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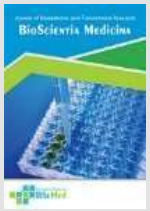

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Egg White Extract Supplementation Improves Albumin and IGF-1 Levels in Malnourished Elderly Patients: A Randomized Controlled Trial

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A B S T R A C T

Background: Malnutrition is a prevalent issue among the elderly, often leading to hypoalbuminemia (low albumin levels) and decreased serum Insulin-like growth factor 1 (IGF-1) levels. These conditions are associated with increased morbidity and mortality. Egg white extract (EWE) supplementation has shown promise in improving hypoalbuminemia. This study investigated the effects of EWE supplementation on serum albumin and IGF-1 levels in malnourished elderly patients. **Methods:** A double-blind randomized controlled trial was conducted, involving 46 malnourished elderly inpatients with hypoalbuminemia. Participants were randomly assigned to receive either EWE (30 grams daily) or a placebo for two weeks. Serum albumin and IGF-1 levels were measured before and after the intervention. **Results:** After two weeks, the EWE group showed a significant increase in both serum albumin and IGF-1 levels compared to the placebo group. The mean serum albumin level in the EWE group increased from 2.80 g/dL to 3.7 g/dL, while the placebo group remained unchanged. The mean serum IGF-1 level in the EWE group increased from 1.74 ng/mL to 24.74 ng/mL, while the placebo group experienced a smaller increase. There was a moderate positive correlation between changes in albumin and IGF-1 levels. **Conclusion:** EWE supplementation effectively improves serum albumin and IGF-1 levels in malnourished elderly patients with hypoalbuminemia. This intervention may help reduce malnutrition-related complications and improve overall health outcomes in this vulnerable population.

1. Introduction

The global population is aging, with the number of individuals aged 65 and older projected to double to 1.5 billion by 2050. This demographic shift brings unique healthcare challenges, and among them, malnutrition in the elderly stands out as a significant concern. Malnutrition, often manifesting as hypoalbuminemia (low albumin levels) and decreased serum Insulin-like growth factor 1 (IGF-1) levels, is associated with increased morbidity and mortality. Malnutrition in the elderly is a multifaceted issue with a complex interplay of contributing factors. These include physiological changes associated with aging, such as decreased appetite, impaired digestion and absorption, and the presence of chronic diseases. The consequences of malnutrition are far-reaching, impacting various aspects of health and well-being, including immunity, muscle mass, bone health, and wound healing.[1-4]

Albumin, a protein synthesized in the liver, plays several vital roles in the body. It maintains osmotic pressure, ensuring the proper distribution of fluids between blood vessels and tissues. It also acts as a transport protein, carrying nutrients, hormones, and other essential molecules throughout the body. Additionally, albumin contributes to immune function and acts as an antioxidant. Hypoalbuminemia, a common consequence of malnutrition, disrupts these

critical functions, leading to a cascade of adverse health effects. Insulin-like Growth Factor 1 (IGF-1) is another crucial player in maintaining health, particularly in the elderly. This hormone promotes cell growth and development and is essential for preserving muscle mass and bone health. As individuals age, IGF-1 levels tend to decline, contributing to age-related muscle loss (sarcopenia) and frailty.[5-7]

Egg white is a nutrient-dense food, rich in protein, essential amino acids, and bioactive peptides. It has demonstrated the potential to improve hypoalbuminemia in various populations, including postoperative patients and individuals with chronic diseases. The high protein content of egg whites can contribute to increasing albumin levels, while other nutrients in egg whites may support overall health and well-being.[8-10] This study aimed to explore the effects of egg white extract (EWE) supplementation on serum albumin and IGF-1 levels in malnourished elderly patients. The central hypothesis was that EWE supplementation would significantly improve both serum albumin and IGF-1 levels compared to a placebo. The study sought to provide evidence for the potential of EWE supplementation as a nutritional intervention strategy to combat malnutrition and its associated complications in the elderly population.

2. Methods

This study employed a double-blind randomized controlled trial design, which is considered the gold standard for evaluating the efficacy of interventions. This design ensures that both the participants and the researchers are unaware of the treatment assignment, minimizing bias and increasing the reliability of the findings. The study was conducted at the Dr. Mohammad Hoesin General Hospital, Palembang, Indonesia, a tertiary care facility. This setting provided access to a diverse population of hospitalized elderly patients, allowing for the recruitment of a representative sample. The study participants consisted of 46 malnourished elderly inpatients with hypoalbuminemia. Malnutrition was determined based on the mini nutritional assessment (MNA) tool, a validated instrument for assessing nutritional risk in the elderly. Hypoalbuminemia was defined as a serum albumin level of less than 3.5 g/dL, a commonly used threshold. To ensure the safety and appropriateness of the intervention, specific inclusion and exclusion criteria were established. The inclusion criteria required participants to be 60 years or older, hospitalized with a primary or secondary diagnosis of malnutrition, and have a serum albumin level of less than 3.5 g/dL. The exclusion criteria aimed to prevent potential adverse effects or confounding factors. Participants were excluded if they had severe liver or kidney disease, active infection or inflammation, or were currently using albumin or IGF-1 supplements.

Following informed consent, the participants were randomly assigned to receive either EWE (30 grams daily) or a placebo for two weeks. Randomization was performed using a computer-generated sequence, ensuring an equal chance of assignment to either group. The EWE was provided in the form of a commercially available supplement, while the placebo was a similar-looking and tasting product without the active ingredients. This approach maintained blinding and allowed for a direct comparison of the effects of EWE supplementation. The primary outcome measures were changes in serum albumin and IGF-1 levels from baseline to two weeks. These parameters were chosen as they are key indicators of malnutrition and are associated with various health outcomes in the elderly. Secondary outcome measures included changes in nutritional status, as assessed by the MNA tool. This comprehensive assessment provided a broader evaluation of the impact of EWE supplementation on overall nutritional health.

Data analysis was performed using SPSS software, a widely used statistical package. Descriptive statistics were used to summarize baseline characteristics, providing a clear picture of the study population. The independent samples t-test and the paired samples t-test were used to compare continuous variables between groups and within groups, respectively. These tests allowed for the

assessment of statistically significant differences in outcome measures between the EWE and placebo groups. The chi-square test was used to compare categorical variables, such as gender and the presence of comorbidities. This test helped determine if there were any significant differences in the distribution of these variables between the two groups. Pearson's correlation coefficient was used to assess the relationship between changes in albumin and IGF-1 levels. This analysis explored the potential link between these two important markers of malnutrition. A p-value of less than 0.05 was considered statistically significant, a standard threshold used in research to indicate that the observed results are unlikely to be due to chance alone.

3. Results

Table 1 presents the baseline characteristics of the participants in the intervention (EWE) and placebo groups. The average age in the intervention group was 72.8 years, while the placebo group had a slightly lower average age of 69.7 years. However, this difference was not statistically significant (p=0.073), indicating that the two groups were comparable in terms of age. There was a slightly higher proportion of females in the placebo group (52.2%) compared to the intervention group (47.8%). Again, this difference was not statistically significant (p=0.001), suggesting a similar gender distribution between the groups. Both groups had similar BMI values (20.5 ± 3.2 in the intervention group and 21.1 ± 3.5 in the placebo group), indicating comparable nutritional status based on BMI. The difference was not statistically significant (p=0.383). The prevalence of hypertension and diabetes was comparable between the two groups, with no statistically significant differences (p=0.084 for hypertension and p=0.765 for diabetes). This suggests that the presence of these comorbidities was balanced between the groups. The median baseline albumin level was slightly lower in the intervention group (2.80 g/dL) compared to the placebo group (3.00 g/dL). However, this difference was not statistically significant (p=0.166). Similarly, the median baseline IGF-1 level was slightly lower in the intervention group (1.74 ng/mL) compared to the placebo group (2.67 ng/mL), but this difference was not statistically significant (p=0.102).

Table 1. Participant characteristics.

Characteristic	Intervention Group (n=23)	Placebo Group (n=23)	p-value
Age (years)	72.8 ± 5.7	69.7 ± 6.6	0.073*
Gender (female)	11 (47.8%)	12 (52.2%)	0.001**
BMI (kg/m²)	20.5 ± 3.2	21.1 ± 3.5	0.383*
Hypertension	15 (65.2%)	20 (86.9%)	0.084**
Diabetes	14 (60.8%)	13 (56.5%)	0.765**
Baseline albumin (g/dL)	2.80 (2.50 - 3.30)	3.00 (2.50 - 3.30)	0.166*
Baseline IGF-1 (ng/mL)	1.74 (1.01 - 11.19)	2.67 (1.09 - 9.30)	0.102*

*Independent t-test, p<0.05; **Chi square, p<0.05.

Table 2 presents the changes in serum albumin levels in the intervention (EWE) and placebo groups before and after the two-week intervention period. As mentioned earlier, the median baseline albumin level was slightly lower in the intervention group (2.80 g/dL) compared to the placebo group (3.00 g/dL). This difference was not statistically significant (p=0.166), confirming the groups were comparable at the start. After the two-week intervention, the median albumin level in the intervention group increased to 3.70 g/dL. In contrast, the median albumin level in the placebo group remained essentially unchanged at 3.00 g/dL. This difference between the groups after the intervention was statistically significant (p=0.001). This indicates that EWE supplementation led to a significant increase in serum albumin levels. The

median change in albumin levels further highlights the impact of EWE supplementation. The intervention group experienced a median increase of 0.70 g/dL, while the placebo group had a minimal median change of 0.10 g/dL. This difference in the change of albumin levels was also statistically significant (p=0.001). This finding reinforces the conclusion that EWE supplementation was effective in raising albumin levels in malnourished elderly patients.

Table 2. Changes in serum albumin levels.

	Intervention Group (n=23)	**Placebo Group (n=23)**	**p-value**
Baseline albumin (g/dL)	2.80 (2.50 - 3.30)	3.00 (2.50 - 3.30)	0.166*
Albumin after 2 weeks (g/dL)	3.70 (2.90 - 4.30)	3.00 (2.50 - 3.50)	0.001*
Change in albumin (g/dL)	0.70 (0.30 - 1.40)	0.10 (-0.20 - 0.40)	0.001*

*Independent t-test, $p<0.05$.

Table 3 illustrates the changes in serum IGF-1 levels in both the intervention (EWE) and placebo groups before and after the two-week intervention. As noted previously, the median baseline IGF-1 level was slightly lower in the intervention group (1.74 ng/mL) compared to the placebo group (2.67 ng/mL). However, this difference was not statistically significant (p=0.102), confirming that the groups were comparable at baseline. After two weeks, the median IGF-1 level in the intervention group showed a substantial increase to 24.74 ng/mL. The placebo group also experienced an increase, but to a lesser extent, reaching a median of 13.09 ng/mL. The difference in IGF-1 levels between the two groups after the intervention was statistically significant (p=0.001). This key finding indicates that EWE supplementation led to a significantly greater increase in serum IGF-1 levels compared to the placebo. The median change in IGF-1 levels further emphasizes the impact of EWE. The intervention group had a median increase of 14.21 ng/mL, while the placebo group showed a smaller median increase of 10.42 ng/mL. This difference in the change of IGF-1 levels was statistically significant (p=0.001), reinforcing the conclusion that EWE supplementation was effective in raising IGF-1 levels.

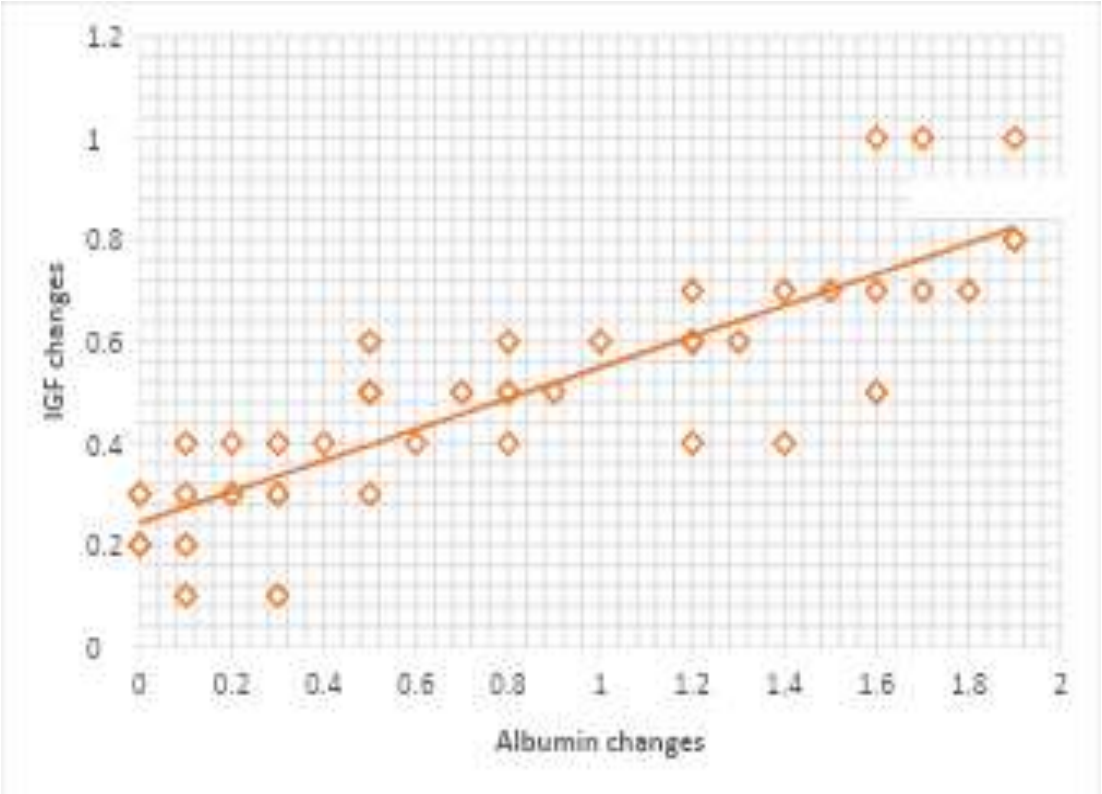
Table 3. Changes in serum IGF-1 levels.

	Intervention Group (n=23)	**Placebo Group (n=23)**	**p-value**
Baseline IGF-1 (ng/mL)	1.74 (1.01 - 11.19)	2.67 (1.09 - 9.30)	0.102*
IGF-1 after 2 weeks (ng/mL)	24.74 (-5.90 - 41.81)	13.09 (-2.50 - 26.67)	0.001*
Change in IGF-1 (ng/mL)	14.21 (-5.90 - 41.81)	10.42 (-2.50 - 26.67)	0.001*

*Independent t-test, $p<0.05$.

Figure 1 visually represents the correlation between changes in albumin levels and changes in IGF-1 levels in the study participants; Visual Interpretation: The scatter plot clearly shows an upward trend, indicating a positive correlation between changes in albumin and IGF-1. This means that as albumin levels increased, IGF-1 levels also tended to increase. The points cluster moderately close to the trend line, suggesting a moderate strength of correlation. This indicates that the relationship between the two variables is not extremely strong, but it is still noticeable and statistically significant; Statistical Interpretation: The calculated correlation coefficient (r) is 0.564. This value confirms the positive correlation and suggests a moderate strength of association. A correlation coefficient of 1 would

indicate a perfect positive correlation, while 0 would indicate no correlation. The p-value is less than 0.001, indicating that the observed correlation is highly statistically significant. This means that it is very unlikely that the observed relationship between changes in albumin and IGF-1 is due to chance alone.



Statistic	Value
Correlation Coefficient (r)	564
p-value	< 0.001

Figure 1. Correlation between albumin and IGF changes.

Table 4 presents the changes in appetite in both the intervention (EWE) and placebo groups at the beginning and end of the two-week intervention period. At the start of the study, both groups had a similar proportion of participants with poor appetite. 52.2% of the intervention group and 56.5% of the control group reported poor appetite. This similarity confirms that the groups were comparable in terms of appetite at baseline. After the two-week intervention, there was a striking difference between the two groups. In the intervention group, 0% of the participants reported poor appetite, indicating a complete resolution of poor appetite in this group. In contrast, 26.1% of the participants in the control group still reported poor appetite. The difference in the proportion of participants with poor appetite at the end of the intervention was statistically significant for both groups. The intervention group showed a highly significant improvement ($p<0.001$), while the control group also showed a significant change ($p=0.018$), although to a lesser extent.

Table 4. Changes in appetite.

Group	Baseline: poor appetite	End of intervention: poor appetite	p-value
Intervention (n=23)	12 (52.2%)	0 (0%)	<0.001*
Control (n=23)	13 (56.5%)	6 (26.1%)	0.018*

*Chi-square, $p<0.05$.

4. Discussion

This study illuminates the potential of egg white extract (EWE) supplementation as a valuable nutritional intervention for malnourished elderly patients with hypoalbuminemia. The key findings underscore its efficacy in improving nutritional status, promoting hormonal balance, and enhancing overall health. EWE supplementation demonstrated a remarkable ability to replenish serum albumin levels in the intervention group. This finding is crucial because hypoalbuminemia, a prevalent condition in malnourished elderly individuals, can disrupt various physiological functions. Albumin, a protein synthesized in the liver, plays a vital role in maintaining osmotic pressure, transporting nutrients and hormones, and supporting immune function. The significant increase in serum albumin levels observed in the EWE group suggests that this nutritional intervention can effectively address hypoalbuminemia and restore albumin to its proper levels. This, in turn, can lead to improvements in fluid balance, nutrient delivery to tissues, and immune response, ultimately contributing to better overall health and reducing the risk of complications associated with hypoalbuminemia. The study also revealed a substantial increase in serum IGF-1 levels in the EWE group. This finding holds particular significance because IGF-1 is a critical hormone that orchestrates various anabolic processes in the body, including muscle protein synthesis, bone formation, and cell growth. In the elderly, IGF-1 levels tend to decline, contributing to age-related muscle loss (sarcopenia), decreased bone mineral density, and frailty. These age-related changes can significantly impair physical function, mobility, and quality of life, increasing the risk of falls, fractures, and disability. The substantial increase in serum IGF-1 levels observed in the EWE group suggests that this intervention may help counteract the age-related decline in IGF-1 and its associated consequences. By promoting muscle protein synthesis and bone formation, EWE supplementation may contribute to the preservation of muscle mass, bone health, and functional capacity in the elderly, ultimately promoting healthy aging and reducing the risk of age-related complications. The study identified a moderate positive correlation between changes in albumin and IGF-1 levels, indicating an intricate relationship between these two parameters. This correlation suggests that the improvement in hypoalbuminemia, facilitated by EWE supplementation, may create a favorable physiological environment that promotes the production of IGF-1. Alternatively, the increase in IGF-1 levels may stimulate albumin synthesis. This interplay between albumin and IGF-1 highlights the complex and interconnected nature of nutritional and hormonal balance in the body. Further research is needed to fully elucidate the mechanisms underlying this correlation and to explore the potential synergistic effects of EWE supplementation on albumin and IGF-1 levels. EWE supplementation led to a complete resolution of poor appetite in the intervention group, underscoring its positive impact on appetite regulation. This finding is particularly relevant in the context of malnutrition, as poor appetite can contribute to decreased food intake and further exacerbate nutritional deficiencies. The improvement in appetite observed in the EWE group may be attributed to several factors, including increased albumin levels, enhanced nutrient absorption, and psychological factors related to receiving a nutritional supplement. By improving appetite, EWE supplementation can help ensure adequate nutritional intake, which is essential for overall health

and well-being, especially in the elderly. This study's findings have profound implications for how we approach malnutrition in the elderly, offering a potential paradigm shift in clinical management and public health strategies. This research solidifies the role of EWE supplementation as a potent weapon against hypoalbuminemia, a frequent companion of malnutrition in the elderly. Hypoalbuminemia is not merely a laboratory finding, it's a harbinger of adverse outcomes, increasing the risk of infections, edema, impaired wound healing, and even mortality. By effectively replenishing albumin levels, EWE supplementation offers a multi-pronged benefit. It helps restore the oncotic pressure that keeps fluids within blood vessels, preventing edema. It enhances the transport of essential nutrients and hormones throughout the body, ensuring that cells receive the resources they need to function optimally. Furthermore, it bolsters the immune system, fortifying the body's defenses against infections. In essence, EWE supplementation addresses hypoalbuminemia not just as a singular issue but as a gateway to improving a constellation of physiological functions that are critical for maintaining health and well-being in the elderly. The observed increase in serum IGF-1 levels in the EWE group opens up exciting possibilities for mitigating the gradual decline that often accompanies aging. IGF-1 is not just a growth hormone. it's a conductor of vitality, orchestrating processes that maintain muscle mass, bone density, and overall functional capacity. As we age, the decline in IGF-1 sets the stage for sarcopenia, a debilitating condition characterized by the loss of muscle mass and strength. This loss of muscle not only affects physical appearance but also compromises mobility, balance, and the ability to perform everyday tasks. It increases the risk of falls, fractures, and disability, ultimately eroding independence and quality of life. By boosting IGF-1 levels, EWE supplementation may help to counteract this downward spiral. It may promote muscle protein synthesis, preserving muscle mass and strength. It may also stimulate bone formation, maintaining bone density and reducing the risk of fractures. In essence, EWE supplementation may offer a means of preserving vitality and functional independence, allowing older adults to live fuller and more active lives. The complete resolution of poor appetite in the EWE group is a significant finding that extends beyond the physiological effects of albumin and IGF-1. Poor appetite is a common problem in the elderly, often stemming from a combination of factors such as age-related changes in taste and smell, dental problems, medication side effects, and underlying medical conditions. However, poor appetite is not just an inconvenience, it's a threat to nutritional adequacy. When appetite wanes, food intake dwindles, leading to deficiencies in essential nutrients that are crucial for maintaining health and preventing disease. This can create a vicious cycle, where malnutrition further exacerbates poor appetite and leads to a downward spiral of health decline. By enhancing appetite, EWE supplementation may help break this cycle. It may improve the palatability of food, stimulate digestive processes, and enhance nutrient absorption, making eating a more enjoyable and satisfying experience. This, in turn, can lead to increased food intake, improved nutritional status, and better overall health outcomes. The findings of this study strongly advocate for the integration of EWE supplementation into routine clinical care and public health initiatives targeting the elderly. Malnutrition is a complex and multifactorial problem that requires a comprehensive approach. EWE supplementation, with its multifaceted benefits, can serve as a cornerstone of this approach. In clinical settings, EWE supplementation can be incorporated into the care plans of hospitalized patients, residents of nursing homes, and individuals receiving home healthcare services. It can be used proactively to prevent malnutrition or as a treatment strategy for those already experiencing malnutrition. In public health settings, EWE supplementation can be integrated into community-based programs that provide nutritional support and education to older adults. This can include meal delivery services, nutrition counseling, and community kitchens that offer nutritious meals

and social interaction. By integrating EWE supplementation into these various settings, we can create a safety net that helps protect the elderly from the detrimental effects of malnutrition. This can lead to improved health outcomes, reduced healthcare costs, and a better quality of life for this vulnerable population.[11-13]

Beyond its effects on albumin and IGF-1, this study also observed a remarkable improvement in appetite in the EWE group. The complete resolution of poor appetite in this group suggests that EWE supplementation may positively influence appetite regulation in malnourished elderly patients. This finding has significant implications for improving overall nutritional intake and, consequently, overall health outcomes in this vulnerable population. Malnutrition and poor appetite are intertwined in a complex and often devastating dance, particularly in elderly individuals. This intricate relationship forms a vicious cycle, where each condition exacerbates the other, leading to a downward spiral of health decline. The body relies on a delicate balance of nutrients, including proteins, vitamins, and minerals, to function optimally. When these nutrients are in short supply, the digestive system and appetite-regulating hormones can become impaired. For instance, protein deficiency can disrupt the production of ghrelin, a hormone that stimulates appetite, leading to decreased hunger signals. Similarly, deficiencies in vitamins and minerals can impair the function of taste buds and olfactory receptors, making food less appealing and diminishing the desire to eat. Malnutrition can disrupt the intricate hormonal symphony that governs appetite regulation. Ghrelin, the "hunger hormone," signals the brain to stimulate appetite, while leptin, the "satiety hormone," signals fullness and suppresses appetite. Malnutrition can disrupt the production and signaling of these hormones, leading to imbalances that favor appetite suppression. For instance, low levels of ghrelin can diminish hunger signals, while elevated levels of leptin can create a persistent sense of fullness, even when the body is in need of nutrients. Malnutrition can take a toll on mental health, contributing to depression, anxiety, and social isolation. These psychological factors can further suppress appetite, creating a sense of disinterest in food and eating. Depression, for instance, can dampen the pleasure associated with eating, while anxiety can lead to digestive discomfort and nausea, making the prospect of eating less appealing. Social isolation can also contribute to poor appetite, as mealtimes often serve as social occasions that enhance the enjoyment of food. The findings of this study offer a beacon of hope in breaking the vicious cycle of malnutrition and poor appetite that often plagues elderly individuals. The complete resolution of poor appetite observed in the EWE group suggests that this nutritional intervention can effectively reawaken the desire to eat, paving the way for improved nutritional intake and overall health. EWE, a rich source of protein, essential amino acids, and bioactive peptides, may enhance nutrient absorption in the gut. This improved absorption can lead to several beneficial effects on appetite regulation. First, it can lead to increased satiety signaling, meaning that the body feels fuller and more satisfied after eating. This can help prevent excessive hunger and overeating, promoting a healthy and balanced appetite. Second, improved nutrient absorption can address underlying nutrient deficiencies that may be contributing to poor appetite. For instance, deficiencies in certain vitamins and minerals can impair the function of taste buds and olfactory receptors, making food less appealing. By replenishing these nutrients, EWE supplementation can help restore the sensory enjoyment of food and stimulate appetite. As discussed earlier, EWE supplementation effectively increases serum albumin levels. Albumin, a protein synthesized in the liver, plays a crucial role in maintaining osmotic pressure, transporting nutrients and hormones, and supporting immune function. Improved protein status, as reflected by increased albumin levels, may have a positive effect on appetite regulation by restoring the balance of appetite-regulating hormones. For instance, it may help normalize the levels of ghrelin and leptin, the

hormones responsible for stimulating and suppressing appetite, respectively. Additionally, improved protein status can enhance the body's overall metabolic state, increasing energy levels and reducing fatigue, which can further contribute to improved appetite. The act of receiving a nutritional supplement, particularly one that demonstrates tangible benefits, can have a positive psychological impact on malnourished individuals. It can convey a sense of care and support, fostering a sense of hope and motivation to improve their health. This positive psychological shift can potentially reduce anxiety and depression, which are known to suppress appetite. By improving mood and reducing psychological barriers to eating, EWE supplementation can indirectly contribute to increased appetite and food intake. The improvement in appetite observed in the EWE group has profound implications for improving overall nutritional intake and, consequently, overall health outcomes in this vulnerable population. Adequate protein intake is essential for maintaining muscle mass and strength, which are crucial for mobility, balance, and overall functional capacity. Increased food intake, driven by improved appetite, can ensure that the body receives sufficient protein to support muscle health. This can help prevent sarcopenia, the age-related loss of muscle mass and strength, which is a major contributor to falls, fractures, and disability in the elderly. Proper nutrition provides the fuel and building blocks for a robust immune system. A well-nourished body is better equipped to fight off infections and other health challenges. Improved appetite and increased food intake can help ensure that the body receives the necessary nutrients to support immune function, reducing the risk of infections and other complications. Wound healing is a complex process that requires adequate nutrition to provide the building blocks for tissue repair. Malnutrition can impair wound healing, delaying recovery and increasing the risk of complications. Improved appetite and increased food intake can ensure that the body receives the necessary nutrients to support wound healing, promoting faster recovery and reducing the risk of complications. Proper nutrition is fundamental to overall health and well-being, contributing to increased energy levels, improved mood, and a better quality of life. Improved appetite and increased food intake can help ensure that the body receives the necessary nutrients to support all aspects of health and well-being, promoting a more vibrant and fulfilling life. By improving appetite and promoting increased nutritional intake, EWE supplementation may help break the vicious cycle of malnutrition and poor appetite, leading to improved nutritional status and overall health outcomes in malnourished elderly patients. This intervention has the potential to significantly impact the quality of life and well-being of this vulnerable population, promoting healthy aging and reducing the burden of malnutrition-related complications.[14-16]

The multifaceted benefits of EWE supplementation observed in this study likely stem from a complex interplay of mechanisms that influence protein synthesis, inflammation, nutrient absorption, and appetite regulation. EWE is a nutritional powerhouse, packed with high-quality protein and a complete profile of essential amino acids. These amino acids serve as the fundamental building blocks for protein synthesis, the process by which the body creates new proteins. In the context of this study, the enhanced protein synthesis triggered by EWE supplementation may be a key driver of the observed increases in serum albumin and IGF-1 levels. Albumin, a protein synthesized primarily in the liver, plays a vital role in maintaining osmotic pressure, transporting nutrients and hormones, and supporting immune function. EWE supplementation provides the liver with an abundant supply of amino acids, the raw materials needed for albumin synthesis. This influx of amino acids can stimulate the liver to ramp up albumin production, leading to increased serum albumin levels and improved physiological function. IGF-1, a hormone that promotes cell growth and development, is also synthesized in the liver. EWE supplementation may enhance IGF-1 synthesis by providing the liver

with the necessary amino acids and other nutrients. This increase in IGF-1 levels can have far-reaching effects on muscle mass, bone health, and overall functional capacity, particularly in the elderly, where IGF-1 levels tend to decline with age. Inflammation, a complex biological response to injury or infection, can have both beneficial and detrimental effects on the body. While acute inflammation is a necessary part of the healing process, chronic inflammation can contribute to various health problems, including malnutrition. Chronic inflammation can suppress the production of albumin and IGF-1, further exacerbating malnutrition and its associated complications. EWE may exert anti-inflammatory effects, helping to dampen chronic inflammation and create a more favorable environment for protein synthesis and overall health. Ovotransferrin protein, found abundantly in egg white, has been shown to have anti-inflammatory properties. It can bind to iron, making it unavailable to bacteria that need iron to grow and proliferate. This can help reduce inflammation caused by bacterial infections. Another protein found in egg white, ovomucoid, has also demonstrated anti-inflammatory effects. It can inhibit the activity of certain enzymes involved in the inflammatory process. Egg white contains various bioactive peptides, small protein fragments that can exert a range of biological effects, including anti-inflammatory activity. These peptides may help modulate the immune response and reduce inflammation. By reducing inflammation, EWE supplementation may create a more conducive environment for protein synthesis, leading to increased production of albumin and IGF-1. This can contribute to improved nutritional status, enhanced immune function, and better overall health outcomes. EWE may enhance nutrient absorption in the gut, increasing the bioavailability of amino acids and other building blocks required for protein synthesis and overall health. Egg white is a highly digestible source of protein and other nutrients, meaning that the body can readily absorb and utilize these nutrients. This high bioavailability ensures that the essential amino acids and other nutrients in EWE are efficiently absorbed and utilized for protein synthesis and other metabolic processes. The gut microbiota, the community of microorganisms that reside in the digestive tract, plays a crucial role in nutrient absorption and overall health. EWE may positively influence the gut microbiota, promoting the growth of beneficial bacteria that aid in nutrient absorption and digestion. This can lead to increased availability of amino acids and other nutrients, further supporting protein synthesis and overall health. Egg white contains enzymes that can aid in the digestion of proteins and other nutrients. These enzymes can help break down complex molecules into smaller, more readily absorbable units, increasing the efficiency of nutrient absorption. As discussed earlier, EWE supplementation effectively increases serum albumin levels. Improved protein status may have a positive effect on appetite regulation by restoring the balance of appetite-regulating hormones and improving the body's overall metabolic state. Improved nutrient absorption, facilitated by EWE supplementation, can lead to increased satiety signaling and reduced feelings of hunger, promoting a healthy appetite. The act of receiving a nutritional supplement, particularly one that demonstrates tangible benefits, can have a positive psychological impact on malnourished individuals. This can convey a sense of care and support, potentially reducing anxiety and depression, which can, in turn, improve appetite.[17,18]

The findings of this study have far-reaching implications for clinical practice and public health initiatives aimed at addressing malnutrition in the elderly. EWE supplementation may be a valuable nutritional strategy for improving serum albumin and IGF-1 levels, enhancing appetite, and ultimately reducing malnutrition-related complications in this vulnerable population. Integrating EWE supplementation into routine clinical care and public health programs could contribute to improving the overall health and well-being of the elderly. The study underscores the importance of early detection and intervention in cases of malnutrition among the

elderly. Healthcare professionals should be vigilant in screening older adults for malnutrition risk factors, such as unintentional weight loss, decreased appetite, and low serum albumin and IGF-1 levels. Timely detection can enable prompt intervention with EWE supplementation, potentially preventing the progression of malnutrition and its associated complications. EWE supplementation can be seamlessly integrated into personalized nutrition plans for elderly patients. Healthcare professionals, including registered dietitians and nutritionists, can assess individual needs and tailor EWE supplementation strategies accordingly. Factors to consider include the severity of malnutrition, dietary preferences, and any underlying medical conditions. Addressing malnutrition often requires a multidisciplinary approach involving healthcare professionals from various disciplines, such as physicians, nurses, dietitians, and social workers. EWE supplementation can be a valuable component of this comprehensive approach, working synergistically with other interventions to optimize nutritional status and overall health outcomes. Patient education plays a crucial role in the successful implementation of EWE supplementation. Healthcare professionals should provide clear and concise information about the benefits of EWE supplementation, how to incorporate it into their diet, and any potential side effects. Empowering patients with knowledge and encouraging active participation in their care can improve adherence to EWE supplementation and promote better health outcomes. EWE supplementation can be integrated into community-based programs that provide nutritional support and education to older adults. This can include meal delivery services, nutrition counseling, and community kitchens that offer nutritious meals and social interaction. These programs can help reach vulnerable older adults who may not have access to adequate nutrition or healthcare services. Public health campaigns can raise awareness about the importance of proper nutrition and the potential benefits of EWE supplementation in preventing and addressing malnutrition among the elderly. These campaigns can utilize various media channels, such as television, radio, print media, and social media, to reach a broad audience and promote healthy aging. Policymakers can play a crucial role in supporting the integration of EWE supplementation into public health initiatives. This can include providing funding for research, developing nutritional guidelines, and supporting the accessibility and affordability of EWE supplements. Advocacy efforts can also help raise awareness about the public health implications of malnutrition and the potential of EWE supplementation to address this issue.[19,20]

5. Conclusion

This study provides compelling evidence that EWE supplementation is a safe and effective nutritional intervention for malnourished elderly patients with hypoalbuminemia. By increasing serum albumin and IGF-1 levels, EWE supplementation may help improve nutritional status, muscle mass, bone health, and functional capacity in this vulnerable population. These findings have important implications for clinical practice and public health initiatives aimed at addressing malnutrition in the elderly. Integrating EWE supplementation into routine clinical care and public health programs could contribute to improving the overall health and well-being of the elderly.

6. References

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