



Case Report: Management of Hypoalbuminemia with A Semi-Elemental Egg White Derived Nutrition Formulation

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ABSTRACT

Hypoalbuminemia is generally defined as a serum albumin concentration ≤ 3.0 g/dL. Hypoalbuminemia is linked to poor outcomes, including an increase in complications, regardless of the underlying processes, also reduced short-term and long-term survival in critical patients. Malnourished patients have high protein needs, and research shows that providing them enough protein can lower mortality and enhance quality of life. Egg whites contain all the essential amino acids required, and it has many beneficial effects on the body. Peptides generated from egg whites maintain the nutritional value of egg whites and are easily absorbed in the body. We reported three cases studies to demonstrate the effectiveness of oral administration of egg white passed formulation in hospitalized patients with hypoalbuminemia and observed that, administration of High Protein Albumin Formula (Albuwise) is safe and effective in improving serum albumin level among hospitalized patient with low serum albumin levels.

Keywords: Hypoalbuminemia, Egg white, semi-elemental, nutrition formulations.

INTRODUCTION

The most prevalent plasma protein in adult humans is albumin, which has a concentration of 3.5 to 5.0 g/dL. Albumin serves a number of physiological functions. Maintaining the oncotic pressure inside the vascular compartments to stop fluid from leaking into the extravascular space is one of the most crucial properties of albumin. Albumin is particularly useful in individuals who are critically ill or chronically ill as a measure of nutritional status and illness severity [1]. Hypoalbuminemia is a drop in serum albumin levels below the reference interval (<3.0 g/dL) [2]. One of the most common conditions among hospitalized and severely ill patients is hypoalbuminemia. Decreased (rare) albumin production, increased albumin loss through the skin, GI tract, kidneys, or extravascular space, increased albumin catabolism, or a combination of two or more of these pathways can all lead to hypoalbuminemia [1]. In hospitalized patients, hypoalbuminemia is utilized as a prognostic marker for morbidity and mortality, especially in the critical care unit [3]. The underlying condition must be treated in order to manage the hypoalbuminemia. Albumin infusions are occasionally administered to critically ill patients. Whether albumin infusions are therapeutically beneficial to other populations of critical illness is controversial [1].

Egg whites are known to be a good source of rich proteins. Egg white and yolk proteins are recognized as functional dietary nutrients because of their biological activity, which includes antibacterial, antioxidant, metal-chelating, antihypertensive, anticancer, and immunomodulatory properties [4, 5]. According to a previous research, egg white proteins—whether cooked or uncooked—have a higher net protein utilization (NPU) value even if their amino acid scores are similar to those of whey and soybean proteins [6]. Patients with hypoalbuminemia may benefit from a protein supplementation formula made from egg and egg white protein. Enzymes hydrolyze fresh chicken egg white to create Egg White Peptides (EP-1). Unlike amino acids or proteins, peptides made from egg whites have special characteristics. Peptide activity is influenced by the length, amount, and order of amino acids. It facilitates rapid intestinal absorption. Egg white hydrolysates preserve the nutritional value of egg whites while being easily absorbed by the body, according to

research done on animals by Matsuoka *et al.*, [6]. In these case reports, we aimed to demonstrate the effectiveness of oral administration of egg white passed formulation in hospitalized patients with hypoalbuminemia along with conventional nutrition counselling.

Case Study 1:

45Y /F was brought to the casualty with second degree burn being involved in a pressure cooker explosion with resultant fire. The patient was hypertensive with an history of hysterectomy. Given the size of her burns, skin grafting was planned for her along with other medical intervention for burns. On baseline (Post operative Day 2). The patient's Weight was 65kg, Height-169cm, BMI (Body Mass Index)-22.4 kg/m² and MUAC (Mid Upper Arm Circumference) was 27cm. From biochemical parameters, her albumin was noted to be 1.4g/dL. Other blood test indices were 7 mg/dL for Serum Prealbumin, 3.4g/dL for Serum Protein and 283 mg/L for CRP (C-reactive protein). Clinical signs and symptoms were noted which included poor appetite, decreased oral intake, fatigue, and weakness. The SGA (Subjective Global Assessment) score for patient was "C" due to severe deficit in nutrient intake as patient was not able to eat on her own, >10% ongoing weight loss due to the clinical condition.

Indirect calorimetry is considered to be the gold standard but it is time-consuming and expensive, therefore predictive equations were used (25-30 kcal/kg body weight). Proteins play a significant role in the nutrition management of critically ill patients. The requirement of protein can vary from 1.5 to 2.5 kg per day based on the level of stress in the patient [7]. In the above case, After Nutrition Rehab reference, the dietitian successively switched to a high-calorie high protein soft diet (Energy: 1950 kcal, Protein: 80g). In order to manage hypoalbuminemia, patient was prescribed high protein albumin formula, she was prescribed 2 scoops of formula (10g per scoop). After a week she was shifted to a full diet and continued on High Protein Albumin Formula, dosage of the supplement was increased 4 scoops per day. Post-discharge, the patient was followed up to check compliance, tolerance, and acceptability.

On next day of follow up, the patient was found to accept and tolerate oral diet, the patient did complain of some nausea for 3 days which was majorly due to clinical conditions and medications. The patient well tolerated the formula without major complaints with respect to GI discomfort, palatability, allergic reaction, or any other clinical signs and symptoms. Patient-reported improved energy levels, and decreased fatigue within 5 days of intervention. Her appetite and oral intake improved on the following consecutive days along with wound healing. On weekly follow-up, the Patient's serum albumin and protein level depicted significant improvement, her levels increased to 1.8 g/dL and 4.3 mg/dL respectively. The patients' wounds showed timely and effective healing which contributed to a reduction in the length of hospital stay and improved medical compliance.

No serious adverse events were reported over the duration of 45 days of usage of formulations and no safety concerns were reported. Within 1 month, the patient's biochemical parameters showed remarkable improvements, The serum albumin was increased to 3.0g/dL, Serum prealbumin improved to 19 mg/dL, Serum Protein increased to 5.7 g/dL for Serum Protein and CRP reduced to 41.

Table 1: Biochemical parameters of Case 1

Parameters (gm/dl)	Baseline	Day 7 th	Day 14 th	Day 30 th	Day 45 th
Ser. Albumin	1.4	1.8	2.2	3	3.3
Sr. Pre-Albumin	7	9	15	19	22
Ser. Protein	3.4	4.3	5	5.7	5.9
CRP	283	282	100	41	15

Case 2:

71Y /M was diagnosed with Stage 2 Colon Adenocarcinoma. Risk factors for the disease include smoking and family history of the disease. He had history of Hypertension, Diabetes Mellitus, Coronary artery disease. He was undergoing Chemotherapy.

The patient's Height was 171 cm, Weight was 65kg, BMI (Body Mass Index)-22.4 kg/m² and MUAC (Mid Upper Arm Circumference) was 26 cm. The biochemical parameters are as follow: SerumAlbumin was noted to be 2.8g/dL. Other blood test indices were 12 mg/dL for Serum Prealbumin, 5.2 g/dL for Serum Protein and 65 mg/L for CRP (C-reactive protein). Clinical signs and symptoms were noted which included decreased oral intakeand weakness. The SGA (Subjective Global Assessment) score for patient was "B" as his intake was suboptimum and had 5-10% ongoing weight loss.

As per the recommendations by the European Society for Parenteral and Enteral Nutrition (ESPEN), due to inability to determine resting energy requirements (REE) through indirect calorimetry, predictive equations were used. The energy requirement was calculated as 25–30 kcal/kg of current body weight per day and protein in the range of 1 to

1.5 g/ kg body weight [8].For this case, the dietitian advised a high-calorie high protein diet [Energy: 1950 kcal (30kcal/kg body weight), Protein: 80g (1.3g/kg body weight)]. To manage hypoalbuminemia, patient was prescribed High Protein Albumin formula (Albuwise), he was prescribed 4 scoops of formula (10g per scoop) which was gradually increased to 6 scoops per day in 4thweek.Post-discharge, the patient was followed up to check compliance, tolerance, and acceptability.

On next day of follow up, the patient was found to accept and tolerate oral diet. After 7 days, the patient complained of vomiting and loose stools which was associated with chemotherapy and managed well with medications. After 15 days, patientreported improved energy levels and improved appetite. He had no complaints, no allergic reaction, or any other clinical signs and symptoms. No serious adverse events were reported over the duration of 45 days of usage of formulations and no safety concerns were reported. On OPD (Out Patient Department) follow up, after 45 days, the patient’s biochemical parameters showed remarkable improvements, The Serum albumin was increased to 3.4g/dL, Serum Prealbumin improved to 23 mg/dL, Serum Protein increased to 6.4 g/dL for Serum Protein and CRP reduced to 10.

Table 2: Biochemical Parameters of Case 2

Parameters (gm/dl)	Baseline	Day 7 th	Day 14 th	Day 30 th	Day 45 th
Ser. Albumin	2.8	2.5	3.0	3.1	3.4
Sr. Pre-Albumin	12	15	18	21	23
Ser. Protein	5.2	5.9	5.5	6.0	5.9
CRP	65	30.5	21	15	10

Case 3:

69Y /M was presented with acute severe epigastric pain, accompanied by alteration of consciousness, vomiting, and fever.Initial laboratory results showed lipase 260 U/L. He had history of chronic alcohol drinkingfor more than 20 years. The patient was diagnosed with Acute Pancreatitis. He had history of Hypertension, Hypothyroidism, Diabetes Mellitus. He underwent ERCP (Endoscopic Retrograde Cholangiopancreatography) and was further managed with medications like analgesic and anti-emetics.

The patient’s Height was 160 cm, Weight was 52kg, BMI (Body Mass Index)-20 kg/m² and MUAC (Mid Upper Arm Circumference) was 19 cm. The biochemical parameters are as follow: Serum Albumin was noted to be 2.4g/dL. Other blood test indices were 11 mg/dL for Serum Prealbumin, 5g/dL for Serum Protein and 158 mg/L for CRP (C-reactive protein). Clinical signs and symptoms were noted which included pain on eating, accepting only liquid diet, nausea, poor appetite and weakness. The SGA (Subjective Global Assessment) score for patient was “B” as there was significant reduction in food intake.

The predicted REE was calculated using predictive equations by a weight-based equation of 25-30 kcal/kg/dayand protein in the range of 1.2 to 2.0 g/ kg body weight [9]. The dietitian encouraged the patient to start with a high-calorie high protein soft diet [Energy: 1600 kcal (30kcal/kg body weight), Protein: 62g (1.3g/kg body weight)]. To manage hypoalbuminemia, patient was prescribed high protein albumin formula, he was prescribed 4 scoops of formula (10g per scoop). Post-discharge, the patient was followed up to check compliance, tolerance, and acceptability.

On next day follow up, the patient was found to accept and tolerate oral soft diet. During initial 3 days there was some nausea and poor appetite but gradually patient had no major symptoms and was able to meet up the requirement. After 1 week, patient reported improved energy levels and improved appetite, even the serum albumin level increased to 3.0 g/dL. He had no complaints with respect to allergic reaction, or any other clinical signs and symptoms. No serious adverse events were reported over the duration of 45 days of usage of formulations and no safety concerns were reported. On OPD (Out Patient Department) follow up, after 45 days, the patient’s biochemical parameters showed remarkable improvements, The Serum albumin was increased to 3.6 g/dL, Serum Prealbumin improved to 20 mg/dL, Serum Protein increased to 6.2 g/dL for Serum Protein and CRP reduced to 8.

Table 3: Biochemical Parameters of Case 3

Parameters (gm/dl)	Baseline	Day 7 th	Day 14 th	Day 30 th	Day 45 th
Ser. Albumin	2.4	3.0	3.0	3.2	3.6
Sr. Pre-Albumin	11	15	14	17	20
Ser. Protein	5.0	5.2	5.4	6.0	6.2
CRP	158	48	55	20	8

DISCUSSION

In the current study, we analyzed the effectiveness and safety of High Protein Albumin Formula (Albuwise) supplementations in hospitalized patients with low serum albumin levels. We reported 3 cases of patients with hypoalbuminemia. All the patients were either moderately malnourished or severely malnourished as per Nutrition assessment and SGA score.

Malnutrition is generally caused by low protein intake that results in a negative nitrogen balance, which lowers blood levels of albumin protein and causes muscular atrophy. One biomarker that shows the severity of the illness is the albumin protein. In these cases, the primary goal of nutrition was to overcome malnutrition by increasing intake of protein and energy. Consuming enough protein and calories has been shown to lower the risk of muscle catabolism, a death risk factor, preserve muscle composition, and ultimately improve prognosis in critically ill patients [10]. Since chicken egg whites contain all of the essential amino acids, they are regarded as a rich source of protein [5]. The production of Egg White Peptides EP-1, which exhibit superior heat resistance, involves the hydrolysis of fresh chicken egg white using enzymes. Egg white peptides have a range of properties not found in proteins or amino acids. In an animal study, Matsuoka et al. discovered that egg white hydrolysates are rapidly absorbed by the body while retaining the nutritious content of egg whites [6].

Every serum protein component that we have measured, such as serum albumin, serum prealbumin, and serum protein, has climbed steadily from the baseline and has done so at every follow-up and 45-day interval. The improvement in serum albumin level of all the 3 cases is demonstrated in Figure 1. It was also interesting to note that the CRP levels consistently decreased between the 45th day and each follow-up. Albuwise's ability to directly or indirectly influence the synthesis, absorption, and breakdown of serum albumin by controlling intestinal absorption capacity, reducing stress response, and reducing inflammatory response is demonstrated by the steady and gradual rise of all serum protein parameters [11]. The inflammatory response may be suppressed if there is a consistent drop in the level of the sensitive inflammatory marker C-reactive protein (CRP). Our findings are consistent with the meta-analysis conducted by Ling-Mei Zhou and colleagues [12]. The dietary intake components, such as the number of calories and protein, increased uniformly from and during each follow-up. This is consistent with Robert's research [13]. From the baseline to the 45th day, there was an increase in weight, BMI (Body Mass Index), and MUAC (Mid Upper Arm Circumference). This demonstrates the formulations' efficacy. The Modified Subjective Global Assessment Scoring System (SGA) divides malnutrition into three categories: A is well-nourished, B is moderately malnourished, and C is severely malnourished. From the baseline to the 45th day of the trial, we saw a shift in SGA of the patients, changing from Grade C or Grade B (Severe – Moderate malnutrition) to Grade A (Normal). Improvements in food intolerance, nausea, vomiting, and stool consistency have been noted in terms of safety measures. Due to the semi-elemental nature of the formulation, we have also found an improvement in gastrointestinal tolerance following supplementations of High Protein Albumin Formula (Albu-wise).

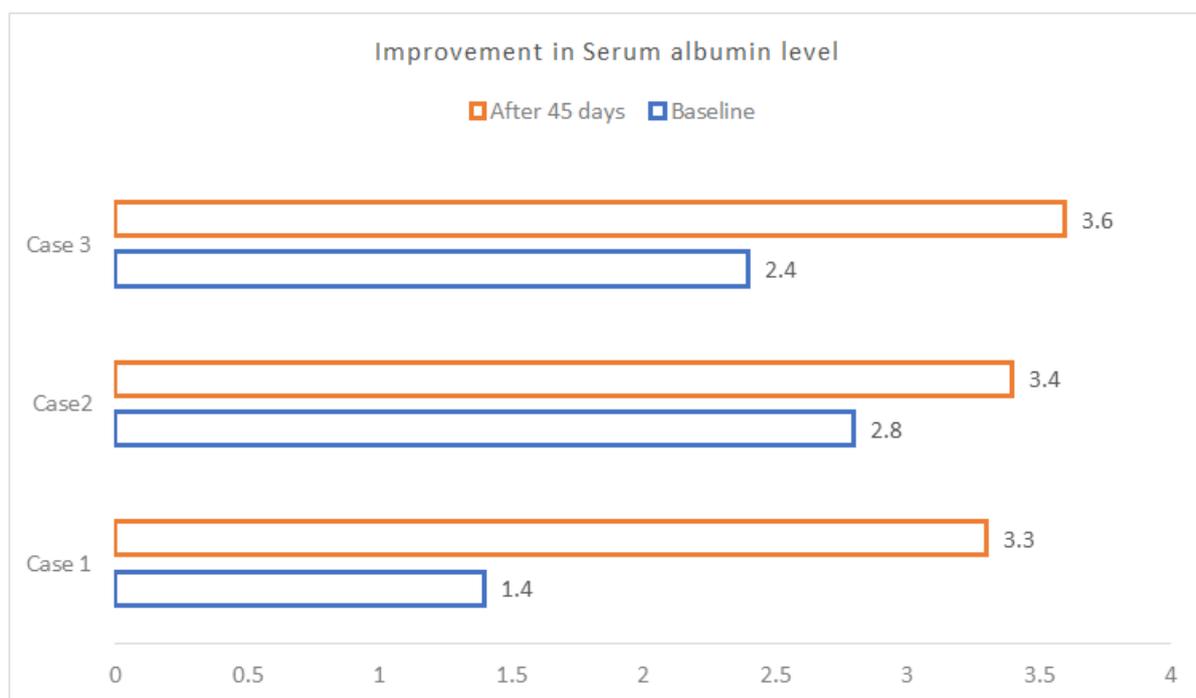


Fig 1: Improvement in serum albumin level of 3 cases

CONCLUSION

These case studies emphasize the significance of high protein, high calories, and adequate nutrition therapy in ensuring patient's nutritional needs and improving their overall condition to support early recovery. Oral high-protein supplements made from egg whites can be a safe and helpful strategy for hospitalized patients with hypoalbuminemia when combined with traditional nutritional counselling. There are disadvantages to other protein supplementing techniques as well, namely the need for parenteral albumin injection and allergic reactions. Our research indicates that giving hospitalized patients with low serum albumin levels the High Protein Albumin Formula (Albuwise) is a safe and efficient way to raise their levels.

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