



ENZYMES AND HEALING FROM INJURY AND WOUNDS



The importance of good nutrition receives a lot of emphasis for anyone recovering from an injury. Nutrition – the vitamins, minerals, amino acids, and fats your body needs – are important but they alone aren't enough. Enzymes also play an integral role in recovering from an injury and wound healing.

In fact, without enzymes, healing any wound or injury simply isn't possible.



THE HEALING PROCESS

Healing is a complex process and involves four stages[i]:

1. The blood clotting, or hemostasis, phase, which stops the blood flow.
2. Inflammation, which increases blood flow to the area to deliver immune cells, nutrients, enzymes and other essential cells to the area.
3. Proliferation, the stage where tissue and new blood vessels heal and seal the wound.
4. Maturation, which is the stage where the tissue is remade, or "remodeled," to match the surrounding tissue and blood vessels in the area are reduced in number.

(You might also see healing listed in three stages: Inflammation, proliferation, and maturation, where hemostasis and inflammation are combined.[ii])

At every step of this process, enzymes – specifically systemic enzymes – play a role.

- è Immune cells use enzymes to kill germs and prevent infection.
- è The body needs enzymes to convert nutrients into the biochemicals needed to heal the wound.
- è Enzymes break up fibrin, an important clotting agent used in the first step. Without adequate fibrin break-down, blood flow remains restricted to the area and a wound heals slowly.

Different types of systemic enzymes are also involved in cell division, DNA replication and, in fact, every biochemical reaction that takes place



during the healing process.

Yet, for all the roles systemic enzymes play in healing, researchers continue to discover new enzymes and ways enzymes are involved. For example, a 2016 study published in *Wound Repair and Regeneration* reported on a newly discovered enzyme used by immune cells called neutrophils to build blood vessels during the proliferation stage of healing.^[iii] This underscores the reality that systemic enzymes drive the entire process.

Systemic enzymes, however, aren't the only ones needed when healing.



THE CONNECTION BETWEEN ENZYMES AND NUTRITION FOR WOUND HEALING

While systemic enzymes contribute to the processes involved healing, digestive enzymes also play a key role.

Digestive enzymes are those enzymes released in the mouth, stomach and small intestine when you eat to breakdown carbs, proteins and fats into nutrients you can absorb. They are especially important when recovering from injury as the body needs every nutrient it can get for healing.

Eating more, nutritious foods to get the extra nutrients needed by the body is important. The value of these extra nutrients, however, is only in their availability to the body. If they never make it into the blood, they do you no good.

It's why eating raw, fresh fruits and vegetables are important. They contain enzymes that help support digestion. This gives digestive enzymes a direct and indirect role in supporting the healing process.

- It directly supports healing by increasing the available amount of nutrients the body has.
- The indirect effect lies in your body's ability to focus on producing systemic enzymes as it needs fewer digestive enzymes to get the job done.



The importance of enzymes to healing is why more and more athletes have started supplementing with enzymes when recovering. Taking a digestive enzyme supplement like [Digest Infused](#) aids the body in maximizing digestion and absorption of nutrients needed for healing.

Digestive enzyme supplements aren't the only ones that support healing. Several systemic and proteolytic enzymes available via supplements are known to encourage speedier healing.

SYSTEMIC AND PROTEOLYTIC ENZYMES THAT SUPPORT HEALING

Proteases are one type of systemic enzyme known for their role in wound healing.^[1] They break down proteins which constitute the fibrin, blood vessels, tissue, immune cells and other components involved in the healing process. The term 'proteolytic enzymes' refers to this type of systemic enzyme.

There are different classes of proteases. For example, our systemic enzyme blend [Metabolic Infused](#) includes Protease I, II, and III. The human body produces proteases like these and many more for every type of purpose like keeping the blood clear of waste and, of course, wound healing.

Proteases made by the body or delivered by supplement, however, aren't the only enzymes known to support healing. Here are 6 more:



SEAPROSE.

Also known as protease-s, this proteolytic enzyme is well-known for the way it improves mucus break-down and helps with respiratory conditions. Researchers have noted it reduces pain and inflammation and improves overall healing.
[ii],[iii],[iv]

NATTOKINASE.

Bacteria called *Bacillus subtilis* produce this enzyme. The enzyme gets its name from natto, the Japanese fermented food these bacteria are involved in making. Nattokinase is a fibrinolytic enzyme, meaning it has a specific effect in breaking down fibrin, a key component in wound formation.

Fibrin must be removed consistently throughout the healing process to allow for repaired tissue to take its place. Scientists have observed that Nattokinase encourages healing with enhanced regeneration at the wound site.[v]

SERRATIOPEPTIDASE.

Here is another proteolytic enzyme. Known for its ability to reduce inflammation, it plays an essential role in healing. As one study noted, "Serratiopeptidase is a leading enzyme which has a very long history in medical [sic] as an effective anti-inflammatory drug." [vi]

BROMELAIN.

This protease enzyme has gotten a lot of attention from scientists in recent years. From pineapple, bromelain has been found to contribute to several stages of wound healing.[vii] Recent research indicates it can be an effective way to improve and speed recovery from athletic injury.[viii]



PAPAIN.

This proteolytic enzyme comes from raw papaya and is known to breakdown the toughest protein fibers. In trials, it has been shown to support the body's healing processes at different stages, a lot like bromelain.[ix] In a study using papain in a topical gel to treat skin wounds, researchers reported it reduced inflammation and improved the speed of tissue recovery.[x]

CATALASE.

Unlike the proteolytic enzymes listed here, catalase reduces hydrogen peroxide (H_2O_2). In wound healing, H_2O_2 plays an important role as a signaling molecule to initiate steps in the healing process.[xi]

Even so, H_2O_2 is a powerful oxidizing agent, making it a potentially harmful molecule that must be broken down once it's done its job. If it's not broken down, H_2O_2 creates free radicals, the molecules which cause damage to cells and DNA. Since injury and wound healing produce a lot of H_2O_2 , catalase is an essential systemic enzyme for recovery.

HOW TO GET ENOUGH ENZYMES TO ENSURE HEALING

The human body produces enzymes naturally. The challenge is by age 20, it starts producing less. Add in exposure to toxins, pre-existing injuries or conditions and other factors which may tax the digestive and immune systems and your body may struggle to keep up.

Consuming a lot of fresh, raw fruits and vegetables is one way to add important digestive enzymes to your diet. Eating natto, if it's to your taste, is one way to get a good source of Nattokinase. Pineapple and papaya are excellent fruits both for their enzymes and nutritional content of vitamins C and A.

Supplements like [Digest Infused](#) and [Metabolic Infused](#) are another way to ensure you get the enzymes you need. Digestive enzymes help to get you the nutrients you need. Systemic enzymes supply the body with enzymes it needs for healing. A big benefit of supplements is that you know the type and volume you're getting with every dose.

None of this is to say you shouldn't eat pineapple, papaya or natto. Rather if you are healing from an injury, the more you can do to support it, the faster you will heal. So eat fresh fruits and vegetables, get plenty of lean protein and healthy fats, and remember to help the process with plenty of digestive and systemic enzymes.



[1] Kurahashi, T.; Fujii, J. [Roles of Antioxidative Enzymes in Wound Healing](#). J. Dev. Biol. 2015, 3, 57-70.

[1] <https://www.clinimed.co.uk/wound-care/wound-essentials/phases-of-wound-healing>

[1] Yinwei Zhang, Liangwei Li, Yuan Liu, Zhi-Ren Liu. [PKM2 Released by Neutrophils at Wound Site Facilitates Early Wound Healing by Promoting Angiogenesis](#). Wound Repair and Regeneration, 2016; DOI: 10.1111/wrr.12411

[1] Sinclair RD, Ryan TJ. [Proteolytic enzymes in wound healing: the role of enzymatic debridement](#). Australas J Dermatol. 1994;35(1):35-41.

[1] Bracale G1, Selvetella L. [\[Clinical study of the efficacy of and tolerance to seaprose S in inflammatory venous disease. Controlled study versus serratiopeptidase\]](#). [Article in Italian] Minerva Cardioangiol. 1996 Oct;44(10):515-24.

[1] Fossati A. [Antiinflammatory effects of seaprose-S on various inflammation models](#). Drugs Exp Clin Res. 1999;25(6):263-70.

[1] Dindelli M1, et al. [\[Clinical effectiveness and safety of Seaprose S in the treatment of complications of puerperal surgical wounds\]](#). [Article in Italian] Minerva Ginecol. 1990 Jul-Aug;42(7-8):313-5.

[1] Zhang, Bin & Liu, Yuwan & Ji, Qian & Zhao, Mengmeng & Zeng, Jian & Liu, Lihua & Xu, Xiao & Yan, Yongmin & Gong, Aihua. (2017). [Nattokinase Crude Extract Enhances Cutaneous Wound Healing](#). Journal of Biomaterials and Tissue Engineering. 7. 1281-1286. 10.1166/jbt.2017.1697.

[1] Manju Tiwari. [The role of serratiopeptidase in the resolution of inflammation](#). Asian Journal of Pharmaceutical Sciences, Volume 12, Issue 3, 2017, Pages 209-215, ISSN 1818-0876. <https://doi.org/10.1016/j.ajps.2017.01.003>.

[1] Aichele K, et al. [Bromelain down-regulates myofibroblast differentiation in an in vitro wound healing assay](#). Naunyn Schmiedebergs Arch Pharmacol. 2013 Oct;386(10):853-63. doi: 10.1007/s00210-013-0890-z. Epub 2013 Jun 15.

[1] Harty PS, Cottet ML, Malloy JK, Kerkick CM. [Nutritional and Supplementation Strategies to Prevent and Attenuate Exercise-Induced Muscle Damage: a Brief Review](#). Sports Med Open. 2019;5(1):1. Published 2019 Jan 7. doi:10.1186/s40798-018-0176-6

[1] Leite AP, et al. [\[Use and effectiveness of papain in the wound healing process: a systematic review\]](#). [Article in Portuguese] Rev Gaucha Enferm. 2012 Sep;33(3):198-207.

[1] Figueiredo Azevedo F, et al. [Evaluating the Effect of 3% Papain Gel Application in Cutaneous Wound Healing in Mice](#). Wounds. 2017 Apr;29(4):96-101. Epub 2017 Jan 23.

[1] Kurahashi, T.; Fujii, J. [Roles of Antioxidative Enzymes in Wound Healing](#). J. Dev. Biol. 2015, 3, 57-70.

Share this:



Like this:

Like

Be the first to like this.



Want to stay up to date? Subscribe to our Newsletter!



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.

* Free US Standard shipping available only within the 48 Contiguous States

The information provided on this web site is for informational purposes only and is not intended as a substitute for advice from your physician or other health care professional. You should not use the information on this web site for diagnosis or treatment of any health problem or for prescription of any medication or other treatment. The information presented on this web site is not presented with the intent of diagnosing any disease or condition or prescribing any treatment. It is offered as information only, for use in the maintenance and promotion of good health in cooperation with a licensed medical practitioner. You should consult with a healthcare professional before starting any diet, exercise or supplementation program, before taking any medication, or if you are pregnant, nursing, or if you have or suspect you might have a health problem. You should not stop taking any medication without first consulting your physician. This

Web site contains links to Web sites operated by other parties. Such links are provided for your convenience and reference only. We are not responsible for the content or products of any linked site or any link contained in a linked site. Life Infused does not adopt any medical claims which may have been made in 3rd party references.

[TERMS OF USE](#) | [PRIVACY POLICY](#) | © 2018 Life Infused, LLC