the fibrinolytic balance sheet. **It’s Nattokinase’s ability to boost your body’s natural clot-busting activity**