



## Short Communication

## Nutraceuticals rich in zinc and branched chain amino acids for improving quality of life in patients with chronic liver disease, hepatic encephalopathy, and geriatrics

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## ABSTRACT

The current paper aimed to highlight the role of nutraceuticals rich in zinc and branched chain amino acids (BCAAs) for improving the quality of life (QoL) in patients with chronic liver disease (CLD), hepatic encephalopathy (HE), and geriatrics. Well-done works based on evidence-based approach were studied thoroughly in order to define the CLD and HE and extract an informative and concise report with valuable knowledge about the important role of zinc and BCAAs as an adjuvant nutraceutical therapy included in the treatment protocol of the CLD and HE, with many health benefits for geriatrics health. Novel nutraceutical formulations structured on scientific basis according to official guidelines were outlined as beneficial dietary supplements containing whey protein as a functional food of milk derivatives with proven health benefits and valuable content (18%) of BCAAs, fortified with a bunch of vitamins, minerals, steviol glycosides (SGs) and natural flavors. It could be concluded the valuable role of zinc and BCAAs in improving QoL in patients with CLD, HE, and geriatrics.

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## 1. Introduction

### 1.1. Role of nutraceuticals for improving quality of life (QoL) in geriatrics health

The field of geriatrics in medicine focuses on improving quality of life (QoL) by preserving functional independence in the face of chronic illness while attending to the varied demands of elderly patients. Treatment of geriatric patients demands a distinct strategy and is quite complex. By treating and preventing illnesses and impairments in senior citizens, geriatric medications seek to improve their overall health. Research on developing effective dietary interventions to promote healthy aging is an ongoing and complex field, as aging is linked to a higher risk of chronic illness, disability, and mortality. Population aging

is a widespread occurrence. Hypertension, congestive heart failure, dementia, osteoporosis, respiratory issues, cataracts, and diabetes are among the most common illnesses impacting the elderly population. The higher morbidity and death from infectious pathogens in the elderly are also partly caused by decreased immunity. One of the main factors explaining variations in infection pathophysiology and incidence is nutritional condition. Micronutrient deficits are more common in the elderly because of a number of circumstances, such as emotional, physical, social, and financial barriers to eating. As a result, we urgently need to refocus our efforts in order to give greater consideration to strategies for preventing chronic disorders linked to aging. People need to work harder on adopting healthy living habits on an individual basis, such as eating a more balanced diet.<sup>1,2</sup>

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### *1.2. Branched chain amino acids (BCAAs) for improving quality of life (QoL) in patients with non-communicable diseases (NCDs) and geriatrics health*

Branched chain amino acids, or BCAAs for short including leucine, valine, isoleucine, are essential for healthy aging. They regulate protein synthesis, metabolism, food intake, sarcopenia, obesity, age-related changes in body composition, and insulin and glucose metabolism. The huge amount of research with huge outcomes can be reconciled by consideration of the role of BCAAs as signaling molecules and the bidirectional mechanistic link between BCAAs and various aging characteristics. The underlying nutritional makeup, including macronutrient ratios and imbalances with other amino acids, also affects how BCAAs work. Through the modulation of dietary BCAAs in conjunction with the titration of macronutrient ratios and other amino acids, the interaction between BCAAs and other components of the diet may offer new options for affecting age-related outcomes.<sup>3</sup>

BCAAs constitute 18% of all amino acids and 63% of all hydrophobic amino acids, which are the main building blocks of most proteins. Leucine, isoleucine, and valine often have molar ratios of 2.2:1.0:1.6. Under physiological conditions, the intake and excretion of BCAAs maintain a careful balance. Since most BCAAs are received by diet and tissue protein breakdown, their oxidative breakdown and tissue protein synthesis are the primary processes that use them up, and their excretion in urine is little, the level of BCAAs in the bloodstream is normally constant. By a variety of signaling pathways, BCAAs not only function as nutritional substrates for protein synthesis but also have important effects on the control of immune response, energy balance, and food metabolism. Numerous diseases, including an increased risk of diabetes, cancer, heart failure, and fibrotic disorders, have been associated to abnormalities in the metabolism of BCAAs.<sup>4</sup> BCAAs enhance protein synthesis in proteolysis with great benefits for liver cirrhosis patients against hepatic encephalopathy risk resulting from reduced plasma BCAAs levels. Also, BCAAs enhance the muscle mass and physical strength. Overall, BCAAs reduces hepatic encephalopathy (HE) symptoms and is recommended as a second-line treatment.<sup>5</sup>

### *1.3. Hepatic encephalopathy (HE)*

Deficits in cognitive, mental, and physical function are hallmarks of hepatic encephalopathy (HE), a broad spectrum of neuropsychiatric disorders that arises during acute liver failure or chronic liver illness. About 30-40% of people with chronic liver disease experience HE at some point during the course of their condition. Brain edema, elevated intracranial pressure, and brain herniation are caused by acute liver failure, while minimal

HE, a milder form of HE, is brought on by chronic liver illness. Despite not being fatal, mild HE has a significant negative impact on quality of life and is a significant financial and societal burden. Among all the hazardous chemicals, elevated brain and systemic ammonia levels have been identified as critical components in the pathophysiology of HE. Acute liver failure with cerebral edema is caused by hyperammonemia, which also causes cytotoxic edema and astrocyte enlargement. Apart from ammonia, neuroinflammation is considered a significant factor in the development of HE and is mostly mediated by microglia. Microglia can be activated by a variety of stimuli, but ammonia is the only one that can cause microglial activation, which in turn causes neuroinflammation. Thus, it's possible that neuroinflammation and hyperammonemia work in concert rather than as two separate processes to cause HE.<sup>6</sup>

### *1.4. Role of zinc and branched chain amino acids (BCAAs) for improving quality of life (QoL) in patients with hepatic encephalopathy (HE)*

Zinc and branched chain amino acids (BCAAs) are two nutritional supplements that have been researched for the treatment of hepatic encephalopathy (HE) as low levels of zinc are linked to hyperammonemia and HE. Zinc is thought to be a cofactor of urea cycle enzymes and is frequently deficient in chronic liver disease (CLD). Skeletal muscle is crucial for ammonia detoxification via glutamine synthetase (GS) in the context of poor hepatic ammonia metabolism in chronic liver disease (CLD). In cirrhosis, skeletal muscle uses BCAAs to produce  $\alpha$ -ketoglutarate, which could be reduced because of increased glutamate amination and subsequent glutamine synthesis. However, BCAA supplementation appears to be helpful in keeping the nutritional state of cirrhotic patients stable and from worsening liver failure.<sup>7</sup>

### *1.5. Novel nutraceutical formulations including zinc and branched chain amino acids (BCAAs)*

Recent studies<sup>8,9</sup> have been carried out according to official guidelines for manufacturing nutraceutical formulations on scientific basis according to the Indian Standard (IS: 8220/1976) for "Specification for Protein-Rich Concentrated Nutrient Supplementary Foods", where the main ingredients were the high quality milk derivatives of whey protein concentrate (WPC) and skim milk powder (SMP) with considerable amount of high quality protein (10 g protein/serving) rich in essential amino acids and BCAAs, fortified with vitamins and minerals in a considerable amount 25% of the daily value (DV) according to the Food and drug Administration (FDA) instructions<sup>10</sup> and sweetened with zero-calorie artificial sweetener steviol glycosides (SGs) from natural source

(stevia leaf extract). Valued nutrient-nutrient interaction was shown by synergism between WPC and SGs.<sup>11</sup> Moreover, the natural flavors have great sound effects with bioactive components. These nutraceutical formulations are recommended as adjuvant therapy for patients with NCDs.

## 2. Emphasizing Strengths of Study

The current study successfully achieved its aim by highlighting the nutraceutical effect of zinc and branched chain amino acids (BCAAs) in geriatrics.

### 2.1. Limitations of study

The current paper is just a short communication to highlight the significant health benefits of zinc and branched chain amino acids (BCAAs) in geriatrics without detailed clinical trials.

## 3. Future Research

Subsequent research is required to investigate the degree to which zinc and branched chain amino acids (BCAAs) in geriatrics and patients with NCDs, CLD, and HE impact the capacity to get a clinically significant outcome.

## 4. Conclusions

The current paper successfully presented in an informative and concise way, the role of zinc and branched chain amino acids for improving quality of life in patients with chronic liver disease, hepatic encephalopathy, and geriatrics with the outline of new nutraceutical formulations structured on scientific basis according to official guidelines as an adjuvant therapy in the treatment protocols.

## 5. Source of Funding

None.

## 6. Conflict of Interest

None.

## References

- Gupta C, Prakash D. Nutraceuticals for geriatrics. *J Tradit Complement Med.* 2015;5(1):5–14.
- Almoselhy RIM. Extra virgin olive oil as nutritional therapeutic immuno-enhancer. *Int J Fam Stud Food Sci Nutr Health.* 2021;2(2):26–45.
- Couteur L, Solon-Biet DG, Cogger SM, Ribeiro VC, De Cabo R. Branched chain amino acids, aging and age-related health. *Ageing Res Rev.* 2020;64:101198.
- Wu T, Wang M, Ning F, Zhou S, Hu X. Emerging role for branched-chain amino acids metabolism in fibrosis. *Pharmacol Res.* 2023;187:106604.
- Espina S, Paris AS, Monterde VB, Deza DC, Arbonés-Mainar JM. Role of Branched-Chain Amino Acids and Their Derivative  $\beta$ -Hydroxy- $\beta$ -Methylbutyrate in Liver Cirrhosis. *J Clin Med.* 2022;11(24):7337.
- Cheon SY, Kim MY, Kim J, Kim EJ, Kam EH. Hyperammonemia induces microglial NLRP3 inflammasome activation via mitochondrial oxidative stress in hepatic encephalopathy. *Biomed J.* 2023;46(5):100593.
- Kerbert AJC, Jalan R. Recent advances in understanding and managing hepatic encephalopathy in chronic liver disease. *F1000 Res.* 2020;p. 312.
- Almoselhy RIM. Formulation and evaluation of novel nutraceuticals rich in protein, vitamins, minerals, natural flavors, and steviol glycosides for improving quality of life. *Food Sci Appl Biotechnol.* 2023;6(2):35–71.
- Almoselhy RIM, Usmani A, Afshar PG, Milani MA. New Aspects on Nutraceutical Formulations of Whey Protein Concentrate Sweetened with Steviol Glycosides for Patients with Non-Communicable Diseases. *SSRN Electron J.* 2023;p. 1–18.
- Almoselhy RIM, Usmani A, Afshar PG, Milani MA. Significance of Nutrition Facts Label of Food Products with Critical Updates by FDA on Nutrition Facts Label. *Trends Med Res.* 2023;18(1):136–40.
- Almoselhy RI, Usmani A, Afshar PG, Milani MA. Biological Synergism in Whey Protein Concentrate Formulations Sweetened with Steviol Glycosides. *Asian J Biolo Sci.* 2023;16(4):537–40.

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