

PRACTICAL ASPECT OF NUTRITIONAL SUPPORT FOR WOUND-HEALING PATIENTS : A COMPREHENSIVE SYSTEMATIC REVIEW

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ABSTRACT

Background: The skin is the largest organ system whose primary function is to serve as a barrier to protect the body against foreign microbes and noxious substances. Skin integrity and function require macro and micronutrients for cell turnover to maintain homeostasis, and support new growth, and repair, especially in the event of injury or decreased integrity. Wound healing is an important focus of care across all settings, not limited to any particular condition or age group. Achieving optimal healing requires an understanding of nutritional requirements, and these need to be adapted to the setting and incorporated into a care plan.

The aim: The aim of this study to show about practical aspect of nutritional support for wound healing patients.

Methods: By the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020, this study was able to show that it met all of the requirements. This search approach, publications that came out between 2014 and 2024 were taken into account. Several different online reference sources, like Pubmed, SagePub, and Google Scholar were used to do this. It was decided not to take into account review pieces, works that had already been published, or works that were only half done.

Result: In the PubMed databasethe results of our search get 40 articles, whereas the results of our search on SagePub get 448 articles, on Google Scholar 4060 articles. Records remove before screening are 3376, so we get 1172 articles for screening. After we screened based on record exclude, we compiled a total of 10 papers. We included five research that met the criteria.

Conclusion: Nutrition is influential in wound healing, and some key nutrients extend their benefits to aesthetic outcomes. Several studies have shown associations between nutritional deficits and suboptimal wound healing outcomes. However, the current corpus of evidence remains rather generalized.

Keyword: Wound, wound healing, Nutrition, nutritional, skin.

INTRODUCTION

Wound healing implicates a well-orchestrated complex of biological and molecular events that involve cell migration, cell proliferation, and extracellular matrix deposition. Although these processes are similar to those driving embryogenesis, tissue and organ regeneration, and even pathological conditions, certain differences exist between adult wounds and these other systems. In acute wounds—cutaneous injuries that do not have an underpinning pathophysiological defect—the main evolutionary force may have been to achieve repair quickly and with the smallest amount of energy. In contrast, evolutionary adaptations have probably not occurred in chronic wounds with pre-existing pathophysiological abnormalities, resulting in impaired healing. Wound care places an enormous drain on healthcare resources worldwide.^{1,2}

In the 20th century, extensive research on the metabolic response to injury increased our interest in the relationship of nutrition and wound healing. In the 1930s, Cuthbertson defined the concept of peripheral to visceral redistribution of metabolic substrates as part of the adaptive mechanism to heal wounds in our critically ill trauma patients. With this concept the carcass of the body provides substrate, especially amino acids, for the healing wound in an injured patient who is unable to eat. As the metabolic reserves dwindled, these patients suffered from general protein calorie under nutrition. Until the introduction of total parenteral nutrition by Dudrick *et al.*, little could be done for critically ill patients due to limited ability to provide enteral nutrition. Total parenteral nutrition stimulated the interest of surgeons in nutrition and wound healing. Initially, it was assumed that more was better and soon discovered the consequences of overnutrition of the critically ill with driving hypermetabolism with increased caloric intake, fatty livers, and elevated CO₂ production and respiratory compromise in these patients.^{3,4}

Beyond nutritional elements, lifestyle factors, such as smoking and alcohol consumption, are increasingly being acknowledged for their detrimental effects on wound healing. Smoking with its plethora of harmful substances, notably nicotine, induces vasoconstriction and disrupts microcirculation, thereby impairing wound healing. The inhibition of cellular migration and neutrophil activity during the inflammatory phase further exacerbates wound complications in smokers compared with that in nonsmokers. Likewise, the consumption of alcohol, including chronic abuse and acute intoxication, has been linked to an elevated incidence of surgical wound infections and impaired wound healing.⁵

Nutritional status plays a central role in the process of wound healing. Malnutrition accompanies a poor outcome and brings about higher morbidity and mortality. Malnutrition should be recognized rapidly and treated accordingly in all patients suffering from pressure ulcers. Malnutrition impedes pressure ulcer healing. Unplanned weight loss – which is defined as 5% weight loss within 1 month or 10% within 6 months by the minimum data set – is a major risk factor for malnutrition and pressure ulcer development. Some of the causes of malnutrition include increased nutritional requirements, difficulty swallowing and chewing, and decreased intake of food and advanced age.^{6,7}

METHODS

Protocol

By following the rules provided by Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020, the author of this study made certain that it was up to par with the requirements. This is done to ensure that the conclusions drawn from the inquiry are accurate.

Criteria for Eligibility

For the purpose of this literature review, we compare and contrast practical aspect of nutritional support for wound healing patients. It is possible to accomplish this by researching or investigating practical aspect of nutritional support for wound healing patients. As the primary purpose of this piece of writing, demonstrating the relevance of the difficulties that have been identified will take place throughout its entirety.

In order for researchers to take part in the study, it was necessary for them to fulfil the following requirements: 1) The paper needs to be written in English, and it needs to determine about practical aspect of nutritional support for wound healing patients. In order for the manuscript to be considered for publication, it needs to meet both of these requirements. 2) The studied papers include several that were published after 2014, but before the time period that this systematic review deems to be relevant. Examples of studies that are not permitted include editorials, submissions that do not have a DOI, review articles that have already been published, and entries that are essentially identical to journal papers that have already been published.

Search Strategy

We used "practical aspect of nutritional support for wound healing patients." as keywords. The search for studies to be included in the systematic review was carried out using the PubMed and SagePub databases by inputting the words: ("Wound"[MeSH Subheading] OR "Wound healing"[All Fields] OR "Mechanism of wound healing" [All Fields]) AND ("Risk of cataract"[All Fields] OR "Management of wound healing "[All Fields]) AND ("Nutrition of wound healing"[All Fields]) OR ("Complications of wound healing" [All Fields]) used in searching the literature.

Data retrieval

After reading the abstract and the title of each study, the writers performed an examination to determine whether or not the study satisfied the inclusion criteria. The writers then decided which previous research they wanted to utilise as sources for their article and selected those studies. After looking at a number of different research, which all seemed to point to the same trend, this conclusion was drawn. All submissions need to be written in English and cannot have been seen anywhere else.

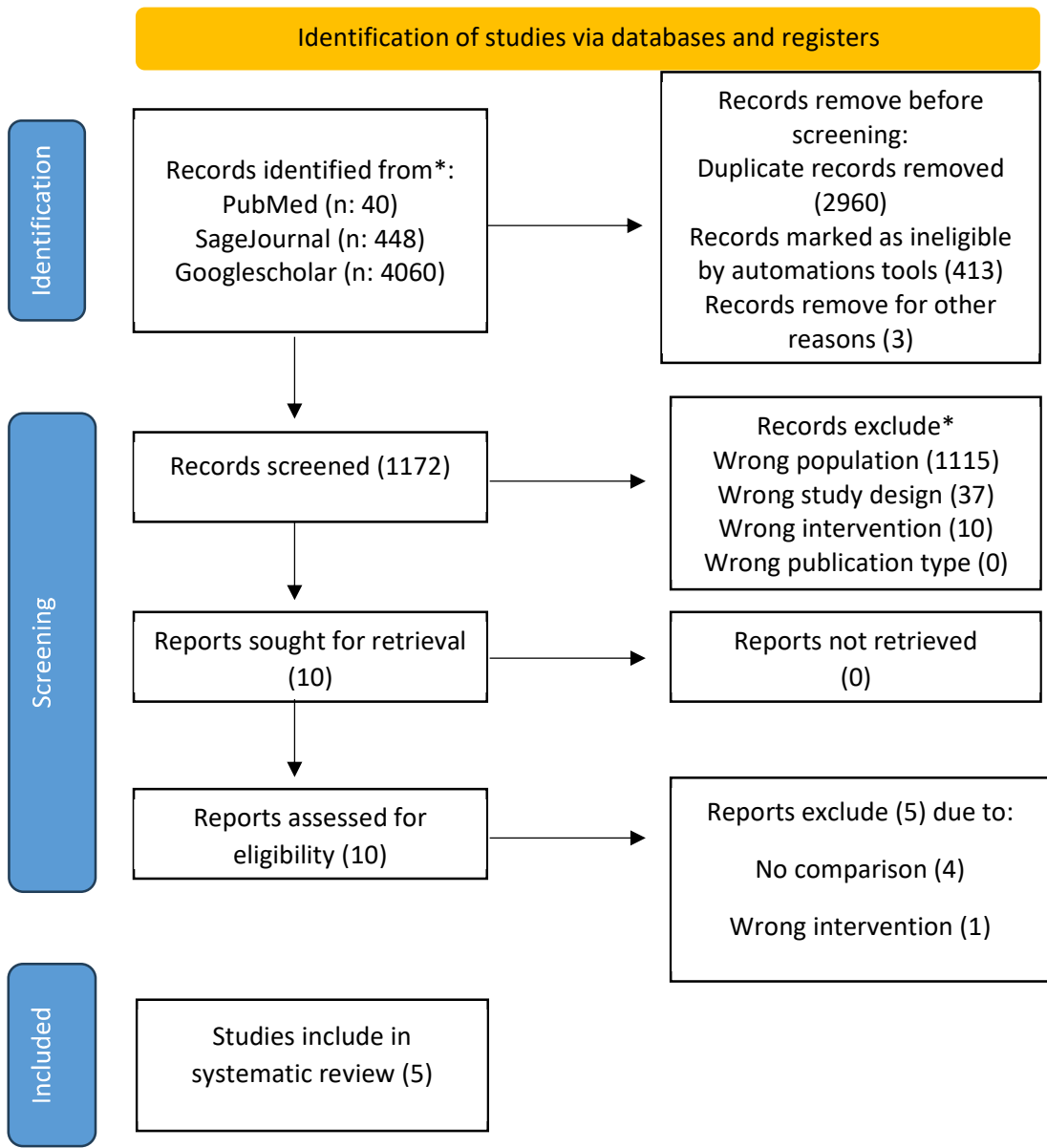


Figure 1. Article search flowchart

Only those papers that were able to satisfy all of the inclusion criteria were taken into consideration for the systematic review. This reduces the number of results to only those that are pertinent to the search. We do not take into consideration the conclusions of any study that does not satisfy our requirements. After this, the findings of the research will be analysed in great detail. The following pieces of information were uncovered as a result of the inquiry that was carried out for the purpose of this study: names, authors, publication dates, location, study activities, and parameters.

Quality Assessment and Data Synthesis

Each author did their own study on the research that was included in the publication's title and abstract before making a decision about which publications to explore further. The next step will be to evaluate all of the articles that are suitable for inclusion in the review because they match the criteria set forth for that purpose in the review. After that, we'll determine which articles to include in the review depending on the findings that we've uncovered. This criteria is utilised in the process of selecting papers for further assessment. in order to simplify the process as much as feasible when selecting

papers to evaluate. Which earlier investigations were carried out, and what elements of those studies made it appropriate to include them in the review, are being discussed here.

RESULT

From the PubMed database, the results of our search get 40 articles, whereas the results of our search on SagePub get 448 articles, on Google Scholar 4060 articles. Records remove before screening are 3376, so we get 1172 articles for screening. After we screened based on record exclude, we compiled a total of 10 papers. We included five research that met the criteria.

Wong, A et al (2024)⁸ showed the INCA Trial serves as a pioneering effort in its approach to PI management in community settings. This study uniquely emphasizes both clinical and economic outcomes and melds education, intensive dietetic support, and community nursing care for a holistic approach to enhancing PI management.

Sheriff, MM et al (2023)⁹ showed there was a positive inclination toward the perceived effectiveness of these supplements, challenges such as limited resources and knowledge gaps need addressing. The study underscores the importance of additional training programs and collaborative initiatives to enhance wound care practices. It contributes valuable insights for healthcare workers, policymakers, and educators, aiming to advance wound care practices and improve patient outcomes in the unique healthcare landscape of Saudi Arabia. Future research and interventions should focus on addressing identified challenges and promoting collaborative efforts among healthcare professionals in the region.

Table 1. The literature include in this study

Author	Origin	Method	Sample Size	Result
Wong, A et al., 2024 ⁸	Singapore	We intend to perform a two-group, non-blinded, cluster randomized, and pragmatic clinical trial with the recruitment of 380 subjects (190 per arm). The duration of the intervention will be 90 days, with data collection of outcomes performed over a one (1)-year period.	380	The primary outcome will be based on an intention-to-treat (ITT) principle for the CEA. The change to total costs will be compared to the change to health benefits, as measured by quality-adjusted life years (QALYs). Total costs will be estimated by considering the extra costs of the intervention and the change to the use of health services in subsequent time periods. QALY outcomes will be estimated using data from the EQ5D-5L, and the change due to the intervention will be estimated. Uncertainty will be included in probabilistic sensitivity analysis.
Sheriff, MM et al., 2023 ⁹	Saudi Arabia	This study adopts a cross-sectional research design to explore the dynamics to assess the awareness and practice among healthcare workers about the use of supplemental Vitamin C, Arginine, and Zinc in managing wounds in Saudi Arabia. The research methodology encompasses developing and	510	In a cross-sectional survey of 510 healthcare professionals, the socio-demographic analysis revealed a predominant hospital workplace (61.56%), with pharmacists representing 10.19%, and comprehensive tabulation of response rates and p-values, while the knowledge and awareness assessment demonstrated varied understanding and perceptions of wound care supplements, including frequent encounters with pressure ulcers or wounds (36.5%), diverse awareness levels for Vitamin C, Arginine, and Zinc, with the collaboration and communication dynamics among healthcare workers,

		validating a questionnaire, data collection, and subsequent analysis.		detailed in tabulated response rates and p-values.
Clark, RK et al., 2023¹⁰	USA	The study was an EMR-based retrospective analysis of patients with existing wounds. We identified records for (a) a Treatment group who received standard wound care + usual hospital diet + daily WS-ONS (Joven, Abbott Nutrition, Columbus, OH), and (b) a Control group who received usual wound care + a usual hospital diet.	341	There were 341 patients identified, 114 with 322 wounds in the treatment group and 227 patients with 420 wounds in the control group. We found that rehabilitation inpatients who were given nutritional support had larger wounds and lower functional independence on admission. At discharge, wound area reduction (percent) was nearly two-fold better in patients who were given daily WS-ONS + usual hospital diet compared to those who consumed usual diet only (61.1% vs 34.5%). Overall, weekly wound improvement (lowered wound area or wound volume) was more likely in the WS-ONS group than in the Control group, particularly from the start of care to week 2. Inpatients with largest wounds and lowest functional independence on admission were most likely to be given WS-ONS, an indication that caregivers recognised the need for supplementation. Week-to-week improvement in wound size was more likely in patients who received WS-ONS than in those who did not.
Herberger, K et al., 2020¹¹	Germany	A prospective study	90	A total of 90 patients with chronic wounds of different aetiologies were included. Pain and dental health were found to be significant factors: Patients with malnutrition or the risk of malnutrition had significantly lower tooth and oral health scores ($r_s = -0.218, P = .039$), and higher pain levels at rest ($r_s = 0.339, P < .001$), while dressing ($r_s = 0.268, P = .014$), and upon exercising ($r_s = 0.303, P = .005$). Our data address the impact of nutrition on chronic wounds and confirm the relationship between pain, dental health, and nutritional status. Clinicians should be aware of adequate pain management and dental health care in chronic wound patients. Further studies, particularly on

				characterisation of preventive and therapeutic measures in the nutrition of chronic wound patients, are of great importance.
Basiri, R et al., 2020 ¹²	USA	In a randomized control study with repeated measures, patients who met the inclusion criteria were informed of the details of the study and consented if they were willing to participate.	29	Wound healing, as measured by planimetry, was examined at baseline and every four weeks until complete wound closure or up to 12 weeks. There were no significant differences between groups for BMI, age, duration of diabetes, wound age estimation, or wound area at baseline. The treatment group experienced a faster wound healing rate (6.43 mm ² /week more reduction in the wound area) than the control group. The mean reduction in the wound area during the first four weeks of the study was almost 13-fold greater in the treatment group compared to the control group (18.0 mm ² /week vs. 1.4 mm ² /week, respectively). Our findings showed that nutrition supplementation plus nutrition education significantly accelerated wound healing in DFU patients compared to those who just received a standard-of-care regimen.

Clark, RK et al (2023)¹⁰ showed in an acute inpatient rehabilitation setting that provided wound care, patients who received daily WS-ONS experienced significant wound healing within 2 weeks, which was faster than for patients on standard food only. Week-to-week improvement in wound size was about 2 times more likely in patients who received WS-ONS than in those who did not. The wound-specialised nutrition supplements contained the anabolic amino acid metabolite HMB along with amino acids arginine and glutamine and the protein collagen, all known to play important roles in skin and connective tissue integrity. Indeed, recent guidance from the American Limb Preservation Society notes that therapeutic nutrition powders, such as the one used in this study, can support wound healing by enhancing collagen production and helping to replenish critical nutrients needed for wound healing. Taken together, our findings support the benefits of wound-specific ONS in improving wound healing for patients with pre-existing wounds.

Herberger, K et al (2020)¹¹ showed the correct and pain-free fit of the denture is important and that oral health, for example, infection detection in these patients should be the focus of attention. Indications of compromised oral health can already be deduced by interviewing the patients. As part of wound management, oral health questionnaires and regular dental consultations should be established. The European guidelines for the management of pressure ulcer emphasise the importance of nutrition on the one hand, but on the other hand, due to the lack of methodological quality of the available studies, no evidence-based recommendations are currently available for various aspects of diagnostics, therapy, and prevention. Future investigations will have to clarify in detail the form and periodicity of suitable screening tools as well as which approaches in therapy and prevention are appropriate and promising.

Basiri, R et al (2020)¹² showed wound healing rate by measuring the decrease in the area of the wound per week to reduce the bias in our analysis. Similar studies measured only percentage change in wound area or time to complete wound closure, which can be biased due to the different sizes of the wounds in different patients. The strength of our study was that energy, protein and essential micronutrients were given to the participants as complete nutrition and within the context of appropriate nutritional care. We educated patients about a healthy diet to increase their knowledge and awareness while giving them supplements to help them meet their requirements easier. The supplements were easy to consume and participants had a choice to choose their favorite flavor which resulted in the high adherence to the treatment. Supplements were tolerated well and no adverse events reported.

DISCUSSION

The wound healing cascade follows a similar complex cellular and biochemical cascade in all tissues. In the gastrointestinal tract healing may involve only the mucosa as observed in inflammatory bowel disease, and ulcers, and the full thickness of the bowel as commonly observed after creation of surgical anastomoses. Unresolved mucosal healing can lead to full-thickness fibrosis due to continued inflammation, so rapid resolution of mucosal injury is a goal of all medical interventions. Although beyond the scope of this review, establishing common standards by which to define the extent of mucosal healing are lacking for both inflammatory bowel² and ulcer disease. As true for all instances of wound healing, in particular collagen synthesis, provision of adequate energy (to sustain synthetic processes), amino acids (as building blocks for collagen synthesis), oxygen, trace minerals and vitamins (all of which are key for optimal synthetic enzyme function) is key to successful repair.^{13,14}

Immunonutrition can be defined as the usage of specific nutritional elements in an attempt to modulate the immune system in a way that benefits a certain injury or disease state. In recent years, a number of studies and reviews have evaluated the role of immunomodulating diets (IMDs) or their components in wound healing. Many variations in formulation and route of administration have been used with mixed results. Although most clinicians agree that the presence of an “ideal” nutritional environment, as yet incompletely defined, is beneficial to the process of wound healing, the nature of this environment and how it should be created is still a matter of significant debate. Most of the literature on immunonutrition explores its impact on a wide variety of important clinical outcomes (ventilator times, hospital stays, rates of infection, and mortality), in which the immune response plays a pivotal role. Research on how immunonutrition affects wound healing has often been extrapolated from or interposed with studies looking at these other clinical outcomes.¹⁵

CONCLUSION

Nutrition is influential in wound healing, and some key nutrients extend their benefits to aesthetic outcomes. Several studies have shown associations between nutritional deficits and suboptimal wound healing outcomes. However, the current corpus of evidence remains rather generalized.

REFERENCES

- [1] Barchitta M, Maugeri A, Favara G, San Lio RM, Evola G, Agodi A, et al. Nutrition and wound healing: An overview focusing on the beneficial effects of curcumin. *Int J Mol Sci.* 2019;20(5).
- [2] Kurmis R, Woodward M, Ryan H, Rice J. The importance of nutrition in wound management: new evidence from the past decade. *Wound Pract Res.* 2021;29(1).
- [3] Molnar JA, Underdown MJ, Clark WA. Nutrition and Chronic Wounds. *Adv Wound Care.* 2014;3(11):663–81.
- [4] Smith-Ryan AE, Hirsch KR, Saylor HE, Gould LM, Blue MNM. Nutritional considerations and strategies to facilitate injury recovery and rehabilitation. *J Athl Train.* 2020;55(9):918–30.
- [5] Seth I, Lim B, Cevik J, Gracias D, Chua M, Kenney PS, et al. Impact of nutrition on skin wound healing and aesthetic outcomes: A comprehensive narrative review. *JPRAS Open [Internet].* 2024;39:291–302. Available from: <https://doi.org/10.1016/j.jpra.2024.01.006>
- [6] 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.
- [7] Berry KG, Seiple SM, Stellar JJ, Nagle ML, Curry K, Immel A, et al. A scoping review to inform a multi-disciplinary approach for nutrition therapy in critically ill children with pressure injuries. *Transl Pediatr.* 2021;10(10 October):2799–813.
- [8] Wong A, Lai P, Chong HH, Lien CTC, Graves N. The Clinical and Cost-Effectiveness of an Individualized Nutritional CARE (INCA) Bundle versus Standard Care for Adults with Pressure Injuries Receiving Home Nursing Services: A Protocol for a Cluster Randomized and Pragmatic Clinical Trial with an Economic Evaluation. *Nutrients.* 2024;16(2):1–15.
- [9] Sheriff MM, Alotaibi SD, Alharbi GH, Alghamdi MMO, Aljadani NM, Alzahrani HA, et al. A Cross-Sectional Study on the Awareness and Practice of the Use of Supplemental Vitamin C, Arginine, and Zinc in Managing Wounds Among Healthcare Workers in Saudi Arabia. *Cureus.* 2023;15(12).
- [10] Clark RK, Stampas A, Kerr KW, Nelson JL, Sulo S, Leon-Novelo L, et al. Evaluating the impact of using a wound-specific oral nutritional supplement to support wound healing in a rehabilitation setting. *Int Wound J.* 2023;20(1):145–54.
- [11] Herberger K, Müller K, Protz K, Zyriax BC, Augustin M, Hagenström K. Nutritional status and quality of nutrition in chronic wound patients. *Int Wound J.* 2020;17(5):1246–54.
- [12] Basiri R, Spicer MT, Levenson CW, Ormsbee MJ, Ledermann T, Arjmandi BH. Nutritional supplementation concurrent with nutrition education accelerates the wound healing process in patients with diabetic foot ulcers. *Biomedicines.* 2020;8(8):1–14.
- [13] Mukherjee K, Kavalukas SL, Barbul A. Nutritional aspects of gastrointestinal wound healing. *Adv Wound Care.* 2016;5(11):507–15.
- [14] Roy M, Perry JA, Cross KM. Nutrition and the plastic surgeon: Possible interventions and practice considerations. *Plast Reconstr Surg - Glob Open.* 2018;6(8):1–3.
- [15] Chow O, Barbul A. Immunonutrition: Role in Wound Healing and Tissue Regeneration. *Adv Wound Care.* 2014;3(1):46–53.