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EON Therapy Ameliorates Cachexia and Quality of Life in Cancer Patients

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Abstract

Cancer induced cachexia, a gross loss of skeletal muscle with or without adipose tissue wasting, remains a clinical impasse resulting in poor prognosis and Quality of Life (QoL). It is characterized by an inflammation driven anorexia and aberrant energy and protein balance. Indubitably, nutritional rehabilitation is required to address various daunting challenges of this multifactorial syndrome. Esperer Onco Nutrition has come up with an optimal clinical nutrition formulation with promising anti-cachexia effects. Towards validating the efficacy and ensuring the safety of EON Therapy (Es-Invigour plus Es-Fortitude-Protect) under clinical settings, a phase IV post marketing surveillance (PMS) study with 63 patients from various hospitals across India was undertaken. This multi-nutrient and multi-targeted nutritional intervention, being concurrent with mainstream therapy, demonstrated potential to ameliorate the cachectic condition which was measured by body weight of the volunteers at each visit. Biochemical parameters improved or remained same. Overall QoL assessment was performed by using ECOG Scale and Malnutrition Screening Tool (MST) which showed significant improvement in physical wellness and nutritional status of the volunteers. No adverse effect was observed during the entire period. These observations reinforce the need of research based nutritional intervention for clinical use in cachectic cancer patients.

Keywords

Cancer, Cachexia, Nutritional Intervention, EON Therapy, Quality of Life

1. Introduction

Cancer cachexia is a paraneoplastic disorder whose distinctive features are alterations in body compositions, involuntary loss of skeletal muscle mass with or without adipose tissue wasting, owing to the altered metabolism and deregulated

homeostasis of protein [1] [2]. Cancer patients with cachexia inevitably evince hypermetabolism with diminished energy intake and enhanced energy expenditure and an aberrant proteostasis associated with the higher proteolysis and lower protein synthesis [3] [4] [5] [6]. Different from starvation and normal malnutrition, it manifests few salient tumors as well as systemic inflammation driven characteristics which finally leads to escalating functional damage, post-treatment complications, impaired Quality of Life (QoL) and the malady-induced human demise [7]. It is worth mentioning that half of all the cancer-related mortalities (~8 million per year) are attributed to cancer cachexia—mostly occurring in cancers of GI tract and in head and neck, lung cancer, etc. Cachexia is heterogeneously spread across cancer patients with varying tumor type, stage and therapeutic modalities. Advanced stage of disease and its effects on intake, digestion and assimilation of nutrients are important determinants of cancer cachexia [8].

Undernutrition is vastly prevalent in cachectic cancer patients as a result of diminished food intake, vitiated quality of diet and catabolism [9]. While tumor-associated mechanical interference affects the dietary ingestion and absorption and tumor-produced catabolic factors (such as Activins, Myostatin, Parathyroid hormone-related protein, HSP70, HSP90, etc.) evoke catabolism, several inflammatory cytokines (such as TNF-α, IL-1, IL-6, IL-17, IFN-γ, etc.) derived from tumor-immune system crosstalk impede the appetite signals within the CNS [10] [11] [12]. Undernutrition inexorably affects the macro and micronutrients status of the patients [13]. As such, there exist no curative modalities for cancer cachexia but nutritional care remains the mainstay of a multimodal therapy. Standardized optimum nutritional intervention can target different pathways causing chronic inflammation and metabolic perturbations to mitigate and partially reverse the propagation of the disease. The general validity of such notions can be established and supported by an array of scientific investigations both in preclinical and clinical settings [14]. Yet, optimized nutritional formulations are lacking to address all the issues mentioned above.

Herein, we report the anti-cachexia effects of an optimal clinical nutrition formulation developed and marketed by Esperer Onco Nutrition. In a phase IV post marketing surveillance (PMS) study with 63 patients from various hospitals across India, the safety and efficacy of EON Therapy (Es-Invigour plus Es-Fortitude-Protect) was recently evaluated. This multi-nutrient and multi-targeted nutritional intervention, being concurrent with mainstream therapy, has a potential to ameliorate the cachectic condition and overall QoL of the patients involved. We are now performing extensive molecular analysis on the same and envisioning more rigorous outcomes of our future studies.

2. Materials and Methods

2.1. Study Design and Objectives

This study was a prospective, open label, multi-centric post marketing surveil-

lance (PMS) to evaluate safety and efficacy of novel oral nutritional supplements (EON therapy) developed by Esperer Onco Nutrition during September 2020 and February 2022. The study was designed to assess if usage of EON therapy helps managing body weight, key biochemical parameter and QoL of cancer patients. Ethical approval was obtained from Institutional Ethics Committee of each of the hospital wherein patients were enrolled for the PMS study. After obtaining informed consent, screening procedures were performed to assess eligibility of the patients based upon predefined inclusion and exclusion criteria. In short, eligible patients were male and females residing in India, above 13 years of age, who gave written informed consent and were cytologically or histologically confirmed cases of malignant neoplasm who were receiving or planned to receive any cancer therapy (chemotherapy, radiotherapy or a combination or surgery and chemotherapy) with a progressive weight loss. Patients on parenteral nutritional support or with clinically significant uncontrolled cardiovascular, renal or pulmonary diseases were considered ineligible. Pregnant or lactating females were also considered ineligible.

The patients were explained about importance of being in touch with study staff on regular basis and maintenance of dosing diary. After a run-in period of two to three days, patients were put on EON therapy.

2.2. Oral Nutritional Supplementation and Assessments

Patients were administered with EON therapy (Es Invigour and Es Fortitude Protect) orally as an enteral nutrition therapy at the dose decided by the treating physician in conjunction with the nutritionist. Both the products in powder form were reconstituted in water for immediate consumption. The recommended daily dose was two sachets of both the products in two divided doses for a minimum of three months or till the end of chemotherapy cycle. The patients were advised to be on regular diet during the period of treatment. Efficacy was assessed by recording body weight, biochemical parameters and BMI at baseline and at every visit.

Impact of nutritional intervention on QoL was indirectly assessed using ECOG Performance Status Scale along with nutritional screening using Malnutrition Screening Tool (MST) at each visit [15] [16]. ECOG Scale is a well-accepted and widely used to assess changes in patients' level of functioning in terms of their ability to care for themselves, daily activity, and physical ability. ECOG gives a score out of five with lower score indicating better physical and mental well-being. MST is an easy to use two question tool that is usually used to assess malnutrition status of an individual. MST gives a score out of five to show the level of malnutrition risk with lower score indicating lesser risk of developing malnutrition. Outcome of ECOG and MST scales were together used to assess impact of nutritional supplements on QoL Adverse events attributed to nutritional supplement were also recorded.

The results were evaluated using descriptive and inferential statistical para-

meters. Changes in average body weight over each of the visits were compared using paired t test. Paired t test was also used to compare change in each of the biochemical parameter monitored over the study duration.

3. Results

Informed consent was obtained from 91 patients for enrolment in the study of which 63 volunteers were recruited for the study post screening using predefined inclusion and exclusion criteria (Table 1). The recruited patients included both males (42) and females (21) with age varying between 19 - 60 years. All the patients were on curative therapy with most of the patients taking one or more chemotherapeutic agents. Detailed baseline demographic data of recruited patients is presented in Table 2. Patients were administered enteral nutritional supplements (Es-Invigour and Es-Fortitude Protect). The composition of both the supplements is presented in Table 3 and Table 4.

Table 1. Inclusion and exclusion criteria for volunteer recruitment.

Inclusion Criteria	Exclusion Criteria
• Cytologically or Histologically confirmed diagnosis of malignant neoplasm who are receiving or planned to receive any cancer therapy (Chemotherapy, Radiotherapy or a combination or surgery and chemotherapy) with progressive weight loss	• Patients on or requiring Parenteral Nutrition (PN) support
• On oral nutrition support or tube feeding	• Patients with known history of food allergy
• Has no contraindication to Enteral Nutrition (EN)	• Known HIV infection
• Willing to abstain from other nutritional/protein supplements throughout the study period	• Pregnancy or lactation(females)
• Patients having ECOG (Eastern Cooperative Oncology Group) performance status score of 2 or less	• History of alcohol abuse
• Life expectancy of more than 6months	• Clinically significant uncontrolled cardiovascular, renal or pulmonary diseases
• Capable or intake/swallowing plant-based foods foreseen by the investigator	• Current treatment with antipsychotics
• Written informed consent according to the local Ethics Committee requirements	
• Ability to maintain a daily contact (by phone or email) with the study staff for the communication of crucial clinical information, including daily body weight, blood pressure, health status and adverse events during the study	

Table 2. Baseline demographic and disease characteristics.

Demographic and Disease Characteristics	
Age in years (Average, Highest, Lowest)	51.25, 60, 19
Males	42
Females	21
Weight in Kg (Average, Highest, Lowest)	66.98, 102, 31.2
Type of Cancer (N)	Oral: 14 Gastrointestinal: 12 Endometrium: 11 Lung: 9 Breast: 8 Bladder: 5 Others: 4
Patients on Chemotherapy (N)	43
Patients on Radiation Therapy (N)	11
Patients on Chemotherapy + Radiation Therapy (N)	17
Patients with Surgical Resection Only (N)	7
Patients with Surgical Resection prior to Chemotherapy or Radiation therapy or both (N)	31

Table 3. Nutritional information of Es Invigour.

NUTRIENTS	UNIT	Per Serving (33 g)
Energy	Kcal	150.3
Protein	g	11.6
Fat	g	5.8
Saturated fatty acids	g	0.7
Medium Chain Triglycerides	g	4.5
Omega 3 Fatty Acid	mg	20
Carbohydrate	g	13
Fructo-oligosaccharides	g	1
Choline	mg	25
Inositol	mg	10
Inulin	g	2
BCAA (L-Leucine:L-Isoleucine:L-Valine: 2:1:1)	mg	148.5
L-Glutamine	mg	0.2
Taurine	mg	20
L-Carnitine	mg	15
Vitamin A	mcg	297
β-Carotene	mg	2.4

Continued

Vitamin D	IU	200
Vitamin E	mg	5
Vitamin K1	mcg	27.2
Vitamin B1	mg	0.6
Vitamin B2	mg	0.7
Niacin	mg	8
Pantothenic acid	mg	5
Vitamin B6	mg	1
Vitamin B8	mcg	100
Folic acid	mcg	100
Vitamin B12	mcg	0.7
Vitamin C	mg	20
Sodium	mg	132
Potassium	mg	154
Calcium	mg	30
Phosphorus	mg	30
Magnesium	mg	34
Iron	mg	1.7
Zinc	mg	1.2
Copper	mcg	0.27
Manganese	mcg	0.5
Chloride	mg	100
Iodine	mcg	53
Chromium	mcg	6.6
Selenium	mcg	6.6
Molybdenum	mcg	14

Table 4. Nutritional information of Es Fortitude Protect.

NUTRIENTS	UNIT	Per Serving (20 g)
Energy	Kcal	83.7
Protein	g	4.5
Fat	g	1.7
Omega 3 Fatty Acid	mg	10
Medium chain triglycerides (MCT)	g	1.4
Carbohydrate	g	12.6
L-Glutamine	mg	1000
Curcumin	mg	75

Continued

BCAA (2:2:1)	mg	250
Bioperine	mg	1
CoQ10	mg	50
Vitamin A	mcg	600
B-Carotene	mg	4.8
Vitamin D	mcg	400
Vitamin E	mg	5
Vitamin K1	mcg	27.5
Vitamin B1	mg	0.3
Vitamin B2	mg	0.35
Niacin	mg	4
Pantothenic Acid	mg	2.5
Vitamin B6	mg	0.5
Folic acid	mcg	100
Vitamin B12	mcg	1
Vitamin C	mg	40
Biotin	mcg	50
Selenium	mcg	60
Zinc	mg	12
Probiotic Blend (*Streptococcus thermophilus*, *Bifidobacterium longum*, *Bifidobacterium breve*, *Bifidobacterium infantis*, *L. acidophilus*, *L. plantarium*, *L. casei* and *L. bulgarius*)	cfu	2 billion

3.1. Impact of EON Therapy on Body Weight

Change in body weight of patients was recorded post administration of EON therapy, as an enteral nutrition supplement, at the dose decided by the treating physician/nutritionist (two sachets a day for each product in two divided doses) for a minimum of three months or till the end of the chemotherapy cycles. **Figure 1(a)** depicts the change in body weight of individual volunteers over six chemotherapy cycles. Out of 63 volunteers, 44 volunteers (nearly 70%) gained weight over the study period. Close to 15% of volunteers were able to maintain their initial weight with insignificant gain or loss of weight. Weight loss was observed in rest of 15% volunteers with only two volunteers losing more than 5% of initial weight with maximum weight loss being 7%.

Drop in average weight (although statistically insignificant) was observed during first two visits of volunteers. However, more importantly, the average weight of volunteers gradually increased over next four cycles and average weight at the end of study duration being significantly ($p < 0.05$) higher than ini-

tial average weight and average weight after second and third cycle of chemotherapy. The initial drop in average weight during first few cycles may be attributed to detrimental effect of cancer as well as chemotherapy on the volunteers and indicates that volunteers take some time to respond to EON therapy. However, over a period of study duration the beneficial effect of EON therapy is distinctly visible indicating anti cachexia effect of EON therapy that help overcome negative protein and energy balance (Figure 1(b)).

3.2. Impact of EON Therapy on Biochemical Parameters

Several biochemical parameters were assessed for all volunteers during each visit, and the average of all the biochemical parameters before and after the treatment is presented in Table 5. Most of the biochemical parameters showed statistically and clinically significant improvement (hemoglobin, liver function, renal function, creatinine, blood urea nitrogen) or remained same (neutrophils, platelets, prothrombin time and electrolytes like sodium, chloride).

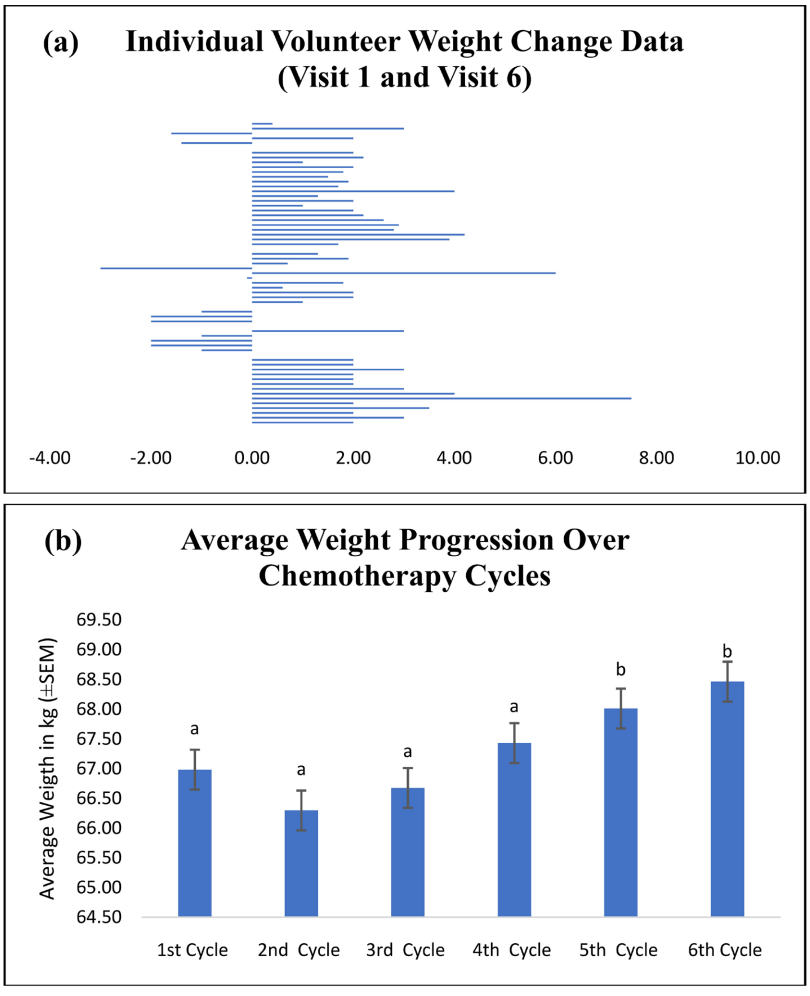

Figure 1. Weight data of volunteers (a). Change in weight of volunteers over the period of study (b). Average weight of the volunteers at the end of chemotherapeutic cycles (a) and (b) are statistically different at $\alpha = 0.05$.

Table 5. Summary of biochemical data.

Test Parameter		Mean	STDEV
Hemoglobin*** (g/dL)	Before	10.66	2.00
	After	11.94	1.13
White Blood Cells** (Cells/mm^3)	Before	7354.16	2971.23
	After	5895.63	1147.07
Neutrophils* (/μL)	Before	5661.77	2579.82
	After	5744.14	1969.14
Platelet Count* (/μL)	Before	179,239.76	79,078.25
	After	180,690.44	41,544.84
SGOT** (/L of serum)	Before	35.98	23.70
	After	25.66	21.70
SGPT** (/L of serum)	Before	35.13	24.53
	After	25.00	18.65
Serum Creatinine** (mg/dL)	Before	0.96	0.33
	After	0.75	0.15
Blood Urea Nitrogen** (mg/dL)	Before	16.60	10.46
	After	13.05	10.21
Prothrombin Time* (INR)	Before	1.18	0.36
	After	1.10	0.07
Sodium* (mEq/L)	Before	133.67	5.67
	After	134.46	3.90
Potassium** (mEq/L)	Before	4.15	0.44
	After	3.72	0.33
Chloride* (mEq/L)	Before	99.22	3.30
	After	98.54	3.12

*Pre and post treatment values are same ($p > 0.05$); **Pre-treatment value is higher ($p < 0.05$); ***Post-treatment value is higher ($p < 0.05$).

Importantly, hemoglobin level showed a sharp increase after the nutritional intervention over the study period. No major statistical difference ($p > 0.05$) was observed in neutrophil and platelet count over the study period. Prothrombin time (PT/INR), sodium and chloride levels also remained unaltered ($p > 0.05$). A steady decrease was observed in SGPT and SGOT level which is indicative of liver function improvement ($p < 0.05$). Statistically significant difference in serum creatinine and blood urea nitrogen values over the period of study were indicative of renal function improvement ($p < 0.05$). While a statistically significant ($p < 0.05$) decrease was observed in WBC, neutrophil values remained same over the period of study indicating that patients in general developed lesser infections during chemotherapy. The biochemical data strongly indicates that EON therapy helped in improvement of most of biochemical parameters of patients and prevented deterioration of others (**Figure 2**).

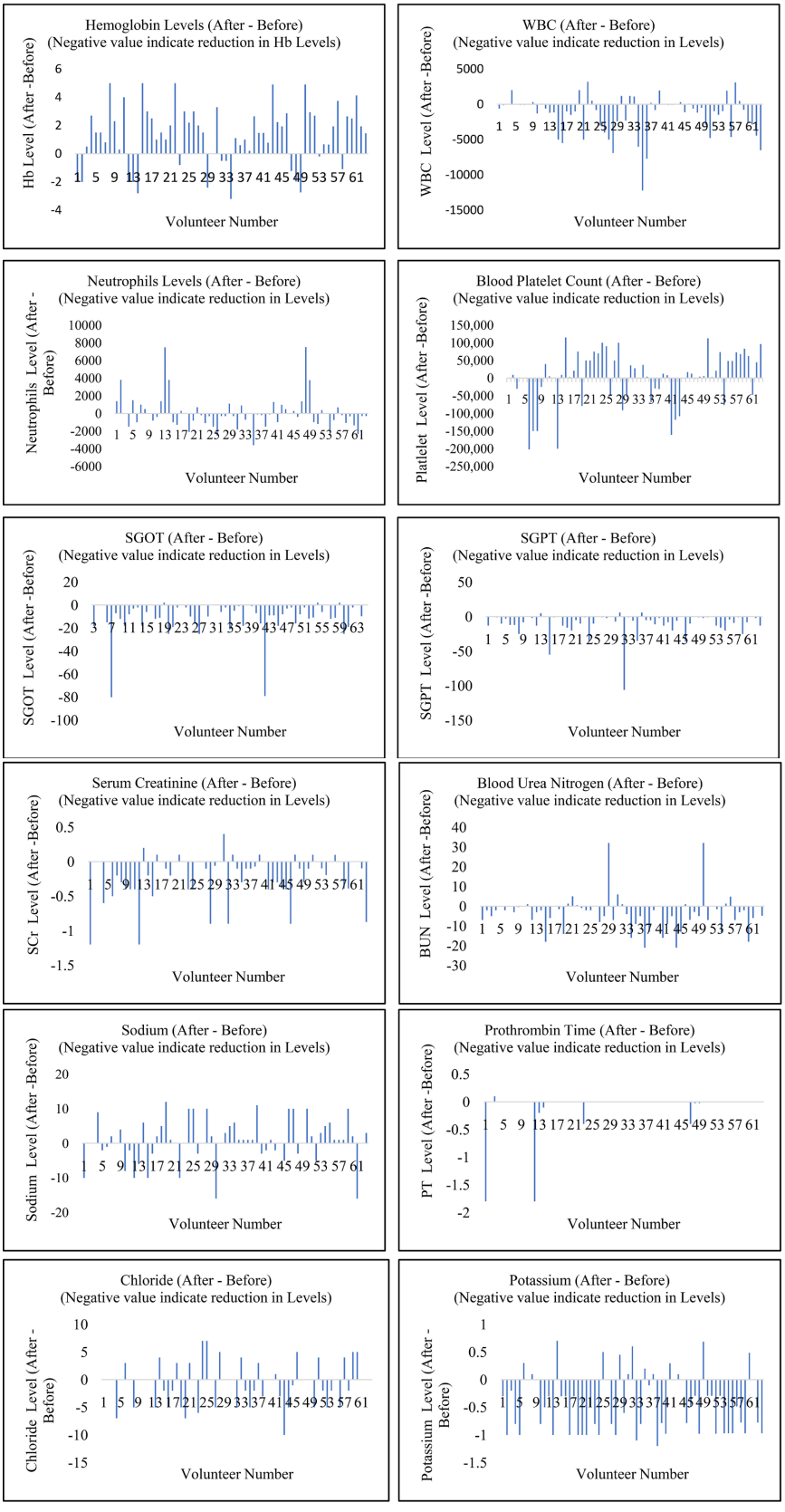

Figure 2. Changes in biochemical parameters of individual volunteers over the study period.

3.3. Impact of Eon Therapy on Quality of Life

ECOG (Table 6) and MST scales were used to evaluate physical/ mental and nutritional status of each patient and the outcome of the evaluation was used for assessment of QoL of patients before and at the end of study duration. Figure 3 depicts the outcome of ECOG and MST evaluation before and at the end of study.

Around 52% of volunteers had some physical concerns with respect to daily activities at the start of the study and the percentage of these volunteers dropped to around 40% even after going through chemotherapy cycles. Almost similar results were obtained using MST scale. At the start of study, the percentage of volunteer with no risk, moderate risk and high risk of malnutrition were 35%, 35% and 30% respectively. After the study duration, the percentage of volunteer with no risk, moderate risk and high risk of malnutrition was 40%, 43% and 17% respectively (Figure 3).

Based upon outcome of both these scales along with no reports of adverse event specific to nutritional supplements, it can easily be concluded that patients had a better QoL. This observation is further substantiated by anti-cachexia effect and improvement in most of the biochemical parameters.

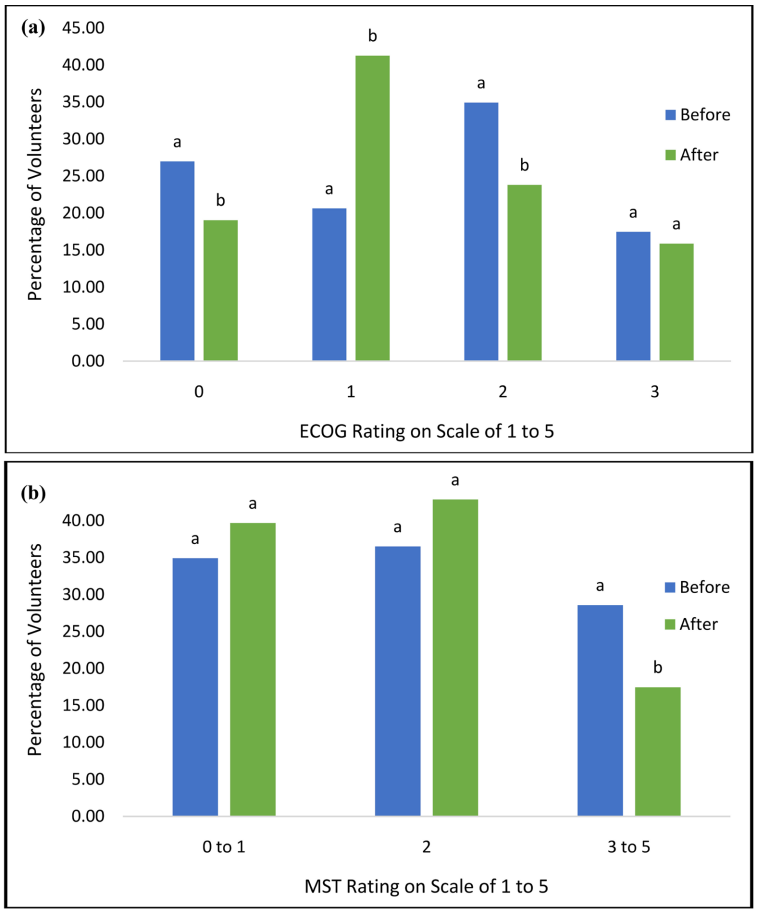

Figure 3. QoL data: change in percentage of volunteers with restricted physical activity and risk of developing malnutrition during the study. (a) ECOG Scale; (b) MST Scale. (a) and (b) are statistically different at $\alpha = 0.05$.

Table 6. ECOG performance scale [15].

Grade	ECOG Performance Status
0	Fully active, able to carry on all pre-disease performance without restriction
1	Restricted in physically strenuous activity but ambulatory and able to carry out work of a light or sedentary nature, e.g., light housework, office work
2	Ambulatory and capable of all selfcare but unable to carry out any work activities; up and about more than 50% of waking hours
3	Capable of only limited selfcare; confined to bed or chair more than 50% of waking hours
4	Completely disabled; cannot carry on any selfcare; totally confined to bed or chair
5	Dead

4. Discussion

Cancer cachexia is a multi-factorial, multi-organ devitalizing, intimidating condition in patients mostly with advanced cancer whose eruption is symptomized by massive loss of lean body mass, anorexia, altered protein and energy metabolism, and chronic inflammation [17] [18]. Besides being an undeviating cause of 20% of all cancer related demise, cachexia makes the patients more intolerant towards mainstream chemotherapy and radiotherapy thereby, exhibiting diminished response to therapy and restricting recourses of therapeutic modalities [19] [20]. Although cachexia (anorexia) demonstrates an entirely disparate way of tissue wasting by targeting skeletal muscle compared to starvation which largely impacts fat tissues, it is not limited to the muscle-waste, rather strikes multiple other organs such as heart, liver, brain and fat tissue [21]. It is, thus, important to have an insight related to the molecular and metabolic factors for tissue wasting taking into account the role of every contributing organs as well as proliferating, high energy-demanding tumor tissue. As an inevitable consequence of the interplay, cancer patients with cachexia manifest a negative energy balance with nutrients unleashed into the bloodstream which again promotes the neoplastic growth [22].

Cancer cells inevitably commandeer the immune system towards exuding certain cytokines which aid in tumor growth and propagation [23]. Chronic local inflammation, described as one of the hallmarks of cancer, provides a microenvironment which, in turn, reinforces malignant growth [24] [25] [26]. Chronic inflammatory state is associated with excess fuel consumption which affects several tissues, promotes catabolism and induces cachexia [27] [28]. Therefore, one established mechanism of cancer cachexia is inflammation-driven well-orchestrated physiological response of substrate mobilization, an adaptive response towards accessing protein and energy stored in body [29] [30]. It turns out that, during disease progression, pro-inflammatory cytokine activity gets elevated which is indicated by the production of acute-phase response (APR) proteins, *viz.*, C-reactive protein (CRP) and fibrinogen. Cytokines, including tumor necrosis

factor-alpha (TNF-α), interleukin-1 (IL-1), IL-6, and interferon-gamma (IFN-γ) have shown to play roles in cancer cachexia [31]. To elaborate a little more, many biological processes are critically dependent on skeletal muscle homeostasis which is regulated by an intricate balance between protein synthesis and proteolysis which is again governed by complex hormonal network of several catabolic (such as Activins, Myostatin, Parathyroid hormone-related protein, etc.) and anabolic (such as IGF-1) factors. Cancer progression is known to be deeply associated with the disruption of this balance [32]. Mechanistically, ubiquitin-proteasome pathway, calpains (Calcium activated proteases) and autophagy are involved in degradation of protein in skeletal muscle [33].

It is, therefore, coherent and counter-intuitive from the above discussion that hindering inflammatory responses and restoring protein balance to protect the loss of skeletal muscle mass—is the goal of cachexia therapy. It turns out that cachexia is partially reversible in both the arms. In this regard, understanding the management of specific inflammatory signaling is very important. Several arsenals, both pharmaceutical and nutraceutical, with anti-inflammatory potential have demonstrated beneficial outcomes against cachexia—such as, medroxyprogesterone, megestrol acetate, ghrelin, cannabinoids, melanocortin antagonists, thalidomide, etanercept, omega-3 fatty acids (eicosapentaenoic acid), herbal medicine (kampo), cortico-steroids, non-steroidal anti-inflammatory drugs, β 2-adrenergic agonists, erythropoietin, etc. [31]. There is no denying the fact that assessment of nutritional and metabolic status, evaluation of malnutrition and thorough counselling have become a part of the zeitgeist. Enriching food, oral nutritional supplements, enteral tube feeding and parenteral nutrition have also gained significant attention. A personalized multimodal combinatorial therapy approach with mutual interactions between multi-target interventions and multi-nutrient interventions has been reckoned as best provision to handle cancer cachexia where nutritional intervention is endorsed as an integral part [34] [35]. Nutrition is equally important for tissue rebuilding and energy supply in patients with cachexia. Recommended protein intake to circumvent anabolic resistance in patients with cancer cachexia is 1.0 - 2.0 g/Kg per day, food energy intake being increased by 300 - 400 Kcal per day [35] [36]. With the advent of this combinatorial multimodal intervention, a new level of nutritional and metabolic patient care where commonality in definitions and grading systems is being established towards efficient treatment with nutritional intervention along with adequate medical resources.

In our clinical validation study performed on many patients across India, nutritional intervention named as EON Therapy (here, Es-Invigour along with Es-Fortitude Protect) is administered concurrently with different stages and cycles of cancer medication [37]. Much to our intrigue, they are showing very promising results in terms of improving quality of life and body weight gain in all the patients enrolled for the treatment. This can be attributed to the ingredients we are using in our formula. It turns out that plant polyphenols are efficacious due to their ability to sensitize drug-resistant cancer cells towards chemo-

therapeutics as well as protect non-target tissues from damage owing to their antioxidant and anti-inflammatory properties. The most popular among these polyphenols is, indubitably, curcumin—which is extracted from the rhizomes of Curcuma longa (known as turmeric) and has a multitude of therapeutic effects in various cancers [38]. It turns out that β-carotene, a polyene dietary carotenoids acts as an immune modulator with a potential to quench singlet oxygen, scavenge free radicals (ROS) at lower partial oxy-gen pressures, provide photoprotection to photosynthetic organisms and prevent cancer, heart diseases, and age-related macular degeneration [39]. The anti-inflammatory activity it exerts can be attributed to the upregulation of Heme oxygenase 1 (Hmox1) mRNA expression. Using lipopolysaccharide (LPS) stimulated RAW 264.7 macrophages, anti-inflammatory property of the branched chain amino acids (BCAAs) was evaluated where BCAA diminished NO production, down regulated iNOS, COX-2, IL-6 mRNA expression [40]. Many proteins involved in DNA damage, signalling and repair, replicative enzymes and transcription factors, need Zinc (Zn), a first transition Group IIB element and an essential mineral, for proper functioning. Zinc deficiency has also been shown to impair the DNA binding abilities of p53, nuclear factor κB (NFκB), and AP-1 transcription factors in rat glioma C6 cells. Few *in vivo* studies showed an effect of Zn in altering antioxidant status in colonic histoarchitecture of rats [41]. Importantly, a wide range of functions are carried out by probiotics, live beneficial organisms, including direct interactions with the gut luminal microbiota, metabolic outcomes, effects on barrier function, and crosstalk with the central nervous system and enteric immunity. They also have shown their potential in the management of Gastroesophageal reflux disease (GERD), an upper digestive tract disorder, often associated with occurrence of cancer [42]. Mechanistically, nutraceuticals mentioned above have exerted their anti-inflammatory properties against cachexia causing local inflammation counter-balancing the negative protein and energy metabolism. Also, concurrent with the mainstream therapy, copious food intake in the form of nutritional supplementation has properly managed cachexia causing reduced food intake. Thus, in both the arms, cancer cachexia is well addressed with nutritional intervention EON Therapy.

5. Conclusion and Future Perspective

EON Therapy, administered along with mainstream chemo and radiotherapy, demonstrated its anti-cachexia efficacy in terms of ameliorating malnutrition and inhibiting weight loss in 63 cancer patients. Simultaneous betterment in several biochemical and QoL parameters further emphasizes its effect on general wellness of patients. Prompted by this clinical outcome, more in-depth mechanistic investigations of the anti-cachexia properties of the ingredients have already been undertaken and will come in public domain soon. Of course, clinical validation studies with larger cohorts of patients and control arms are being investigated to corroborate the initial findings. This study strongly suggests that extensive research should be performed towards developing and marketing nu-

tritional supplements specifically for cachectic cancer patients for better management and prognosis.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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