

Wound Care Nutrition: The Recipe for Successful Wound Healing in Long Term Care

PRESENTER

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Disclosures

Dr. Nancy Collins PhD, RDN, LD, NWCC, FAND, faculty for this educational event discloses the following:

Abbott Nutrition – speaker’s bureau and consultant

Nutricia – speaker’s bureau

Medtrition – speaker’s bureau and consultant

All relevant financial relationships listed for this program have been mitigated.

Today's Objectives

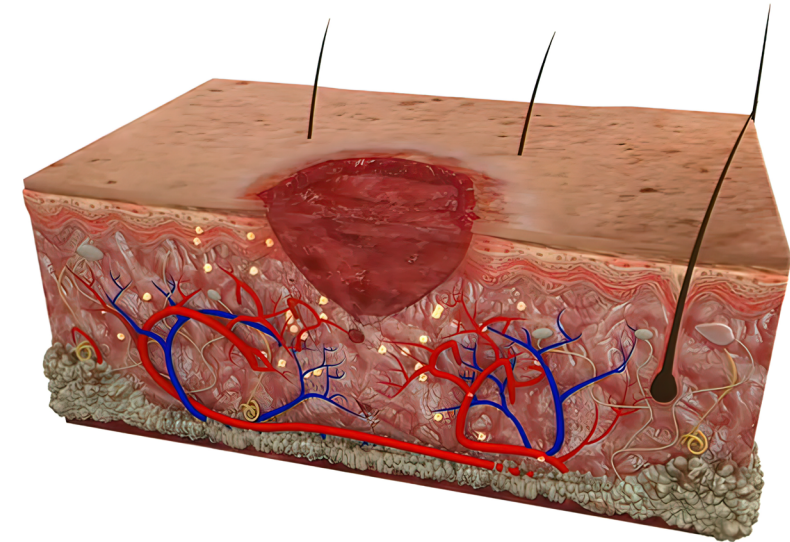
Describe	Describe the detrimental effects of malnutrition and loss of lean body mass on wound healing
Identify	Identify the key macro- and micronutrients needed to build new tissue
Illustrate	Illustrate the function of collagen dipeptides in the wound healing process



Skin Integrity Problems Come in Many Forms

A break in the continuity of any bodily tissue

- Pressure injury
- Diabetic ulcer
- Surgery
- Trauma
- Arterial or venous disease
- Sickle cell ulcer
- Burn



Goals of optimal healing:

- ✓ Proceeds in an orderly, timely fashion
- ✓ Newly built collagen needs to be strong and have tensile strength
- ✓ Closure should maintain physiologic function
- ✓ Scarring should be minimized

Why Don't All Wounds Heal in a Timely Manner?

- Co-morbidities
- Medications
- Lifestyle choices
- **Nutritional compromise**



Diagnosis: Malnutrition

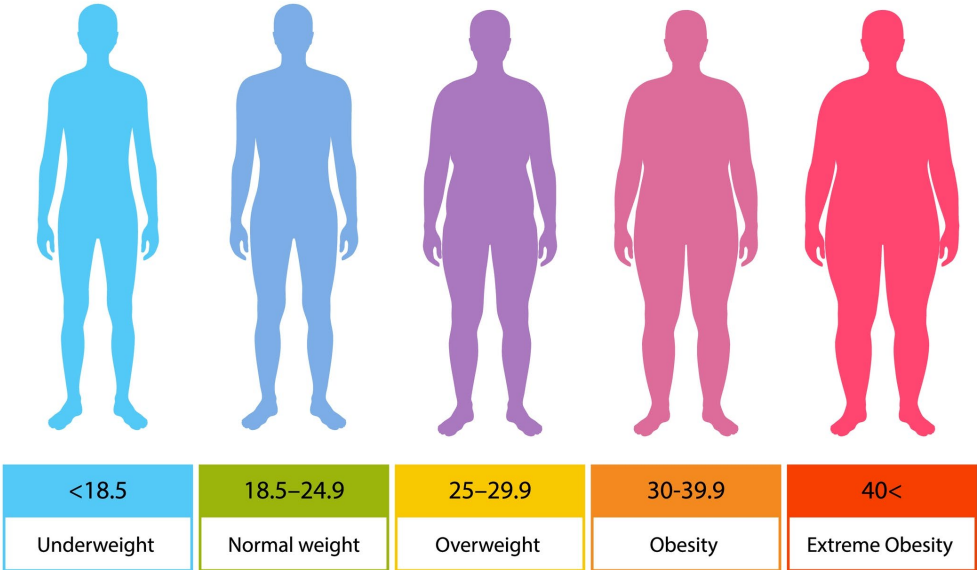
Two of Six Characteristics Recommended for Diagnosis

1. Insufficient energy intake
2. Weight loss
3. Loss of muscle mass
4. Loss of subcutaneous fat
5. Localized or generalized fluid accumulation that may sometimes mask weight loss
6. Diminished functional status as measured by handgrip strength



My Patient Did Lose Weight But Still Has a BMI of 32.

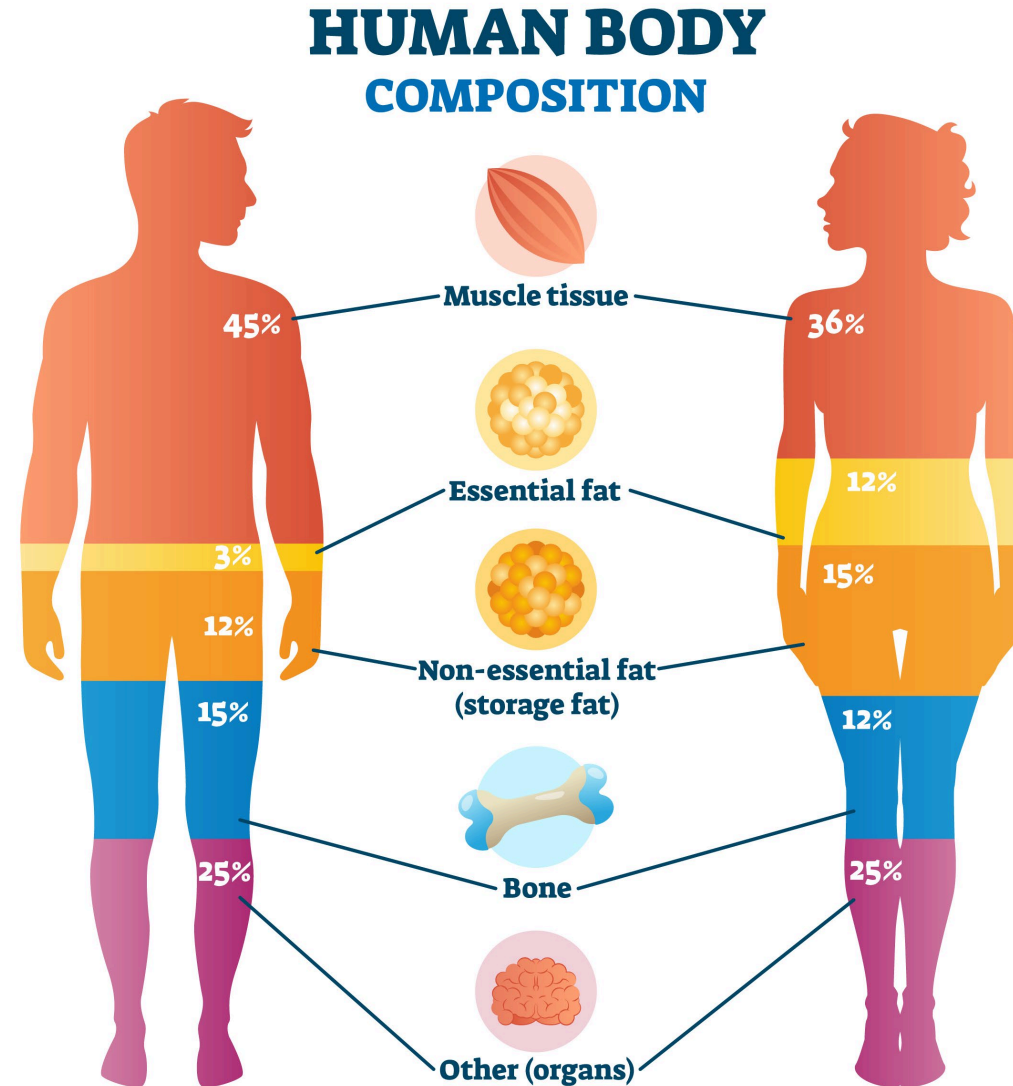
BODY MASS INDEX



Remember, scale weight does not tell the whole story!

Body Composition

Muscle mass
+ Fat
+ Bone
Total Body Weight



Loss of Lean Body Mass Leads To:

- Inability to heal and recover from surgery, illness, or disease¹
- Decreased strength and energy¹
- Loss of independence¹
- Increased risk of falls and fractures¹
- Impaired healing¹
- Reduced respiratory muscle strength²
 - In patients with COPD



My patient doesn't have much appetite and is losing weight. What should I do?



You Must Find the Underlying Cause

Root causes are underlying causes

- Root causes are specific
- Root causes are addressable
- Root causes are identified when you cannot answer “why?” anymore
- Root causes are not people



The Five Whys Approach

- My patient's pressure injury is not healing.
Why is that?
- Because he has lost 20 pounds since getting the wound. **Why is that?**
- Because he eats only bites at each meal.
Why is that?
- Because he says he gets nauseated after eating.



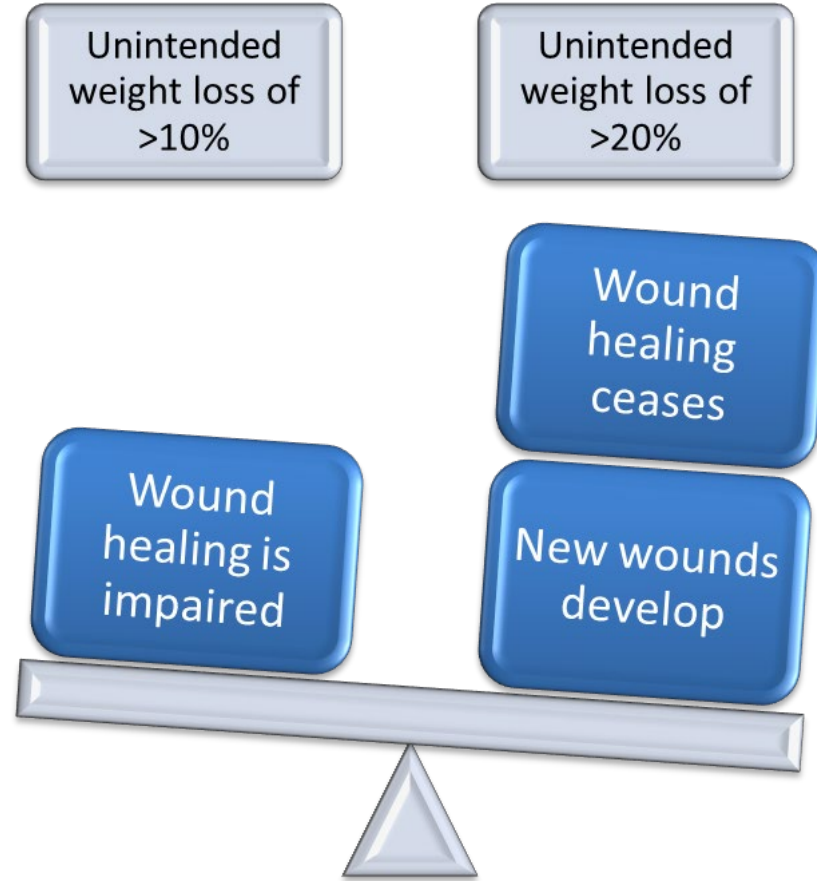
10 Common Reasons For Unintended Weight Loss



1. Dislikes the food/cultural preferences
2. Nausea or stomach issues
3. Dental problems
4. Swallowing problems
5. Depression
6. Requires mealtime assistance
7. Decreased smell and taste
8. End of life
9. Hypermetabolic
10. Medication side effects

Each of these causes requires a very different intervention!

Relationship Between Weight Loss and Wound Healing



Two WRONG Ways to Document Unintended Weight Loss



- Using “above ideal body weight” as a justification that weight loss is acceptable
- Adding more food for a person who is not consuming the food already being served
 - Must do a root cause analysis



Documenting Declining Body Weight

- Weight loss is anticipated due to...
- Communicated to family and team
- Discussion on enteral nutrition
- Hospice services does not mean discontinuation of nutrition care





Violations in Standard of Care

Did not:

- Identify nutritional risk
- Prevent weight loss, dehydration, wounds
- Treat in a timely manner
- Use appropriate supplements, vitamins, treatments, etc.
- Provide adequate nutrition and hydration
- Follow MD orders
- Communicate and document adequately

Recommended Caloric Intake

➤ **30 – 35** calories/kg body weight

....for an adult at risk of a pressure injury or with an existing pressure injury who is assessed to be at risk of malnutrition when compatible with goals of care, and reassess as condition changes...



Food First

- Encourage high protein foods
- Favorite and culturally appropriate foods
- Diet liberalization policies
- Proper dining environment
- Assistance and encouragement as needed





Oral Nutrition Supplements

Find something the patient enjoys and will consume!

- Many flavor profiles and forms available
- High calorie
- High protein
- Protein modular supplement
- Collagen dipeptides
- Arginine/Citrulline

Recommended Protein Intake

- **1.25 to 1.5** grams protein/kg body weight

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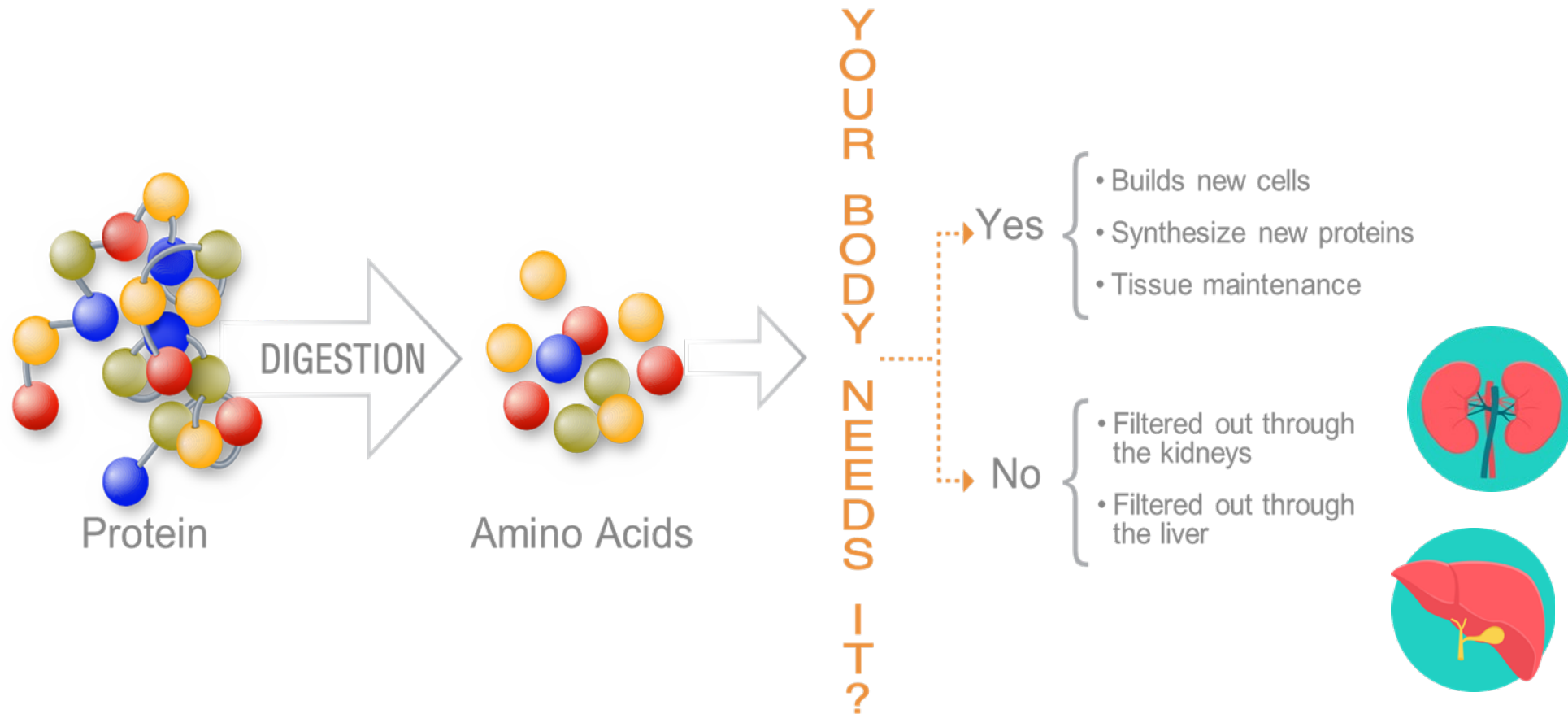
The Macronutrients = Protein, Carbohydrates, Fat



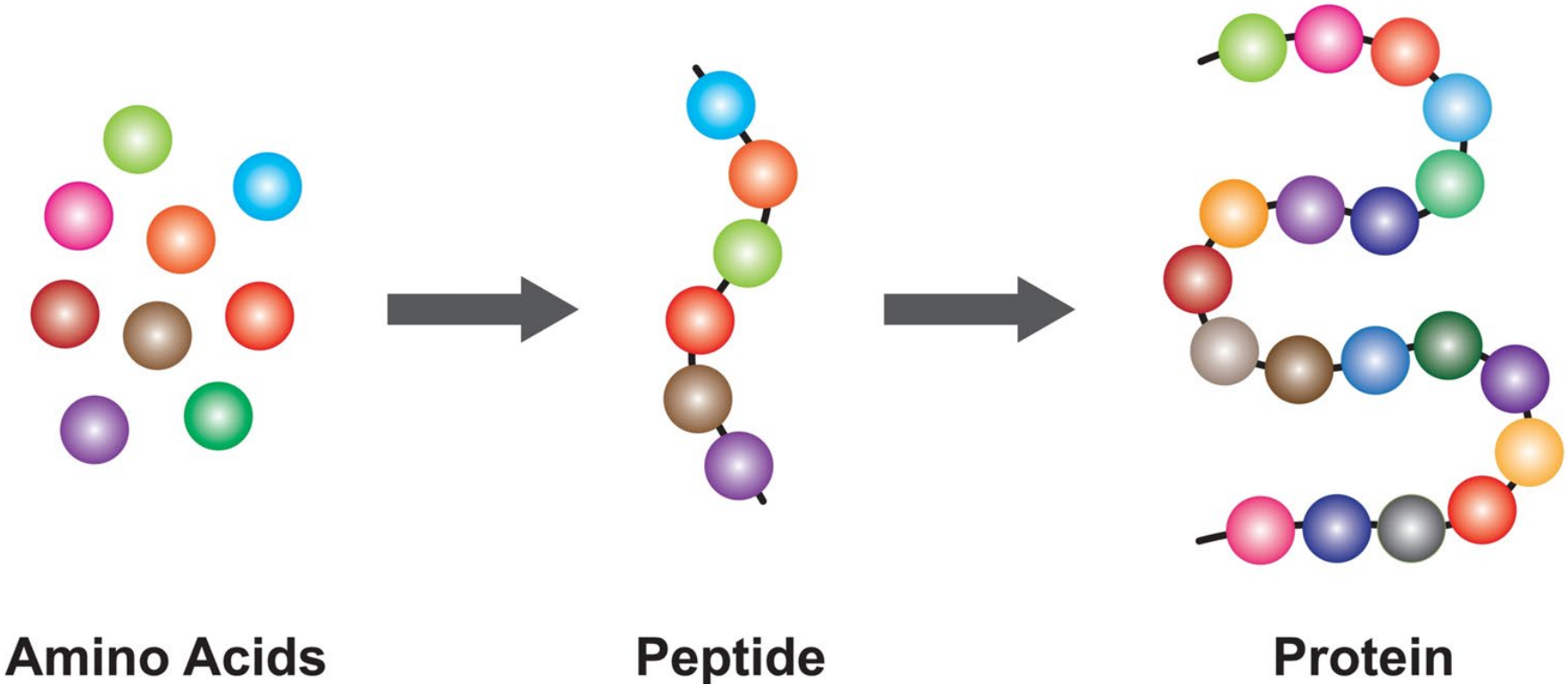
Protein is the key
macronutrient!

What's the Difference Between Protein and Amino Acids?

Fact: Protein is made up of amino acids



How Amino Acids Form Protein



Collagen Di-Peptides Specific to Wound Healing

- Readily absorbed through the wall of small intestine
- PO is a low molecular weight fibroblast-initiating factor
- Enhances wound healing by stimulating the growth of p75NTR-positive fibroblasts
- Promotes hyaluronic acid synthesis, required for maintaining dermal integrity

Pro-Hyp
prolyl-hydroxyproline



Hyp-Gly
Hydroxyprolyl-Glycine

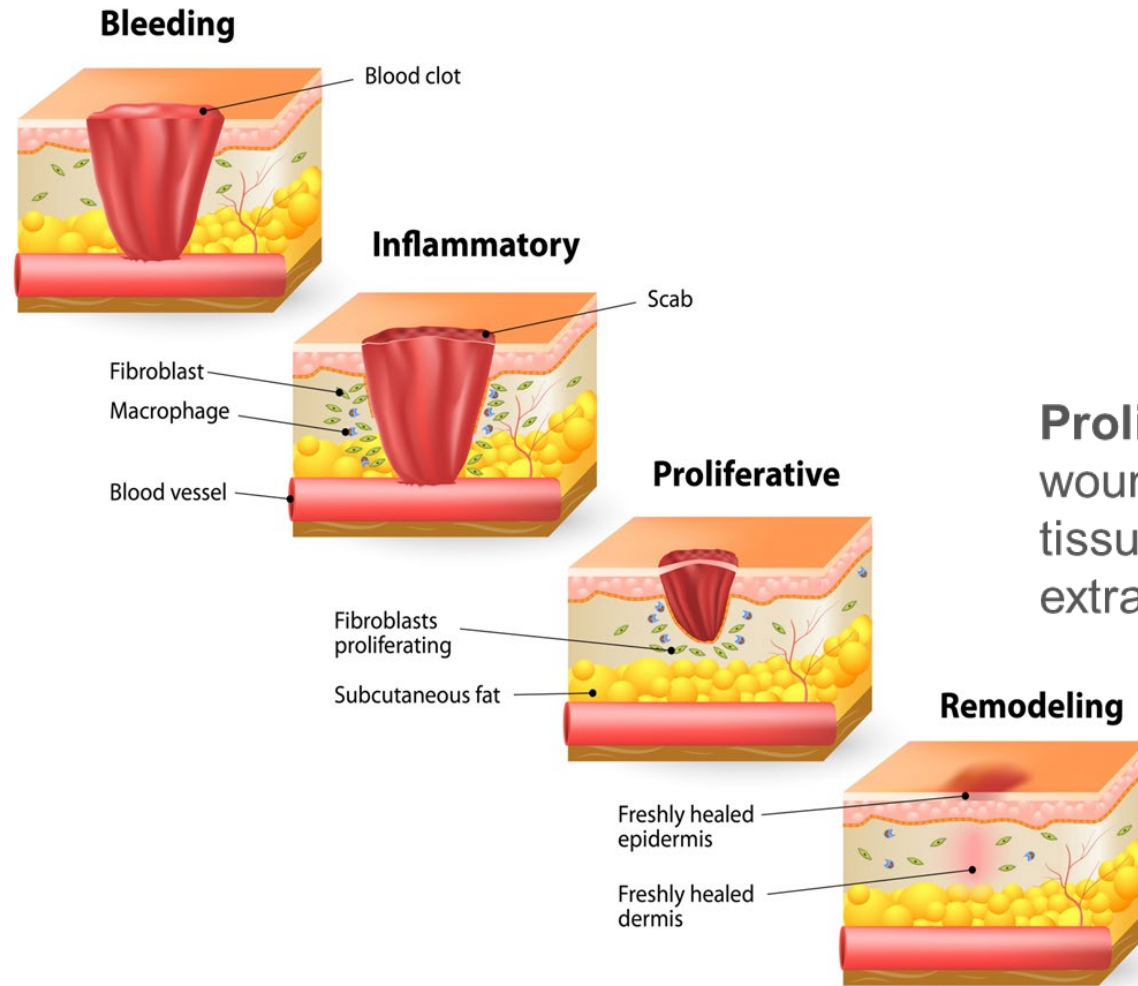


Not easily degraded

- PO is twisted
- OG is stacked

WOUND HEALING

- ✓ Granulation tissue fills in the wound bed
- ✓ Fibroblasts lay collagen in the wound bed, strengthening new granulation tissue
- ✓ Epithelial cells migrate from the wound margins



Proliferative phase: when the wound is rebuilt with new tissue made up of collagen and extracellular matrix

SCIENTIFIC REPORTS

OPEN

Ingestion of bioactive collagen hydrolysates enhanced pressure ulcer healing in a randomized double-blind placebo-controlled clinical study

Received: 2 February 2018

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Fumihito Sugihara¹, Naoki Inoue¹ & Sriiram Venkateswarathirukumara²

We conducted a double blind, multi-centric, placebo-controlled, randomized trial to compare the Pressure Ulcer Scale for Healing (PUSH) and Pressure Sore Status Tool (PSST) scores and wound area measurements at 16 weeks of subjects with pressure ulcers who were given standard care plus one of two types of collagen hydrolysate (CH-a), which contained low levels of prolylhydroxyproline (Pro-Hyp) and hydroxyprolylglycine (Hyp-Gly), and CH-b, which contained high levels of Pro-Hyp and Hyp-Gly with the placebo group. A total of 120 subjects with stage II or III pressure ulcers were entered into the trial and 112 subjects completed the study. The subjects were randomized to receive CH-a (n = 39), CH-b (n = 39), or a placebo (n = 42) twice daily (10 g per day) for 16 weeks. The PUSH score, PSST score, and wound area of the CH-b group were significantly lower than the placebo group at week 16 (PUSH score, $P < 0.001$; PSST score, $P < 0.01$; wound area, $P < 0.05$). The PUSH score of the CH-a group was significantly lower than the placebo group at week 16 ($P < 0.05$). This study demonstrated that CH-b ingestion helps healing of pressure ulcers as an add-on to the standard therapy.

Collagen Dipeptides in Pressure Injury Healing

DESIGN

- 16 week double blind study
- Multi-center
- n = 120 enrolled
- n = 112 completed

INTERVENTION

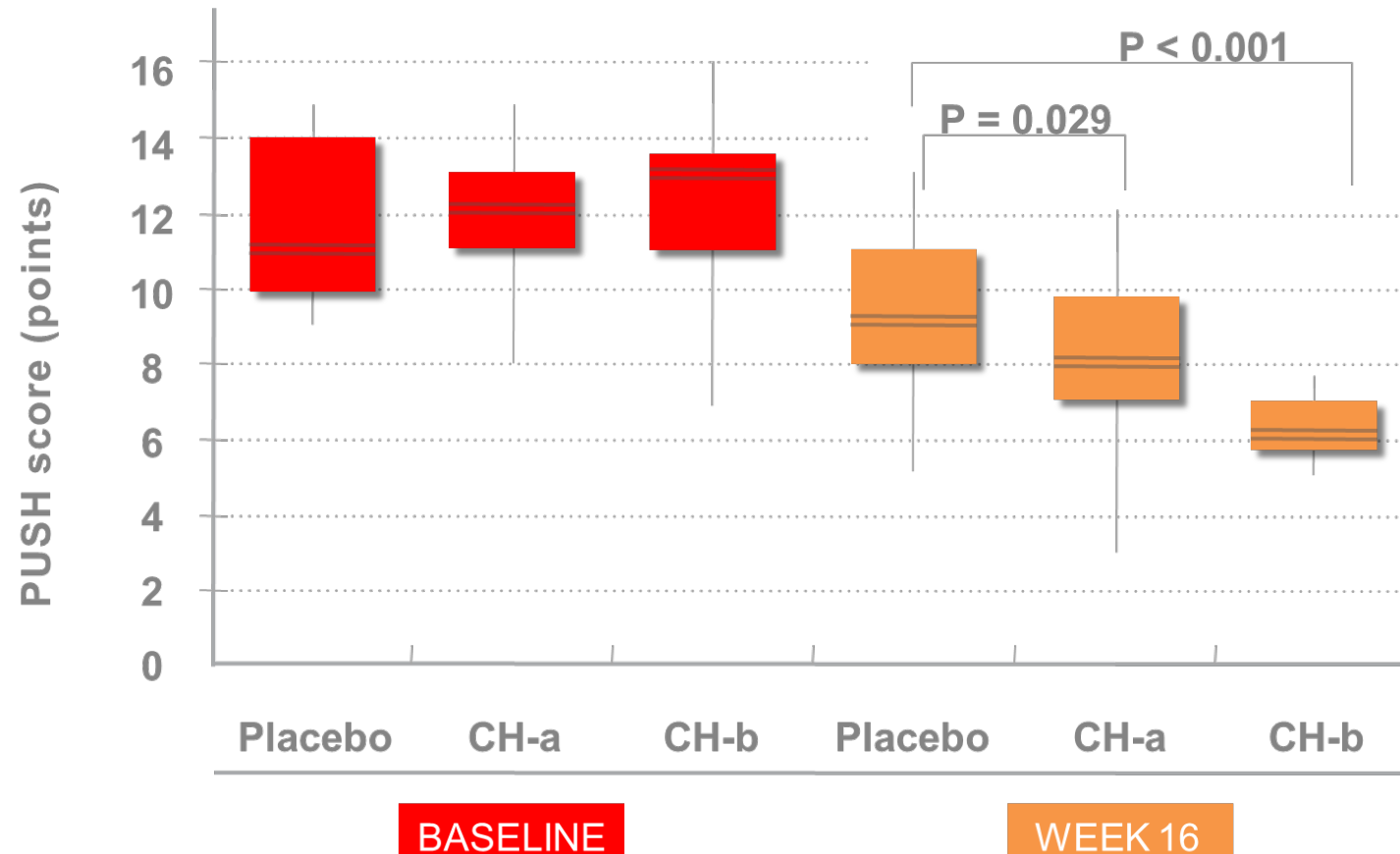
- Three randomized study groups
 1. CH-a (n = 39) Low level of PO and OG
 2. CH-b (n = 39) High level of PO and OG
 3. Placebo (n = 42)
- Twice daily (10g per day) for 16 weeks

OUTCOME

- Measure
 1. PUSH score
 2. PSST score
 3. Wound area

Results:

Pressure Ulcer Scale for Healing (PUSH) Score



CH-a = Ordinary collagen hydrolysate

CH-b = collagen hydrolysate with high concentration of PO and OG

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“These results suggest that although all CH are derived from similar raw materials, it might be possible to control the healing effects of CH on pressure ulcers by altering their dipeptide content...”

“These findings suggest that the PO and OG absorbed into the blood after the ingestion of CH act on **fibroblasts** in the dermal layers of pressure ulcers and also might affect stem cells, resulting in re-epithelialization and improved healing”.

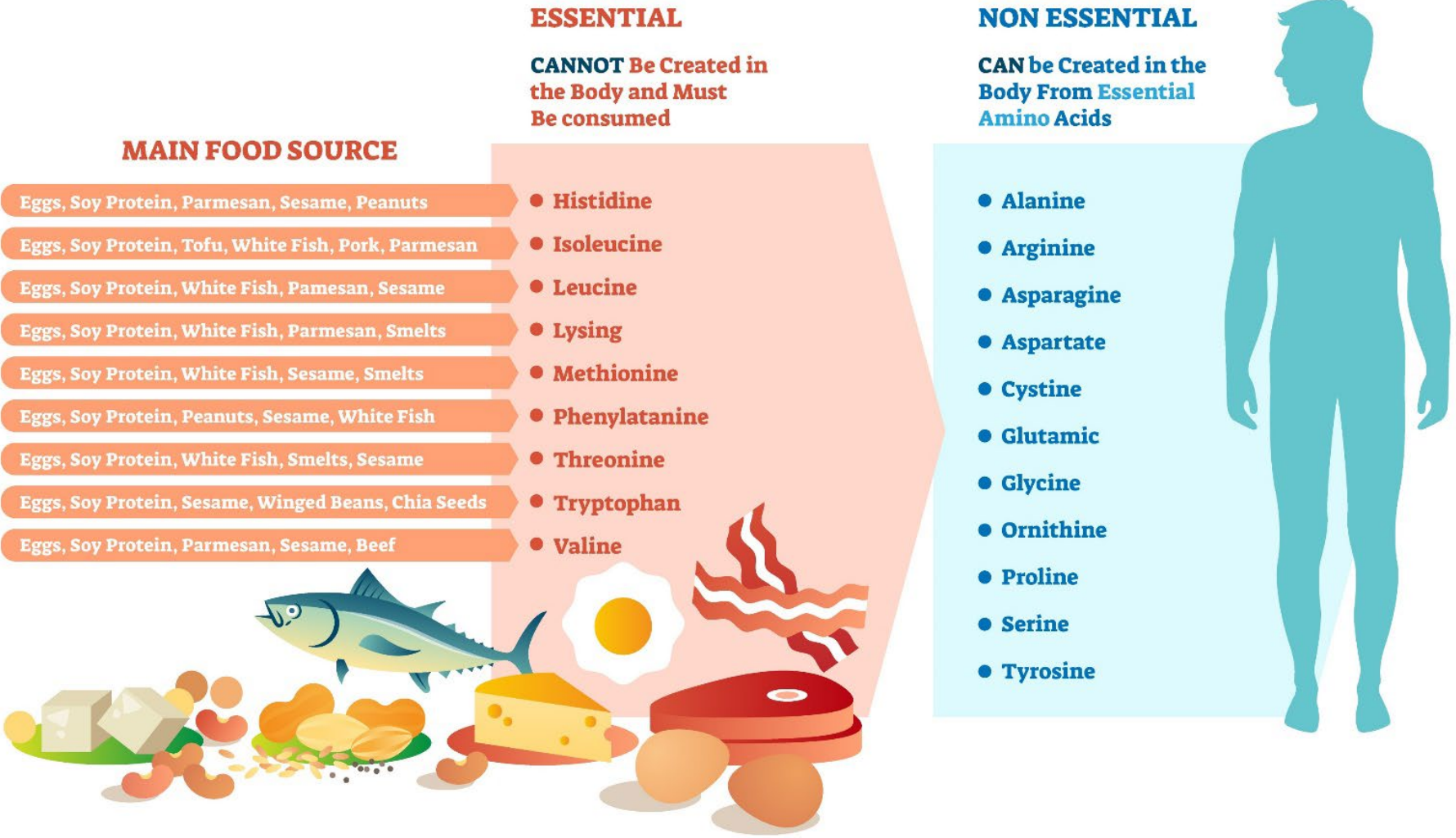
Sugihara F, Inoue N & Venkateswarathirukumara S. Ingestion of bioactive collagen hydrolysates enhanced pressure ulcer healing in a randomized double-blind placebo-controlled clinical study. *Sci Rep* 8, 11403 (2018).

<https://doi.org/10.1038/s41598-018-29831-7>

Protein in Patients with Declining Renal Function

Source	CKD stages 3-5, no diabetes	CKD stages 3-5 with diabetes
Protein	0.55-0.6 g/kg BW/day Or 0.28-0.43 g dietary protein/kg BW/day with additional ketoacid/amino acid analogs to meet first recommendation	0.6-0.8 g/kg BW/day

Categories of Amino Acids



Arginine Functions in Wound Healing

- Under stress arginine becomes essential
- Role in protein synthesis¹
 - Promotes cell division
 - Hormone release
- Stimulates T cell response²
 - Helps prevent infection
 - Promotes cell division
- Nitric oxide production¹
 - Promotes blood flow

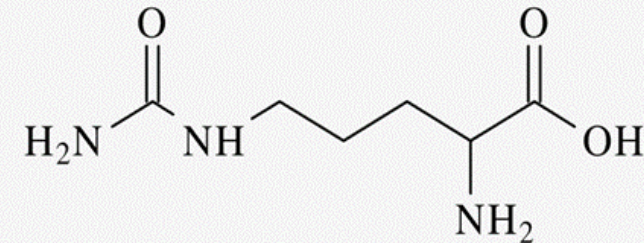


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2. Saghaleini SH, Dehghan K, Shadvar K, Sanaie S, Mahmoodpoor A, Ostadi Z. Pressure ulcer and nutrition. Indian J Crit Care Med 2018;22(4):283–9.

L-Citrulline

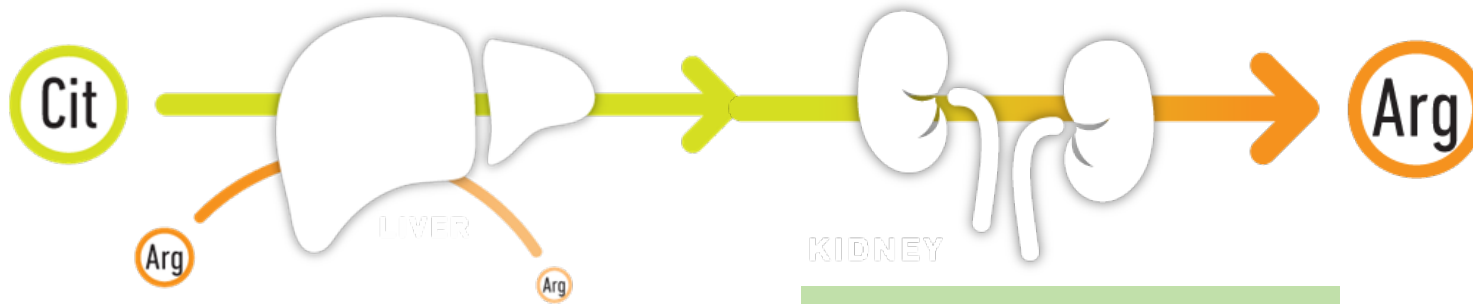
- Has been suggested as an alternative to increase arginine availability due to drawbacks of arginine
 - First pass metabolism
 - GI complaints
 - Use in critically ill
- Natural arginase inhibitor

L-CITRULLINE



1. Agarwal U, Didelija IC, Yuan Y, Wang X, Marini JC. Supplemental Citrulline Is More Efficient Than Arginine in Increasing Systemic Arginine Availability in Mice. *J Nutr.* 2017;147(4):596-602. doi:10.3945/jn.116.240382
2. Shatanawi A, Momani MS, Al-Aqtash R, Hamdan MH and Gharaibeh MN (2020) L-Citrulline Supplementation Increases Plasma Nitric Oxide Levels and Reduces Arginase Activity in Patients With Type 2 Diabetes. *Front. Pharmacol.* 11:584669. doi: 10.3389/fphar.2020.584669

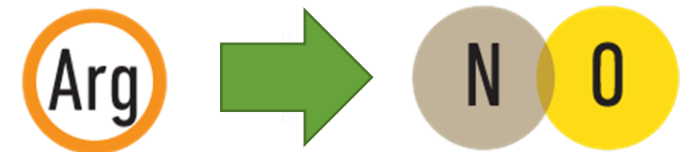
L-Citrulline Is a Powerful Stimulator of Nitric Oxide



L-citrulline is easily absorbed unchanged

Ingested L-arginine - 40% is filtered and removed

L-citrulline is converted to **bioavailable arginine** in the kidneys



Arginine stimulates the production of nitric oxide bringing blood flow to the wound site

What About Vitamins and Minerals?
Should I be instructing my patients to take any?



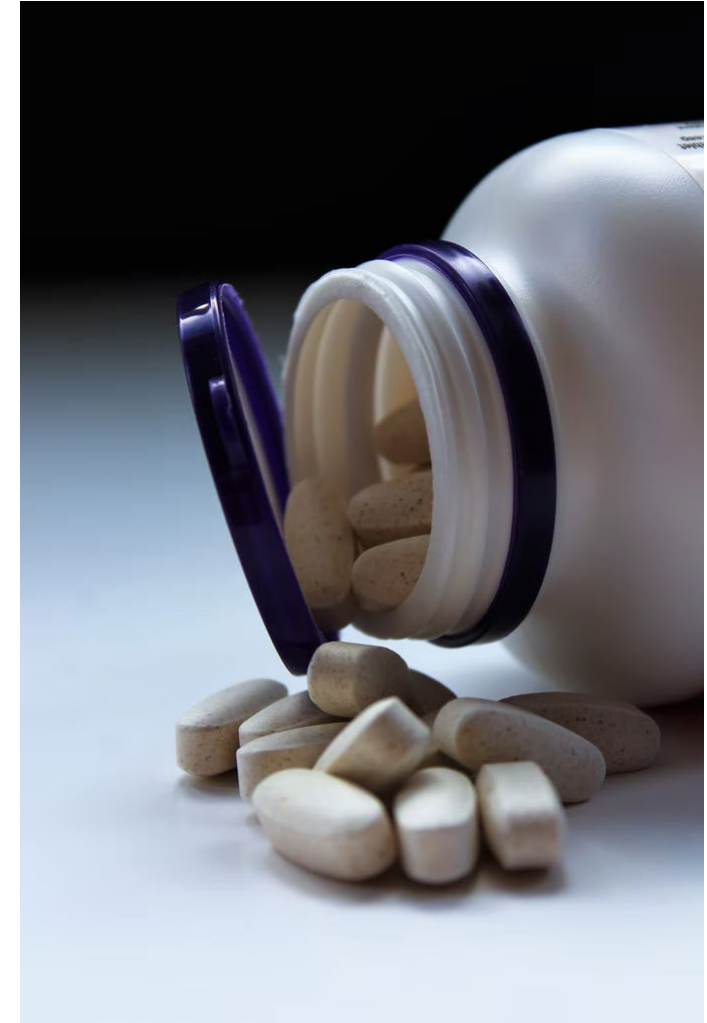
Vitamins and Minerals

Most nutrient needs can be met through a healthy diet

BUT

Most don't consume an optimal diet every day

Provide/encourage an individual assessed to be at risk of or with a pressure ulcer to take vitamin and mineral supplements when dietary intake is poor or deficiencies are confirmed or suspected



Vitamin C^{1,2}

- Co-factor in proline and lysine hydroxylation, a necessary step in the formation of collagen
- Provides tensile strength to newly built collagen
- Immune function
- Antioxidant to inhibit damage to body cells
- Necessary for the synthesis of carnitine, a molecule essential for the transport of fat to mitochondria
- Protects iron in the intestines from oxidation and promotes absorption
- Protects vitamin E in the blood from oxidation and may recycle it to its active form



1. Shai A, Maibach HI. *Wound Healing and Ulcers of the Skin*. Heidelberg, Germany: Springer Verlag;2005:230.
2. Moores J. Vitamin C: A wound Healing Perspective. *Br J Community Nurs*. 2013 Dec;Suppl:S6, S8-11. Available at <https://www.ncbi.nlm.nih.gov/pubmed/24796079>.

Vitamin C Dosage

- RDA for vitamin C
 - 75 mg/day for adult women
 - 90 mg/day for adult men
- The UL is 2000 mg/day
- Toxic levels are unlikely to occur, but high doses of vitamin C can have adverse effects such as nausea, abdominal pain, and diarrhea



Foods High in Vitamin C

Papaya

Bell pepper

Broccoli

Brussels sprouts

Strawberry

Pineapple

Orange

Kiwi

Cantaloupe

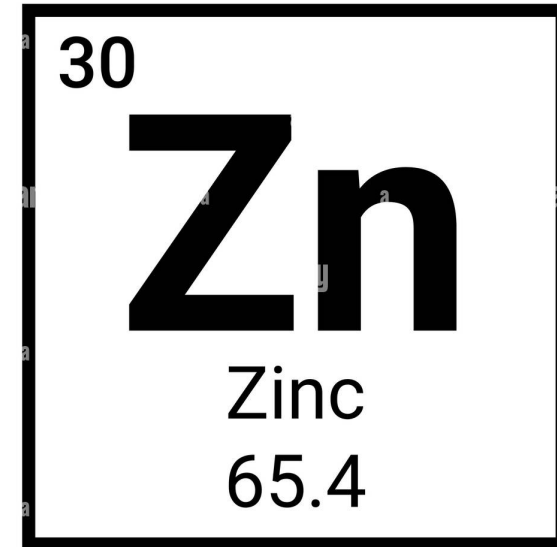
Cauliflower



Foods Highest in Vitamin C. Data is sourced from the USDA ARS database www.myfooddata.com

Zinc

- Co-factor for many metalloenzymes required for cell membrane repair, cell proliferation, growth and immune system function
- Co-factor for RNA and DNA polymerase
 - involved in DNA synthesis, protein synthesis, and cellular proliferation
- Zinc levels can be depleted in levels of severe stress and trauma



Zinc Dosages



- Studies of zinc supplementation for wound healing range from 15 to 60 mg/day
 - Look at cumulative daily zinc intake
- The RDA for zinc
 - 8 mg/day for adult women
 - 11 mg/day for adult men
- The UL is 40 mg/day for adult men and women
 - Doses >40 mg/day can adversely affect copper status and possibly result in anemia

Foods High in Zinc

Oysters

Chicken leg

Lean pork chops

Lentils

Oatmeal

Beef (chuck)

Firm tofu

Hemp seeds

Wheat germ

Mushrooms



Foods Highest in Zinc. Data is sourced from the USDA ARS database
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Applying This to *Your* Practice

- ✓ Recognize nutritional needs are elevated for wound healing
- ✓ Look for malnutrition and document it
- ✓ Look beyond scale weight
- ✓ Educate on the link between food and healing
- ✓ Find enjoyable supplements that can be consumed every day until healed



Time for Questions, Thoughts, Comments



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Advocating. Nourishing. Healing.

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