HEALING FROM WITHIN

THE CRUCIAL ROLE OF NUTIRTION AND WOUND RECOVERY

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Director of Nutirtion, Medtrition

DISCLOSURE

Karen Sudders MS, RD, LDN is an employee of Medtrition Inc

This presentation is for educational purposes only. The ideas shared are my own and do not necessarily represent the views of SCAND or Medtrition Inc

OBJECTIVES

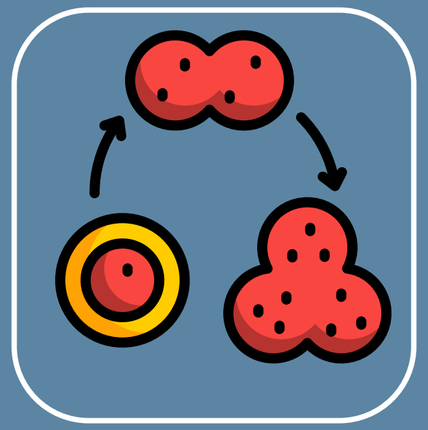
- Understand the physiological process of wound healing
- Explore the impact of macronutrients and micronutrients on recovery
- Identify nutritional strategies to optimize wound healing
- Discuss evidence-based dietary recommendations
- Case study discussion

Karen Sudders MS, RD, LDN

OVERVIEW OF WOUND HEALING STAGES

HEMOSTASIS

INFLAMMATION



PROLIFERATION

REMODELING (MATURATION)

Rodrigues et al., 2018

HEMOSTASIS PHASE

Initial response to injury – blood clot formation

Importance of vitamin K and calcium in clotting mechanisms

Protein’s role in clot stabilization

Rodrigues et al., 2018

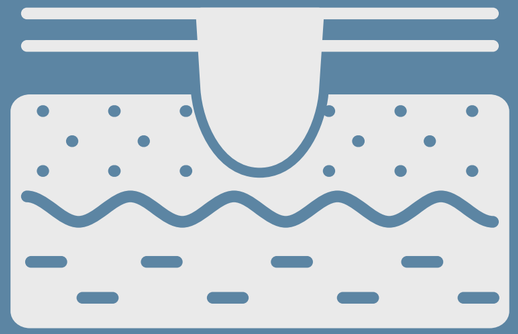
INFLAMMATION PHASE

Activation of immune response

Role of antioxidants in reducing oxidative stress

Omega-3 fatty acids and their impact on inflammation control

Rodrigues et al., 2018



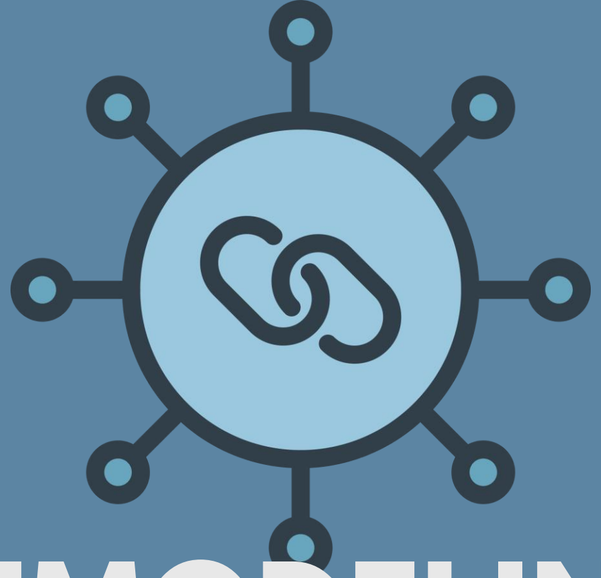
PROLIFERATION PHASE

Fibroblast activity and collagen synthesis

Importance of vitamin C and zinc in new tissue formation

Energy demands for cellular replication

Rodrigues et al., 2018



REMODELING (MATURATION) PHASE

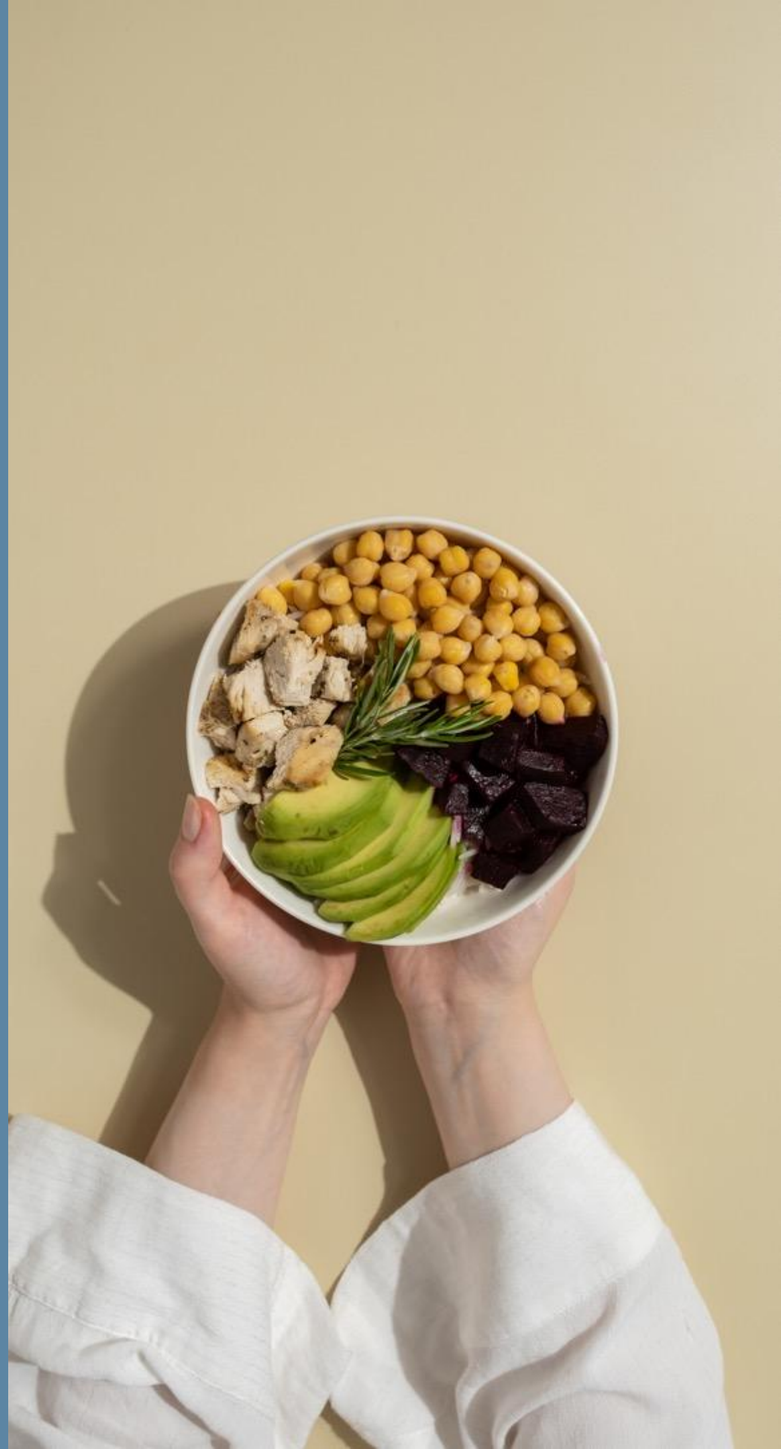
Long-term tissue repair and strengthening

The role of collagen cross-linking

Importance of adequate protein intake for final wound strength

Rodrigues et al., 2018

Nutritional Intervention and Screening



MALNUTRITION AND WOUNDS

Malnutrition adversely affects the physiological response to infection through the loss of immune function, predisposes people to skin infections by rendering the skin thin and friable so more susceptible to wound development, increases the likelihood of pressure wound development through loss of subcutaneous fat over pressure points and increasing immobility through a lack of energy reserves, and reduces the collagen synthesis essential to healing....

Ghaly, P.et al. 2021.

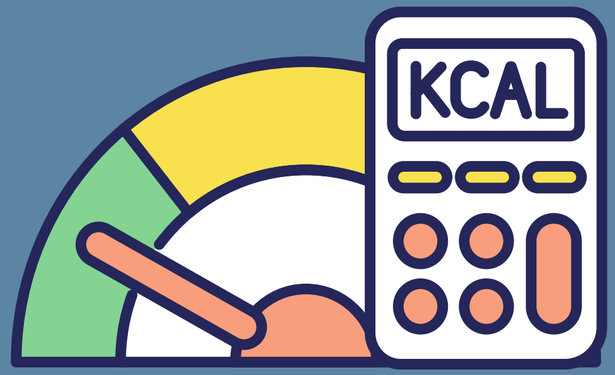
NPIAP GUIDELINES

EUROPEAN PRESSURE ULCER ADVISORY PANEL, NATIONAL PRESSURE INJURY ADVISORY PANEL, PAN PACIFIC PRESSURE INJURY ALLIANCE. PREVENTION AND TREATMENT OF PRESSURE ULCERS/INJURIES. HAESLER E, ED. 3RD ED. EPUAP/NPIAP/PPPIA; 2019.

NPIAP GUIDELINES

Calories	30- 35 kcal/ kg
Protein	1.25-1.5 grams per kilogram of body weight
Hydration	30 ml/ kg of body weight
Micronutrients	Arginine, zinc, and antioxidants

EUROPEAN PRESSURE ULCER ADVISORY PANEL, NATIONAL PRESSURE INJURY ADVISORY PANEL, PAN PACIFIC PRESSURE INJURY ALLIANCE. PREVENTION AND TREATMENT OF PRESSURE ULCERS/INJURIES. HAESLER E, ED. 3RD ED. EPUAP/NPIAP/PPPIA; 2019.



CALORIE GOALS

....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...

EUROPEAN PRESSURE ULCER ADVISORY PANEL, NATIONAL PRESSURE INJURY ADVISORY PANEL, PAN PACIFIC PRESSURE INJURY ALLIANCE. PREVENTION AND TREATMENT OF PRESSURE ULCERS/INJURIES. HAESLER E, ED. 3RD ED. EPUAP/NPIAP/PPPIA; 2019.

HYDRATION AND WOUND HEALING

- Importance of maintaining fluid balance
- Signs of dehydration and its impact on skin integrity
- Strategies to ensure adequate hydration

NPIAP:
30ML PER KG BODY WEIGHT OR AS CLINICALLY APPRORPAITE

EUROPEAN PRESSURE ULCER ADVISORY PANEL, NATIONAL PRESSURE INJURY ADVISORY PANEL, PAN PACIFIC PRESSURE INJURY ALLIANCE. PREVENTION AND TREATMENT OF PRESSURE ULCERS/INJURIES. HAESLER E, ED. 3RD ED. EPUAP/NPIAP/PPPIA; 2019.

MACRONUTRIENTS IN WOUND HEALING

PROTEIN

Essential for tissue repair, collagen synthesis, immune response

CARBOHYDRATES

Provide energy for cellular repair

FATS

Important for cell membrane integrity and inflammation modulation

Wolfe, 2006
Demling, 2009
Posthauer et al., 2017

PROTEIN SOURCES AND REQUIREMENTS

HIGH-QUALITY PROTEIN SOURCES
(LEAN MEATS, DAIRY, LEGUMES)

RECOMMENDED PROTEIN INTAKE FOR WOUND HEALING
1.25-1.5 GRAMS / KG BODY WEIGHT

SPECIAL CONSIDERATIONS FOR PATIENTS WITH RENAL DISEASES

WHITE ET AL., 2012

KEY MICRONUTRIENTS FOR WOUND HEALING

VITAMIN C

Collagen synthesis and immune function

ZINC & COPPER

Cell proliferation and immune support

VITAMIN C AND WOUNDS

Essential for Hydroxylation of proline and lycine in collagen synthesis

Immune System Function to Fight Infection

Inflammatory Response

Clinical evidence shows that vitamin C supplementation enhances wound closure rates

Moores, 2013

Supplementation recommendations:

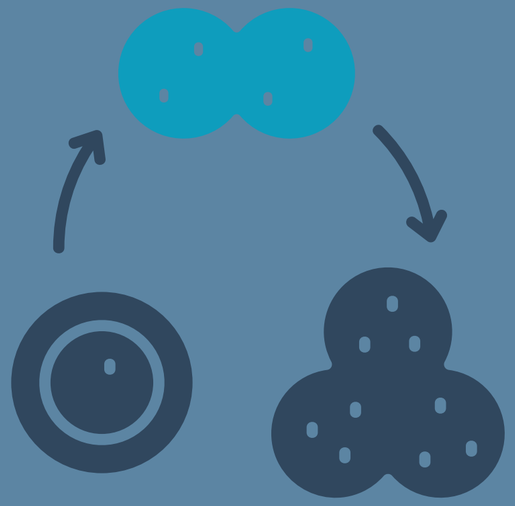
Adults: 75 mg/day (women), 90 mg/day (men)

Higher doses (500-1000 mg/day) may be beneficial in wound healing
UL-2000mg/day

Considerations for supplementation in at-risk populations (elderly, smokers, individuals with chronic wounds)

CKD/ ESRD on HD should not exceed 60mg/ day due to risk of oxalate development

Moores, 2013.
NIH, 2023.
Kalantar-Zadeh, K et.al. 2013.



ZINC SUPPLEMENTATION

ZINC PLAYS A VITAL ROLE IN:

CELL PROLIFERATION AND IMMUNE FUNCTION

COLLAGEN SYNTHESIS AND TISSUE REPAIR

DEFICIENCY LINKED TO DELAYED WOUND HEALING AND INCREASED INFECTION RISK

LIN ET AL., 2018

Zinc and Copper Balance

EXCESS ZINC INTAKE CAN LEAD TO COPPER DEFICIENCY,
IMPAIRING WOUND HEALING

SUPPLEMENTATION RECOMMENDATIONS:
ZINC: 15–40 MG/DAY IN WOUND HEALING
COPPER: 1–3 MG/DAY TO MAINTAIN BALANCE

NIH, 2023

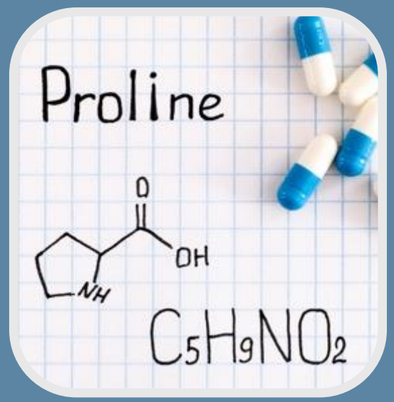
AMINO ACIDS AND THEIR ROLE

ARGININE

Enhanced nitric oxide production and circulation

CITRULLINE

More efficient way to enhanced nitric oxide production and circulation



PROLINE & HYDROXYPROLINE

Essential for collagen formation

Wolfe, 2006
Demling, 2009
Posthauer et al., 2017

ARGININE AND CITRULLINE

Arginine

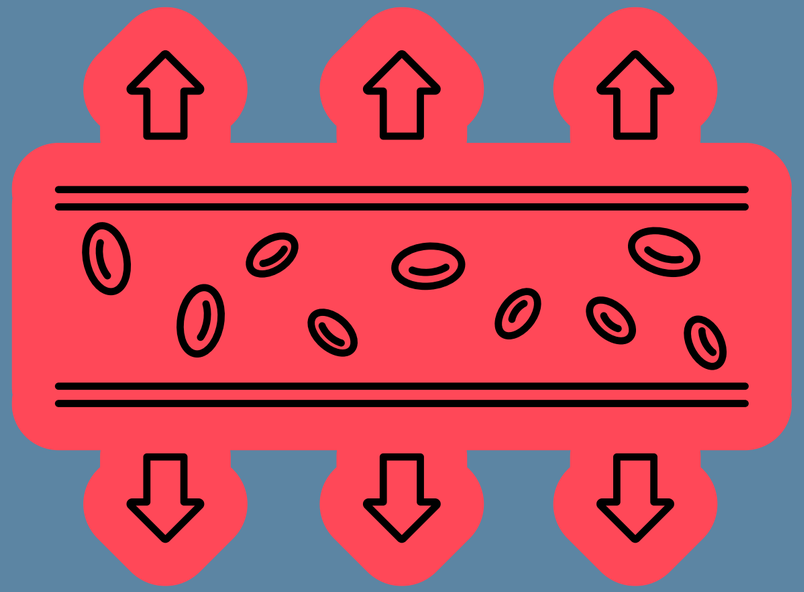
- ARGININE AS A CONDITIONALLY ESSENTIAL AMINO ACID
- SUPPORTS COLLAGEN SYNTHESIS AND IMMUNE FUNCTION
- ENHANCES NITRIC OXIDE (NO) PRODUCTION FOR VASODILATION
- SUPPLEMENTATION RECOMMENDATIONS: 4.5–9 G/DAY FOR WOUND HEALING SUPPORT

Citrulline

- CITRULLINE AS A PRECURSOR TO ARGININE IN NO SYNTHESIS
- MORE EFFECTIVE AT INCREASING SYSTEMIC ARGININE AVAILABILITY
- POTENTIAL BENEFITS IN CHRONIC WOUND HEALING
- RECOMMENDED DOSAGE: 3–6 G/DAY (

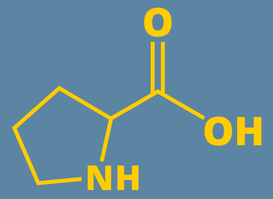
Shatanawi et al., 2020
Agarwal et al., 2017

NITRIC OXIDE (NO) AND WOUND HEALING



- NO ENHANCES BLOOD FLOW TO WOUND SITES, DELIVERING OXYGEN AND NUTRIENTS
- SUPPORTS IMMUNE CELL FUNCTION AND ANGIOGENESIS
- ARGININE-CITRULLINE INTERPLAY IN NO PRODUCTION
- POTENTIAL THERAPEUTIC APPLICATIONS IN WOUND MANAGEMENT

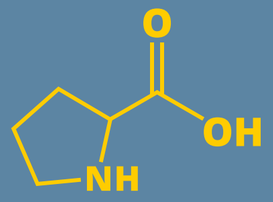
SHATANAWI ET AL., 2020



PROLINE AND HYDROXYPROLINE

- Proline: A key amino acid necessary for collagen stability and structure
- Hydroxyproline: A hydroxylated form of proline crucial for collagen cross-linking
    - **Deficiencies may lead to weakened skin and delayed healing**

Sato et al., 2020

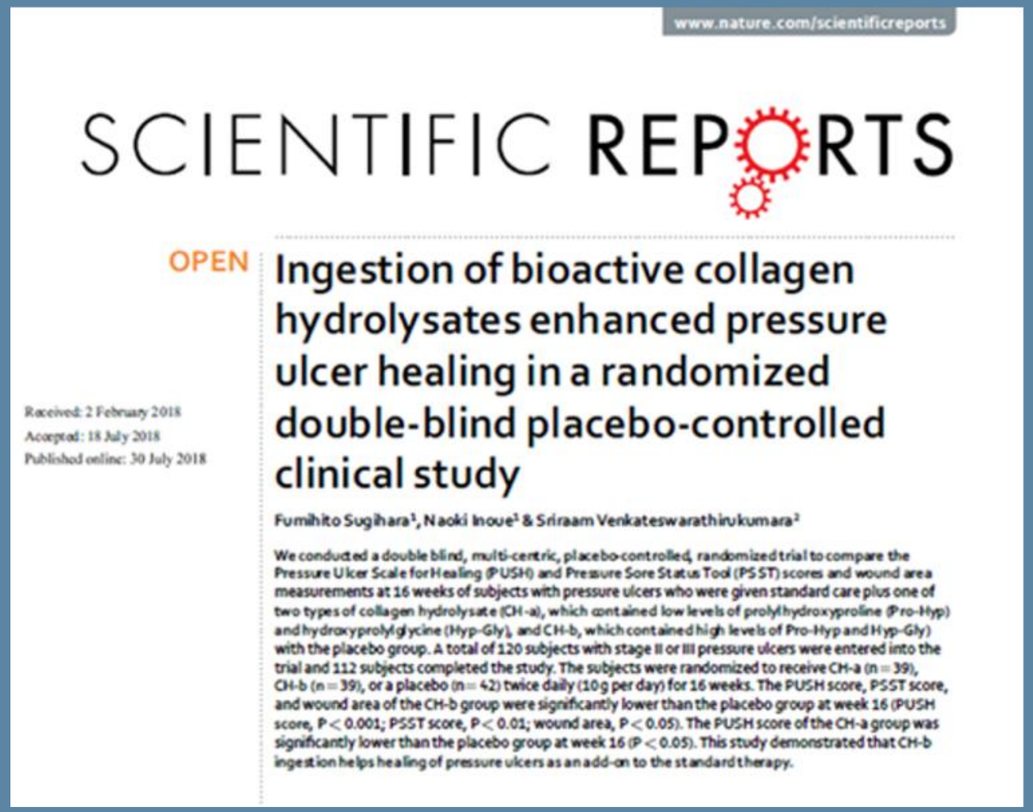


DIETARY SOURCES PROLINE AND HYDROXYPROLINE

Proline: Meat, dairy, eggs, gelatin
Hydroxyproline: Primarily found in collagen-rich foods (bone broth, collagen supplements)

Supplementation Recommendations:
Collagen peptides containing hydroxyproline: 5–15 g/day may enhance wound healing

Sato et al., 2020



www.nature.com/scientificreports

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
Accepted: 18 July 2018
Published online: 30 July 2018

Fumihito Sugihara[1], Naoki Inoue[1] & Sriraam Venkateswarathirukumara[2]

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.

Design

16 weeks

Double Blind, Palcebo controlled clinical trial

112 subjects

Subjects:

Palcebo-n=42

CHa- n=39, standarad collagen, low dipeptide content

CHb-n=39, high dipeptide content

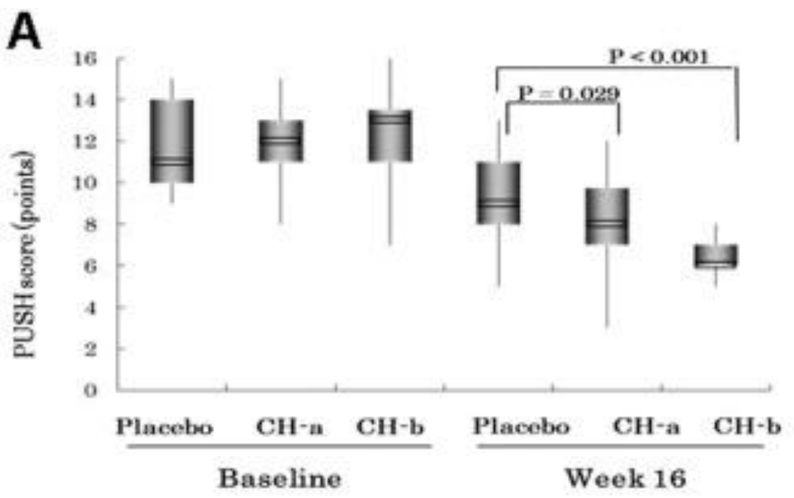
Outcome Measures:

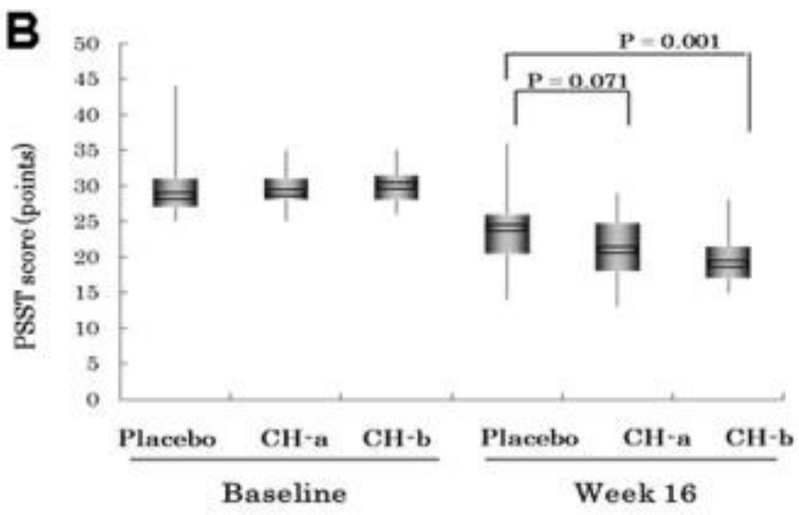
PUSH Scores

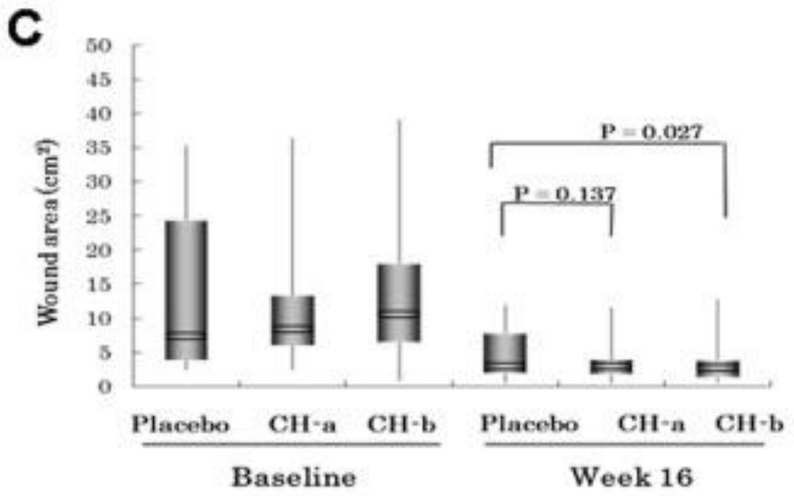
PSST Scores

Wound Area

Sugihara F, et.al, 2018







PUSH Score Improvement

CHa-46.2%

CHb-71.8%

Placebo-21.4%

PSST Score Improvement

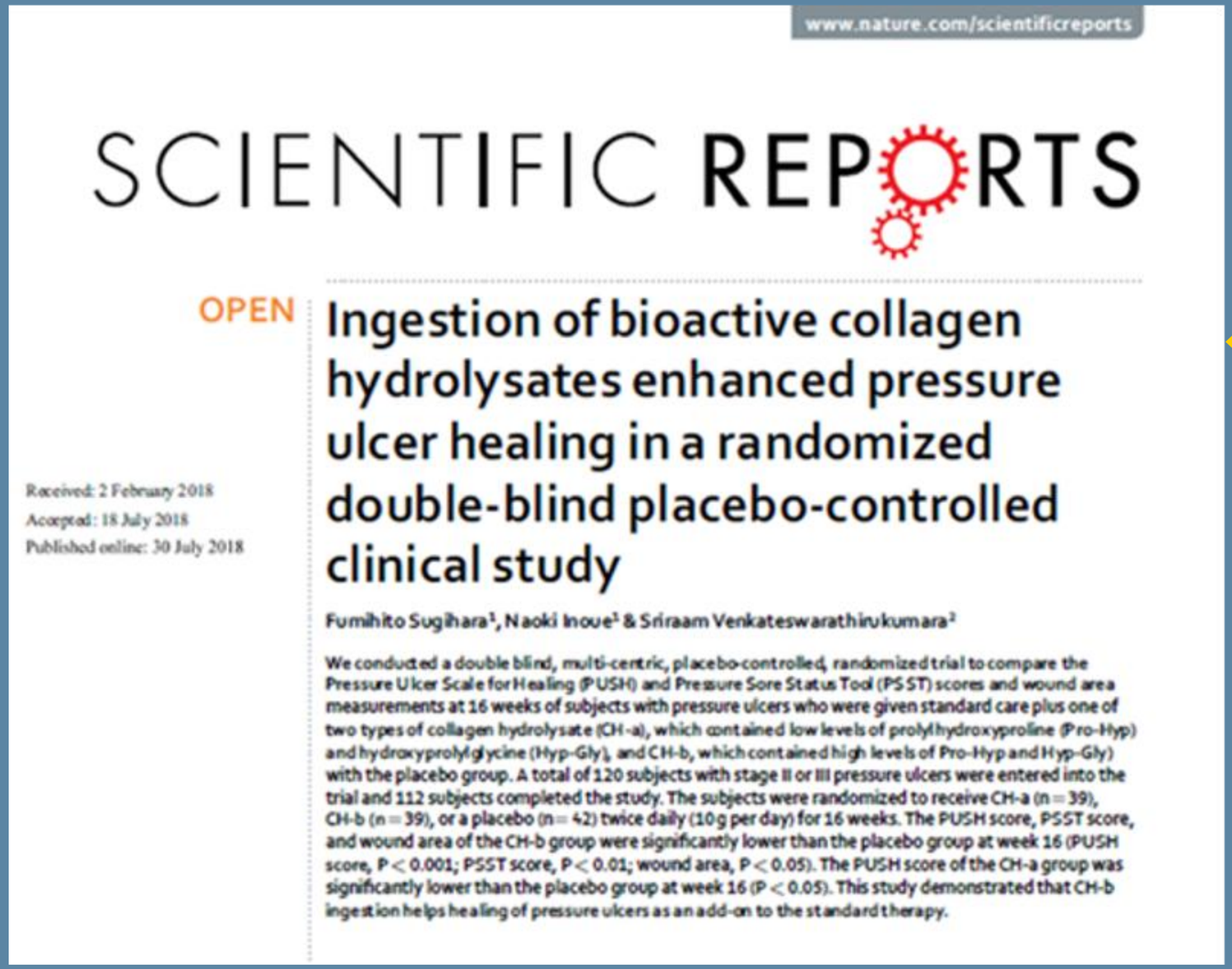
CHa-48.8%

CHb-74.4%

Placebo-19.0%

Sugihara F, et.al, 2018.

www.nature.com/scientificreports



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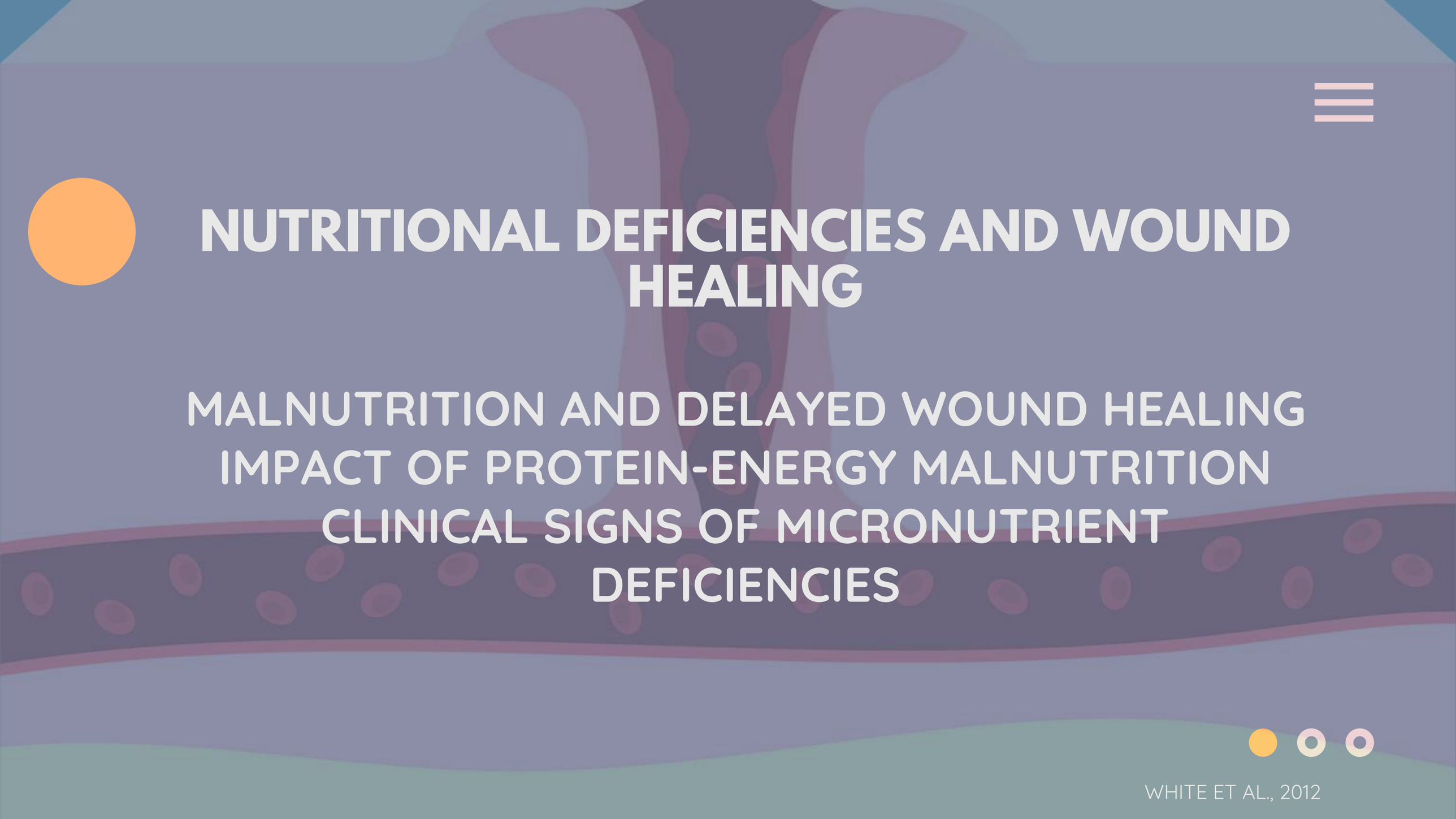
These results suggest that although all CH are derived from similar raw materials, it might be possible to control the healing effects of CH on pressure ulcers by altering their dipeptide content....

Sugihara F, et.al, 2018.



NUTRITIONAL DEFICIENCIES AND WOUND HEALING

MALNUTRITION AND DELAYED WOUND HEALING
IMPACT OF PROTEIN-ENERGY MALNUTRITION
CLINICAL SIGNS OF MICRONUTRIENT DEFICIENCIES

WHITE ET AL., 2012

SPECIAL CONSIDERATION FOR PRESSURE INJURIES

Screening	Presentations are tools that can be used as demonstrations, lectures, speeches, reports, and more.
Early Intervention	Nutrition in pressure ulcer prevention and treatment
Nutrition Support	Evidence from EPUAP/NPIAP/PPPIA guidelines (2019)
Protein Provision	High-protein diets and supplementation strategies

Saghaleini et al., 2018

NUTRITION SUPPORT FOR CHRONIC WOUNDS

Long term dietary modifications

Addressing underlying comorbidities

Regular reassessment for updated recommendations

CASE STUDY 1

“Randy” the ES Renal Patient

PATIENT NAME: RANDY RANDERSON
AGE: 65
SEX: MALE
REASON FOR ADMISSION: CHRONIC NON-HEALING LOWER EXTREMITY WOUND

MEDICAL HISTORY: END-STAGE RENAL DISEASE (ESRD) ON HEMODIALYSIS, HYPERTENSION, TYPE 2 DIABETES MELLITUS, PERIPHERAL ARTERIAL DISEASE (PAD)

- PATIENT REPORTS NON-HEALING ULCER ON THE RIGHT LATERAL ANKLE FOR 3 WEEKS.
- PATIENT REPORTS PERSISTENT WOUND DRAINAGE, MILD PAIN (3/10), AND OCCASIONAL NUMBNESS/TINGLING IN THE FOOT.
- NO FEVERS OR CHILLS REPORTED.
- REPORTS POOR APPETITE, WITH RECENT WEIGHT LOSS OF 4 LBS OVER THE PAST MONTH.
- COMPLAINS OF FATIGUE, WHICH HAS WORSENED SINCE HIS LAST FEW DIALYSIS SESSIONS.

CASE STUDY 1

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MEDICAL HISTORY: END-STAGE RENAL DISEASE (ESRD) ON HEMODIALYSIS, HYPERTENSION, TYPE 2 DIABETES MELLITUS, PERIPHERAL ARTERIAL DISEASE (PAD)

ALBUMIN: 3.1 G/DL (LOW)
CALCIUM: 8.5 MG/DL (LOW-NORMAL)

PHOSPHORUS: 5.8 MG/DL (ELEVATED)

PTH: 620 PG/ML (ELEVATED, SECONDARY HYPERPARATHYROIDISM)

WBC: 7.2 (NORMAL, NO ACUTE INFECTION)

HEMODIALYSIS STATUS:
RECEIVING HEMODIALYSIS 3X/WEEK VIA AV FISTULA.
RECENT DIALYSIS SESSION WAS WELL TOLERATED.
NUTRITIONAL INTAKE:
EATING ~40% OF HOSPITAL MEALS, REPORTS LOW PROTEIN INTAKE DUE TO POOR APPETITE.

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CHRONIC NON-HEALING RIGHT ANKLE ULCER – LIKELY DELAYED HEALING DUE TO ESRD-RELATED MALNUTRITION, POOR PERFUSION FROM PAD, AND DIABETES

.

PROTEIN-ENERGY WASTING (PEW) IN ESRD INADEQUATE DIETARY INTAKE

.

END-STAGE RENAL DISEASE (ESRD) ON HEMODIALYSIS – REQUIRES SPECIAL CONSIDERATION FOR WOUND HEALING, PROTEIN INTAKE, AND VITAMIN/MINERAL SUPPLEMENTATION

.

TYPE 2 DIABETES MELLITUS – SUBOPTIMAL GLYCEMIC CONTROL CONTRIBUTING TO DELAYED WOUND HEALING.

.

CASE STUDY 1-PLAN

WOUND RECOMMENDATIONS

- WOUND CONSULT FOR SPECIALIZED WOUND CARE RECOMMENDATIONS.
- CLEAN WOUND WITH NORMAL SALINE, APPLY CALCIUM ALGINATE DRESSING, AND COVER WITH A FOAM DRESSING EVERY 2 DAYS.
- AVOID OCCLUSIVE DRESSINGS DUE TO ESRD-RELATED FLUID RETENTION RISK.
- PRESSURE OFFLOADING WITH HEEL PROTECTORS AND FREQUENT REPOSITIONING.

NUTRITIONAL SUPPORT (ESRD-SPECIFIC CONSIDERATIONS):

- Dietitian consult for a high-protein, low-phosphorus renal diet.
- Protein intake goal: 1.2 g/kg/day to support wound healing without overloading dialysis clearance capacity.
- Nutritional supplements to increase calorie and protein intake without excess electrolytes.
  - Vitamin & Mineral Supplementation:Vitamin C: Avoid doses >60 mg/day due to oxalate accumulation risk.
  - Zinc 220 mg daily for 2 weeks to promote wound healing.
  - Phosphate binders (sevelamer, calcium acetate) with meals to control phosphorus levels and support bone healing.

CASE STUDY 2

“Karen” being a Karen

Patient Name: Karen McMarr
Age: 72
Sex: Female
Medical History: Type 2 Diabetes, Hypertension, Osteoarthritis
Current Medications: Metformin, Lisinopril, Acetaminophen

- Patient reports discomfort and mild pain (4/10) over the sacral area.
- Denies fever or chills but notes occasional itching.
- Appetite has been poor in the last two weeks, and she reports unintentional weight loss of 5 lbs.
- Complains of feeling fatigued and weak.
- Caregiver notes that the patient has been consuming less than 50% of her meals.

CASE STUDY 2

“Karen” being a Karen

Patient Name: Karen McMarr
Age: 72
Sex: Female
Medical History: Type 2 Diabetes, Hypertension, Osteoarthritis
Current Medications: Metformin, Lisinopril, Acetaminophen

- **Vital Signs:** BP 135/85, HR 82, Temp 98.2°F, RR 18, SpO2 96%

Skin Assessment: Stage II sacral pressure injury (3 cm x 2 cm, shallow open ulcer, no slough or necrosis, minimal serous drainage, periwound skin intact).
Lab Results: Albumin: 2.9 g/dL (low)
Hemoglobin A1c: 7.8% (elevated)
Vitamin D: 25 ng/mL (low)
WBC: 6.5 (normal)

CASE STUDY 2

“Karen” being a Karen

Patient Name: Karen McMarr
Age: 72
Sex: Female
Medical History: Type 2 Diabetes, Hypertension, Osteoarthritis
Current Medications: Metformin, Lisinopril, Acetaminophen

- **Stage II Sacral Pressure Injury –** Delayed healing likely due to inadequate protein intake and micronutrient deficiencies.
- **Poor Nutritional Status –** Evidence of unintentional weight loss, and decreased appetite.
- **Diabetes Mellitus –** Suboptimal glucose control contributing to impaired wound healing.

CASE STUDY 2-PLAN

WOUND CARE PLAN:
CLEAN WITH NORMAL SALINE AND APPLY HYDROCOLLOID DRESSING EVERY 3 DAYS UNLESS SATURATED.
OFFLOAD PRESSURE WITH A PRESSURE-RELIEVING MATTRESS AND REPOSITIONING EVERY 2 HOURS.
NUTRITIONAL SUPPORT PLAN:
INCREASE PROTEIN INTAKE: ENCOURAGE 1.2-1.5 G/KG/DAY OF PROTEIN (E.G., LEAN MEATS, EGGS, DAIRY, OR HIGH-PROTEIN SUPPLEMENTS).
CALORIC INTAKE GOAL: 30-35 KCAL/KG/DAY TO SUPPORT TISSUE REPAIR.
SUPPLEMENT WITH:
VITAMIN D (1000 IU DAILY) – ADDRESS DEFICIENCY.
MULTIVITAMIN WITH IRON TO SUPPORT OVERALL NUTRITION.
ENCOURAGE HYDRATION: GOAL OF 1.5-2L/DAY.

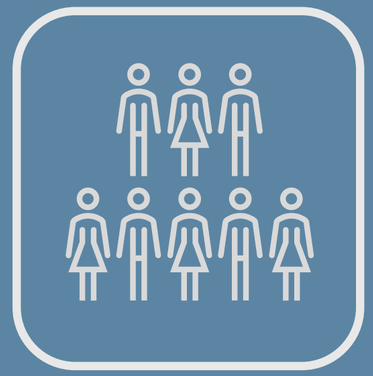
CONSULT WITH A REGISTERED DIETITIAN
DIABETES MANAGEMENT PLAN:
MONITOR BLOOD GLUCOSE CLOSELY TO PREVENT FURTHER WOUND HEALING DELAYS.
ADJUST CARBOHYDRATE INTAKE TO SUPPORT BETTER GLYCEMIC CONTROL.
ENCOURAGE SMALL, FREQUENT MEALS WITH COMPLEX CARBOHYDRATES AND LEAN PROTEINS.
FOLLOW UP WITH ENDOCRINOLOGY FOR POTENTIAL MEDICATION ADJUSTMENTS.

CORE CONCEPTS

Nutrition and Wounds

FOUNDATIONAL NUTRITION INTERVENTION IS ESSENTIAL FOR ADQUATE HEALING

NUTRITION IS NOT ONE SIZE FITS ALL AND CUSTOMIZED INTERVENTION WILL BE ESSENTIAL TO HEALING SUCCESSFULLY



WOUND HEALING REQUIRES A MULTIDISPLINARY APPROACH

QUESTIONS OR COMMENTS?

Get in touch!

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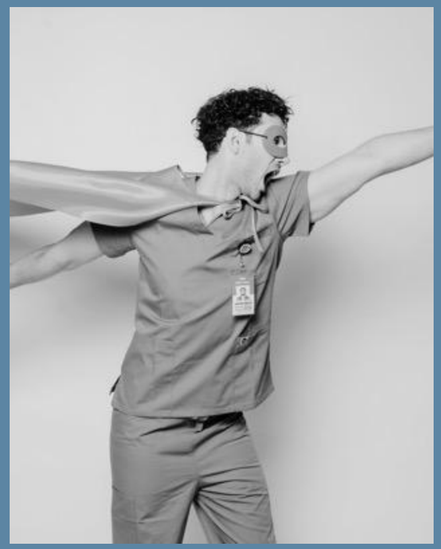

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