Special Article

Clinical Application of Micronutrients in Recovery : A Practical Guidebook for Clinicians

Jayesh Lele[1], Ketan Mehta[2], Agam Vora[3], Rashmi Mehta[4], Graima Aggarwal[5], Jagruti Sanghvi[6], Jigar Mehta[7], Ashish Mehta[8], Pratibha Dileep[9], Dhruva Chaudhary[10], Sonali Joshi[11]

Abstract

Micronutrients play a vital role in enhancing recovery and improving overall health, particularly in individuals dealing with acute or chronic illnesses[1,2]. Adequate intake of vitamins and minerals supports immune function, tissue repair, metabolic regulation, and long-term health outcomes[3,4,6]. Despite substantial clinical evidence affirming their value, micronutrient supplementation remains limited in routine medical practice[5,7,13]. To address this gap, the Indian Medical Association (IMA) has developed comprehensive, evidence-based guidelines aimed at integrating micronutrient support into standard care for both adult and paediatric patients across medical and surgical settings[8,10,11]. These guidelines are designed to assist healthcare professionals in adopting targeted nutritional strategies, improving patient outcomes, reducing complications, and enhancing quality of life[9,12]. Authored by a multidisciplinary panel of experts—including General Practitioners, Paediatricians, Internal Medicine Specialists, and Surgeons—the guidelines are grounded in current research, clinical practices, and patient care outcomes[10,12]. Each chapter provides focused insight into specific micronutrients, outlining their physiological roles, implications of deficiencies, and evidence-based supplementation approaches tailored to various diseases[1,3,5,14]. In conclusion, the document emphasizes a holistic approach to recovery that incorporates both physical and psychological dimensions of patient well-being[11,15]. By prioritizing micronutrient adequacy in clinical care, these guidelines serve as a valuable resource for healthcare providers, reinforcing the essential role of nutrition in optimizing recovery and improving overall patient health across diverse care environments[15,16].

Key words : Micronutrients, Clinical Guidelines, Acute and Chronic Illness, Patient Recovery, Holistic Approach.

Recovery is the process of returning to normal routines and habits following illness or surgery, involving both physiological and psychological aspects. Physiological recovery involves tissue repair, restoration of organ function, and systemic balance through proper nutrition, hydration, and micronutrient support. Key recovery mechanisms include tissue

Editor's Comment :

- Micronutrient supplementation is crucial for enhancing recovery in both acute and chronic conditions.
- These IMA guidelines aim to bridge the implementation gap by offering evidence-based, disease-specific micronutrient strategies to improve patient outcomes.

[1]MBBS, Coordinator, Department of Family Medicine, IMA West, Mumbai, Maharashtra 400049 and Corresponding Author
[2]MD (Medicine), FCPS, FICP, FISE, FGSI, FDI, Professor, Department of Medicine, Health Harmony, Mumbai, Maharashtra 400064
[3]MD, Director, Department of Pulmonary, Brahma Kumari Global Hospital and Research Centre and Vora Clinic, Mumbai, Maharashtra 400058
[4]MS, President, IMA West, Department of Surgery, Benz Hospital, Mumbai, Maharashtra 400054
[5]MD (Medicine), FCPS, FICP, FISE, FGSI, FDI, Consultant Nephrologist and Renal Transplant Physician, Department of Nephrology, Manipal Hospital, Bangalore, Karnataka 560017
[6]MD (Medicine), FCPS, FICP, FISE, FGSI, FDI, Consultant, Centre for Child Health, Department of Pediatrics, Centre for Child Health Nanavati Max Super Speciality Hospital, Mumbai, Maharashtra 400056
[7]MD, Consultant, Critical Care Chief Intensivist and ICU Head, Department of Anaesthesia, KD Hospital, Ahmedabad, Gujarat 382421
[8]MD (Medicine), FCPS, FICP, FISE, FGSI, FDI, Director and Consultant Neonatologist, Department of Neonatology, Arpan Newborn Care Centre, Ahmedabad, Gujarat 380059
[9]MD (Medicine), FCPS, FICP, FISE, FGSI, FDI, Critical Care Specialist, Critical Care and Hospital Infection Control, Ahmedabad, Gujarat
[10]MD (Medicine), FCPS, FICP, FISE, FGSI, FDI, Senior Professor, Pulmonary and Critical Care Medicine, University of Health Sciences Rohtak, Haryana 124001
[11]MBBS, IMA West, Mumbai, Maharashtra 400049

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repair, immune function, energy metabolism, bone health, cognitive function, and antioxidant defence. Psychological recovery is influenced by mental health, as conditions like anxiety and depression can impair medication adherence, behaviour, and immunity. Micronutrients play a crucial role in metabolism, immune function, and the regulation of oxidative stress, thereby aiding overall recovery. A holistic approach integrating physical, mental, and emotional well- being, alongside pharmacological and non-pharmacological strategies, is essential for optimal recovery outcomes.

Key Micronutrient Roles (Fig 1) :

Micronutrients in Adults :

The Vitamin B complex is essential for recovery across various conditions by supporting immune function, energy metabolism, nerve health, and tissue repair. Infections, burns, fractures, and post-surgical recovery benefit from B1, B2, B6, and B12, while B9 and B12 address anaemia linked to malabsorption. B3 aids DNA repair, B5 supports wound healing, and B7 promotes skin and hair health. In neurological conditions, B6 and B12 enhance nerve regeneration and cognition. Lysine complements these actions by boosting collagen synthesis and immunity, while zinc, selenium, iron, vitamin D, and calcium further support healing and bone strength.

Micronutrients in Disease Recovery :

In acute infections, Vitamin B complex (B1, B2, B6, B12) supports immune cell production, energy metabolism, and tissue repair, while lysine aids immune modulation. In burns, B9 and B12 help manage anemia and regeneration, with lysine promoting healing. In fever, Vitamin B complex, zinc, and electrolytes support gut integrity by reducing inflammation and restoring balance. Across all conditions, Vitamins C and D provide added support by boosting defense and reducing inflammation, with lysine aiding recovery.

Micronutrient Support in Chronic Conditions :

Respiratory Diseases

- Tuberculosis : Vitamin B6 prevents neuropathy, B12 supports red blood cell formation, and B2 aids mucosal integrity. Vitamin C and Zinc assist in oxidative stress reduction and immune recovery.

Skin & Autoimmune Conditions

- Skin Infections : Vitamin B2 prevents eczema, B3 maintains the skin barrier, B6 aids immune defense, and B7 supports skin repair. Lysine enhances collagen synthesis, while Vitamin A and C aids in wound healing.
- Autoimmune Disorders : Vitamin B6 regulates immune response, B6 and B12 reduces inflammation, and B2 supports antioxidant defense. Lysine assists in tissue repair, while Vitamin D modulates immune activity.

Metabolic & Cardiovascular Health

- Diabetes : Vitamin B9 and B12 counteracts metformin-induced deficiencies, B3 improves lipid balance and B6 aids glucose metabolism. Vitamin C and D enhances insulin sensitivity, while Zinc supports metabolic function.
- Cardiovascular Disease : Vitamin B1 aids cardiac function. B6 regulates homocysteine levels and B12 supports red blood cell production. Magnesium and controlled sodium intake contribute to vascular health.

Kidney Disease

- Chronic Kidney Disease (CKD): Vitamin B complex (B1, B2, B6, B12) helps to counteract deficiencies due to dietary restrictions, while Vitamin D and Iron support bone and red blood cell health.
- End-Stage Renal Disease (ESRD): Vitamin B complex are essential to replenish losses during dialysis, with careful regulation of sodium, potassium, calcium, lysine, and iron for metabolic balance.

Fig 1

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Liver Disease

- Alcohol-Associated Liver Disease (ALD): Vitamin B1 prevents Wernicke-Korsakoff syndrome, B9 addresses anemia, and B12 supports red blood cell formation. Lysine aids liver recovery alongside Vitamin A, D, Magnesium, and Zinc.
- Hepatitis: Vitamin B9 aids cellular regeneration and B12 enhances neurological function, and lysine supports liver repair, with additional support from Vitamins A, D, and Zinc.
- Metabolic-Associated Fatty Liver Disease (MAFLD) & Cholestatic Liver Disease: Vitamin B complex B1, B6, B12, and Folate optimizes energy metabolism, DNA synthesis, and detoxification, preventing liver dysfunction.

Malnourishment

- Malnutrition: Vitamin B complex B1, B3, and B9 supports metabolism and address deficiencies from chronic alcohol use, with additional needs for Calcium, Magnesium, Phosphorus, and Iron.
- Obesity: Vitamin B complex enhances energy metabolism, reduces fatigue, and supports nerve function in managing obesity-related complications.

Micronutrient Needs in Surgery :

The role of key micronutrients in recovery from certain surgeries, as covered in this chapter, includes:

- Bariatric surgery requires lifelong follow-up, including supplementation with Vitamin B9, B12, and iron to prevent anemia; Vitamin B complex, calcium, and Vitamin D3 for bone health; and zinc, Vitamin C, magnesium, lysine, and Vitamin K to support healing and collagen synthesis.
- Cardiac surgery benefits from Vitamin B6, B9, and B12 to regulate homocysteine levels; Vitamin B1 to support heart function; and Vitamin C, E, magnesium, zinc, selenium, and lysine to enhance vascular and immune health.
- Post-surgical recovery is supported by the Vitamin B complex for energy metabolism and immunity; iron, B9, Vitamin D, and calcium for blood and bone health; and lysine to accelerate overall healing.

Micronutrients for Paediatric Recovery :

Micronutrients are essential in managing paediatric conditions by supporting immunity, reducing oxidative stress, aiding tissue repair, and enhancing recovery.

This chapter highlights essential micronutrients and their significance in some of the acute and chronic paediatric conditions, such as:

Acute Conditions :

Hepatitis : Vitamin B complex supports energy metabolism and liver detoxification and Zinc and Selenium aids in liver regeneration.

Dengue Fever : Vitamin B complex supports nerve function, energy metabolism, and immunity, while Vitamin C improves vascular stability, and Vitamin D and Magnesium helps to reduce fatigue.

Chronic & Metabolic Disorders :

- Respiratory & Immune Support: Vitamin B6 and B12 helps to reduce inflammation, while B9 supports in cell regeneration. Lysine also aids in infection recovery.
- Metabolic & Endocrine Health: The Vitamin B complex (B1, B6, B12, and folate) is crucial for glucose metabolism, nerve function, and red blood cell synthesis, especially in diabetes. B9 and B12 help prevent anaemia, while lysine supports muscle maintenance. The Vitamin B complex also aids in thyroid function and reduces oxidative stress.
- Gastrointestinal & Nutrient Absorption: Vitamins B1 and B2 aid in energy production, while B5 supports fat metabolism. B9 and B12 are essential for cell repair and preventing deficiencies in conditions such as IBD or malabsorption syndromes. Lysine helps maintain protein balance and improves nutrient utilization.
- Blood & Kidney Function: Vitamins B6, B9, and B12 are vital for red blood cell formation, haemoglobin synthesis, and lowering homocysteine levels to reduce stroke risk. The Vitamin B complex supports kidney function by regulating energy metabolism and reducing nitrogen waste. Lysine aids in protein metabolism while minimizing kidney strain.

Surgical & ICU Recovery :

Some of the key micronutrients that play a major role

in paediatric surgical and ICU recovery are listed below:

Postoperative Recovery: Vitamin B complex supports red blood cell production, nerve function, and tissue repair, preventing anemia and aiding metabolism. Lysine enhances collagen formation and accelerates healing. Additional support from Vitamin A, C, K, Zinc, and Magnesium.

Pediatric ICU: Vitamin B complex are critical for energy metabolism, neurological function, and red blood cell formation, helping sustain recovery in critically ill children. Vitamin D, Calcium, and Selenium provides additional metabolic support.

Drug interactions :

Fat-Soluble Vitamins – Avoid Vitamin A in pregnancy and liver disease; Vitamin D may reduce statin efficacy;

Vitamin E increases bleeding risk; Vitamin K needs caution in neonates and kidney disease.

Water-Soluble B Vitamins – B1, B2, B7, and B9 are generally safe; B3, B5, and B6 require caution in liver disease, pregnancy, and macrolide use.

Vitamin C – Caution in G6PD deficiency, thalassemia, and hemochromatosis due to oxidative stress or iron overload risk.

Minerals & Metabolism – Manganese toxicity risk increases with iron deficiency.

Iron & Zinc – Avoid excess iron in overload conditions; limit zinc to <40 mg/day in pregnancy.

Selenium – Requires caution in allergy-prone individuals.

Conclusion

Overall, micronutrients support immunity, repair, and recovery, with Vitamin B complex playing a key role in metabolism, nerve function, and red blood cell production. Targeted supplementation in adults and paediatrics helps to prevent deficiencies and optimize health.

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