HERBAL SUPPLEMENTATION AS ESCALATING PARADIGM FOR MANAGEMENT OF SARCOPENIA

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Abstract: Sarcopenia is described as chronic muscle loss and typical reason for this ailment is diminished physical action for the duration of the day. Frailty is probably going to include various organ frameworks and might be a decent objective for multicomponent herbal grown medications. Given the complex and interlacing relationship among these putative etiological elements and the inadequate information on the cell measures hidden the pathogenesis of sarcopenia, the journey for successful medicines to deal with this condition has been an interesting, yet uncertain issue for geriatricians. In outline, there is some proof that oral nutritional supplementation may diminish muscle wasting; however test results are to a great extent fundamental and far to be clinically significant. Nutrient supplementation could profit muscle protein digestion during maturing, yet further preliminaries in people and with satisfactory example sizes are needed to plainly build up the theorized connection among cell strength and sarcopenia.

Keywords: Sarcopenia, Nutrient supplementation, Frailty, herbal medications, muscle wasting

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Introduction

Sarcopenia is characterized with loss of muscle mass particularly with reference to aging¹. It is very common to lose some muscular mass as you age. Sarcopenia is described as chronic muscle loss that continues from the normal one. Sarcopenia effects movement, balance, and capacity to perform daily activities. Since long time, Scientists have believed that this worsening was inevitable. However, now they’re starting to look into cures that might prevent or
slow down this activity\textsuperscript{2}. A typical reason for sarcopenia is diminished physical action for the duration of the day. Notwithstanding, although less continuous, a few people with dynamic ways of life may likewise be determined to have sarcopenia\textsuperscript{3}. This recommends there could be different purposes behind the improvement of the ailment. Scientists right now accept that different reasons for sarcopenia could include\textsuperscript{4}:

- a decrease in the nerve cells that impart signs from the brain to directs muscles to move
- a bringing down of hormone levels
- a decrease in body's capacity to change protein to energy
- not expanding enough every day calories and protein so as to keep up muscle mass\textsuperscript{5}

Treatment for Sarcopenia

The essential treatment for sarcopenia is work out, explicitly opposition training or quality training. These exercises increment muscle quality and continuance utilizing loads or resistance groups\textsuperscript{6}. Resistance training can support neuromuscular framework and level of hormones. It additionally can improve a more seasoned grown-up's capacity to change over protein to energy in as meager as about fourteen days\textsuperscript{7}. The correct number, power, and recurrence of resistance training are significant for getting the most advantage with minimal danger of injury. One can work with an accomplished physiotherapist or mentor to build up an activity plan\textsuperscript{8}. Despite the fact that prescription isn't the favored treatment for sarcopenia, a couple of them are being contemplated. They include:

- Urocortin II This therapy prevents muscle decay that can take place when one is in a cast or taking some medications. Its usage for progressing muscle mass in people who has not been considered and isn't suggested.
- Testosterone containing nutritional supplements
- Growth hormone containing supplements
- Medication for treatment of metabolic condition (counting, insulin-resistance, heaviness, and hypertension)\textsuperscript{9}

In the event that these demonstrate valuable, one can use them with resistance work out, not rather than it. In older people, polypharmacy is regularly risky and may prompt antagonistic medication responses or ADRs\textsuperscript{10}. Frailty is probably going to include various organ frameworks and might be a decent objective for multicomponent herbal grown medications.

In spite of the fact that the decrease in muscle mass and quality with age has been known for a long time, the investigation of cell systems liable for such a rot is still in its outset\textsuperscript{11}. By and by, a few cycles and components have been distinguished that are probably going to add to the advancement of sarcopenia, including adjusted hormonal status (e.g., decrease of development hormone, estrogens and testosterone levels), expanded creation
of supportive of pro-inflammatory cytokines, loss of α-motor neurons, muscular mitochondrial destruction, altered autophagy, myonuclear apoptosis, and debilitated satellite cell work. Every one of these elements in the end lead to an irregularity among anabolic and catabolic cycles, which brings about muscle protein breakdown, loss of myocytes, inadequate satellite cell renewal, and at last decreases in muscle mass and capacity. Given the complex and interlinking relationship among these putative etiological elements and the inadequate information on the cell measures hidden the pathogenesis of sarcopenia, the journey for successful medicines to deal with this condition has been an interesting, yet uncertain issue for geriatricians. The situation is additionally muddled by the way that operational meanings of sarcopenia and models to choose the most suitable objective populace for clinical preliminaries on this condition have been delivered as of late. Besides, signs about the biomarkers to be utilized to recognize sarcopenia and track its movement after some time have quite recently been distributed. In any case, established researchers is as yet bantering on the best way to recognize clinically significant limits that recognize typical from anomalous estimations of muscle mass and quality. Given these restrictions, it isn't astounding that no pharmacological treatment is at present accessible to obstruct the movement of sarcopenia. So also, no pharmacological cures exist to forestall the beginning old enough related muscle misfortune. In this specific circumstance, a sufficient protein and energy consumption along with physical exercise (opposition, high-impact or their blend) has been demonstrated as the best system right now accessible to oversee sarcopenia. The reasons for this audit are to introduce the latest discoveries relating the part of nourishment in the administration of sarcopenia, show the systems of activity of significant dietary specialists on the maturing muscle, that may help battle sarcopenia. As indicated by the notable free extreme hypothesis of maturing, the accumulating of oxidative harm to cell macromolecules over the existence course is the focal component driving the maturing cycle. In light of this hypothesis, the presence of all age-related phenotypes, including sarcopenia, ought to consequently be essentially credited to the adverse impacts of reactive oxygen species (ROS). In like manner, in more established people, raised degrees of oxidative harm have been connected with diminished muscle mass and quality, and portability handicap. Then again, positive affiliations have been found for selenium, Vitamin E, and Vitamin C. These perceptions would hypothetically give a decent reason to the organization of cancer prevention agents as a countermeasure for sarcopenia. Shockingly, redox physiology isn't as clear as it shows up. Undoubtedly, while unreasonable ROS age is related with the pathogenesis of a few sickness conditions and, maybe, adds to maturing and sarcopenia, oxidant creation inside a hormetic window assumes major parts in cell flagging and variation to different stressors. For example, during moderate power work out, ROS advance power creation, animate mitochondrial biogenesis, and improve cell cancer prevention agent and fix limit. This hormetic reaction is safeguarded in more seasoned
people. Reliably, some ongoing investigations propose that mellow supportive of oxidants may even have against maturing properties\textsuperscript{34}. Then again, the aimless utilization of cell reinforcement enhancements could revoke the physiological activities of ROS, cause reactive pressure and gruff the gainful impacts of non-comprehensive physical exercise\textsuperscript{35}. Meta-investigations and efficient surveys have unmistakably indicated an expanded mortality hazard related with nutritional supplementation in both sound people and patients with different infections, which ought to caution against the far and wide utilization of uncontrolled supplementations\textsuperscript{36}. Subsequently, except if a clear inadequacy is archived, cancer prevention agent supplements are not to be endorsed to sarcopenic people, particularly to those occupied with physical exercise programs\textsuperscript{9}. By the by, more established people should even now be encouraged to expand nourishments wealthy in cancer prevention agents, for example, leafy foods, since they additionally contain an immense range of sound supplements (e.g., nutrients, minerals and filaments)\textsuperscript{27}.

**Type and timing of nutritional interventions for sarcopenia**

The accessible proof gives away from about the sort of antioxidant supplement(s) to be endorsed to sarcopenic older. The decision of explicit nutritional supplementations ought to likewise be founded on the patient's inclinations and the inevitable presence of comorbid conditions that may profit by or be exacerbated by specific supplements. For example, within the sight of renal disappointment, protein and Cr enhancements may not be fitting, while the organization of omega-3 unsaturated fats is probably going to be helpful\textsuperscript{28}. One significant admonition of current nourishing proposals for sarcopenia is that no reasonable sign is given about the span of the mediation that augments the advantages and lessens the danger for unfriendly impacts\textsuperscript{29}. Undoubtedly, while a half year have been demonstrated as the base time period to anticipate sizable changes in bulk, it is indistinct whether nutritional supplementations instigate direct gains in bulk and quality after some time or if a roof impact happens before considerable enhancements in muscle wellbeing have been achieved\textsuperscript{30}. The assessment of the adequacy of healthful mediations for sarcopenia is muddled by the multifaceted idea of the disorder, which includes different blends of decreases in bulk and quality just as in physical execution. It is conceivable that particular dietary mediations may differentially affect the different clinical highlights of sarcopenia\textsuperscript{31}. This suggests explicit mixes of supplements might be important to advance treatment in subsets of sarcopenic patients and this should be tended to by future clinical preliminaries. At last, the wellbeing of long haul nourishing mediations in sarcopenic older still can't seem to be set up\textsuperscript{32}.

Another significant highlight be tended to concerns the ideal planning of nourishing mediations. Plainly, healthful supplementation and conceivably physical exercise should be recommended to all people determined to have sarcopenia\textsuperscript{33}. Yet, is it conceivable to distinguish subjects who are in danger to become sarcopenic and in whom supplementation could be begun before throughout everyday life? In such manner, it has been indicated that way of life propensities and physical wellbeing during adulthood could decide the pace of muscle wasting decrease and the
improvement of practical restrictions in cutting edge age. For example, Stenholm et al. discovered that midlife truly arduous work, overabundance body weight, smoking, cardiovascular infection, hypertension, diabetes mellitus, and asthma anticipated muscle quality decay more than 22 years of development. Also, critical weight reduction, getting genuinely stationary, steady smoking, occurrence coronary illness, diabetes mellitus, ceaseless bronchitis, incessant low-back agony, enduring cardiovascular ailment, hypertension, and asthma were related with quickened decreases in handgrip quality. Other normal conditions related with beginning stage and quickened movement of sarcopenia incorporate malignancy, fringe conduit ailment, ceaseless obstructive pneumatic illness, congestive cardiovascular breakdown, rheumatoid joint pain, kidney damage, interminab le liver sicknesses, HIV contamination, and long haul utilization of meds, for example, steroids and certain nonsteroidal mitigating drugs. Strikingly, birth weight and prepubertal and pubertal development may influence muscle mass and quality just as physical execution in late life. In further help to the presence of a formative segment in the sarcopenia disorder, Robinson et al., found that a more noteworthy presentation to breast milk in outset was related with more prominent hold quality in more seasoned network dwelling men.

Taken together, these discoveries propose that people at high danger for sarcopenia could be recognized well before the decrease in bulk and quality arrives at a basic limit. Data relating to physiological, obsessive, utilitarian, and pharmacological boundaries could be used to process a "sarcopenia hazard score" or a "sarcopenia hazard outline", like what is regularly accomplished for other ailments (e.g., cardiovascular illness and osteoporosis). Such a methodology could permit the ideal execution of essential preventive procedures, including dietary intercessions. As examined further on, the advancement of coordinated "omics" profiling procedures will probably aid the early distinguishing proof of subjects in danger to become sarcopenic just as in the meaning of the healthful mediation that all the more properly coordinates the patient's particular needs.

**Nutritional Supplementation and Sarcopenia**

In spite of the clinical significance of sarcopenia and the enormous enthusiasm for cancer prevention agent supplementation, proof in this field is incredibly restricted and disputable. The choice of the investigations accessible in the writing is from epidemiological information with most in any event, originating from cross-sectional perceptions. The nonappearance of a novel usable meaning of sarcopenia speaks to a significant issue restricting the conduction of evaluation on the point. Indeed, a large portion of the human examinations are based on investigations of the connection between dietary cancer prevention nutrient supplementation and physical execution or muscle quality measures, without explicitly zeroing in on the more extensive state of sarcopenia. Indeed, the quantitative (i.e., muscle mass) and subjective (i.e., muscle quality, muscle work) decreases follow independent and various directions with maturing. The need of joining them into one single bidimensional meaning of sarcopenia is basic from a hypothetical and methodological point of view and must be considered when explicitly confronting the subject sarcopenia. As far as anyone is concerned, there are as of now no preliminaries...
confirming the impacts of nutritional supplementation on sarcopenia (as distinguished by one of a few the agreement definitions gave by global gatherings of specialists)\textsuperscript{28}. Strikingly, an ongoing explanation from the Society on Sarcopenia, Cachexia, and Muscle wasting disease doesn't make reference to nutritional supplementation as a potential instrument to oversee sarcopenia in more established people. A few investigations have been directed to assess the impacts of nutritional supplementation on cancer prevention agent status. Generally, results reliably report critical upgrades of nutrition biomarkers after a time of explicit supplementation\textsuperscript{43}. In an unexpected way, the impact of cancer prevention agent supplementation on muscle execution is still and generally questionable. Here are only a couple of instances of positive investigations (from both creature and human models) among the huge group of writing recommending an advantageous impact of nutritional supplementation and sarcopenia\textsuperscript{44}. A cancer prevention agent blend containing Vitamin E, Vitamin A, rutin, zinc, selenium has appeared to expand the anabolic reaction of old muscle to leucine and the leucine-incited restraint of protein debasement in rats\textsuperscript{45}. Resveratrol, a characteristic polyphenol found in grapes, peanuts, and berries, has demonstrated a defensive impact against oxidative worry in skeletal muscle through the outflow of nutritional proteins. Simultaneously, a comparative (conceivably bigger) number of studies have announced negative outcomes on the point\textsuperscript{34}. An debate of standard degrees of cancer prevention agent mitochondrial compounds was accounted for by Strobel and partners following 14 weeks of nutrient E and α-lipoic corrosive organization in rodents\textsuperscript{46}. A few examinations demonstrated no impacts of nutritional supplementation on muscle work after exercise-initiated muscle harm. Furthermore, this is especially obvious when testing intercessions in an amazingly mind boggling field as geriatric disorder, in which one sign/side effect isn't really demonstrative of a very much characterized condition\textsuperscript{47}. The heterogeneity and methodological restrictions influencing the investigation of sarcopenia may additionally clarify the questionable discoveries\textsuperscript{48}. At long last, it is significant the outrageous shortage of accessible clinical preliminaries in people on this subject. Indeed, the greater part of the positive outcomes are acquired in creature models and still stand by to be affirmed in people\textsuperscript{49}. Moreover, ongoing examinations detailing conceivable negative impacts (e.g., cardiovascular and all-cause mortality) of long haul, high-dose nutritional supplementation (specifically, for Vitamin E) can't be overlooked\textsuperscript{50}.

In outline, there is some proof that oral nutritional supplementation may diminish muscle wasting, however test results are to a great extent fundamental and far to be clinically significant, in any event, as reminiscent of positive advantages. Indeed, a huge assemblage of proof may demonstrate outrageous mindfulness in accepting nutritional supplementation as preventive measures against maturing cycle and age-related conditions\textsuperscript{51}. Further investigations are expected to help the boundless act of oral cancer prevention agent supplementation and to decide proper suggestions in elder\textsuperscript{51}. In spite of the fact that in cancer prevention nutrient supplementation through eating routine is accepting developing consideration, supporting proof is still scant and dubious. Nutrient supplementation could profit muscle protein digestion during maturing, yet further preliminaries in people and with satisfactory example sizes are needed to plainly build up the theorized connection among cell reinforcements and sarcopenia\textsuperscript{52}. In this
unique circumstance, a superior comprehension of oxidation instruments, timing and dosages of nutritional supplementation, and fitting methodological ways to deal with study this subject is expected to give persuading confirm and legitimize the current far reaching utilization of nutritional supplementation\textsuperscript{53}.

**Herbal agents in sarcopenia**

**HMB**

While protein will always be critical for muscle health since it provides the building blocks for muscle, one ingredient that has been extensively studied is HMB, also known as beta-hydroxy-beta-methyl butyrate, HMB has been used by the fitness community for decades, but research shows it also helps adults who want to maintain their muscle or are recovering from muscle loss following illness, injury or surgery. HMB reduces muscle breakdown, especially when your body is under stress like from an illness or injury that leads to muscle loss.

“HMB, a leucine metabolite, has been found to be capable of attenuating muscle decline in healthy older adults during complete bed rest\textsuperscript{54}.

While the body produces HMB when it breaks down the amino acid leucine found in protein-rich foods, it is hard to maintain the right level of HMB because we make less of it with age, and common foods only contain small amounts of HMB (e.g., a consumer would have to eat more than 6,000 avocados or 110 eggs to get enough).

“Most foods contain trace amounts of HMB, with meats being the premier source,” said Larry Kolb, president, TSI USA Inc. While some vegetables such as asparagus and squash, or even herbal tea contain comparable amounts of HMB, the average concentration in fruits and vegetables is approximately five-fold lower. Endogenous production of HMB via transamination of leucine to alpha-ketoisocaproic acid (KIC), which is then oxidized to HMB, occurs in the muscle and liver, with 5 percent of leucine being converted into HMB.

Fortunately, HMB is found in high-protein nutrition drinks, which can supplement the diet\textsuperscript{55}.

A 2016 study published in *Clinical Nutrition* found that Ensure® Enlive, a high-protein drink containing HMB, was in connection with a 50% lower mortality rate in elder malnourished patients with chronic cardiac or pulmonary disease after 90 days following hospitalization.

**Leucine**

Leucine is a branched-chain amino acid (BCAA) critical to hemoglobin formation. It’s also one of the nine essential amino acids in humans that’s provided by food.
“Leucine is a key activator of muscle protein synthesis (MPS) via activation of the mTOR pathway,” said Mayuresh Bedekar, global product manager at Glanbia Nutritionals. “Glanbia has done research looking at the role of its PepForm BCAA product, which is a leucine-rich whey peptide, in the muscular health of the elderly.” In skeletal muscle, there is a decrease in leucine level and a reduction in glycogen stores during exhaustive aerobic exercise\(^56\). In a 2015 study published in *The Journal of Physiology*, extended high-intensity resistance training following usual care after hip fracture was shown to improve muscle strength and physical function. Researchers noted the protein supplement leucine provided to participants following each exercise session might have served as an important rehabilitation adjunct to maximize muscle gains in this venerable population. In the study, older individuals who participated in rehabilitation following bed rest, as defined by eccentric resistance training programs (combined with BCAA-enriched protein supplementation, as PepForm), reversed muscle functional deficits and restored muscle nutrient anabolic sensitivity to pre-bed rest levels\(^57\). According to Glanbia, the PepForm technology provides much higher levels of soluble and bioavailable amino acids that are linked to whey peptide.

Since most plant proteins have lower levels of leucine, it is suggested to use blends of different vegan proteins to reach the desired amino acid profile.

**Astaxanthin**

Natural astaxanthin is obtained from the microalgae *Haematococcus pluvialis* which is a carotenoid found in arctic marine environments as well as common fresh water pools. Lower levels of astaxanthin are also found in marine animals, such as krill, that eat the microalgae\(^58\).

The AstaReal Group, a foremost in the field of natural astaxanthin, recently declared the results of a randomized, double-blind, placebo-controlled study on the effectiveness of a new medical protocol to improve the muscular function. Published in the *Journal of Cachexia, Sarcopenia and Muscle*, the study investigated the restoration of muscle loss and improvement of functional decline in elderly people with sarcopenia.

The four-month study focused on individuals aged 65 to 82 who took either natural astaxanthin (as AstaMed MYO\(^{TM}\), from AstaReal) or placebo, and undertook an interval exercise training protocol. Over a four-month span, treatment recipients experienced a 40-percent increase in endurance, a 14 percent increase in muscle strength and an 8 percent increase in mobility, compared to no muscle strength improvement in those taking placebo\(^59\).

“We saw improvements in strength, endurance and mobility among the study participants who took astaxanthin medicinal formula with a moderate exercise plan,” said lead researcher Kevin Conley, professor of radiology,
University of Washington School of Medicine. “This gives clinicians an option for their patients who cannot make the substantial lifestyle changes required to halt the crippling impact of muscle loss.”

**L-carnitine**

L-carnitine is a naturally occurring derivate of the amino acid lysine. It is commonly involved in the metabolism of most mammals and may help protect muscle.

In a study published in the *American Journal of Physiology* L-carnitine tartrate (as Carnipure®, from Lonza) was shown to help reduce oxidative stress resulting from exercise, as well as muscle tissue soreness.

“This provides a potential mechanism for reduced hypoxic stress, particularly following resistance exercise,” said Juliana Erickson, senior marketing manager, Lonza Consumer Health & Nutrition. “Recently, Lonza sponsored a trial showing that a new formulation of Carnipure® L-Carnitine along with creatine and leucine increased lean muscle mass and strength among subjects between 55 to 75 years old.”

**Green tea extract**

A pre-clinical study sponsored by Abbott examined the capacity of the green tea catechin, epigallocatechin-3-gallate (EGCG), to impact muscle mass and the molecular pathway involved in muscle atrophy in an animal model of sarcopenia. The study concluded that a specialized green tea extract with high levels of antioxidant polyphenols can preserve muscle mass and function in animals undergoing age-related muscle loss.

Even though green tea extract has shown to positively correlate with muscle performance, muscle recovery is still an issue. The results suggested that while many of the cells proliferate and show differentiation which are critical for muscular repair to occur, green tea-induced changes in cells by itself and insufficient to improve muscle recovery following a period of atrophy in old rats.

**Berberine**

Berberine belongs to isoquinoline alkaloid category which is found mainly in Berberis vulgaris (barberry), Berberis aristata (tree turmeric), Mahonia aquifolium (Oregon grape), Hydrastis canadensis (goldenseal), Xanthorrhiza simplicissima (yellowroot), Phellodendron amurense (Amur cork tree) and Coptis chinensis (Chinese goldthread). Researchers found that it has been extensively studied in many diseased conditions including cancer, inflammation...
and diabetes.\textsuperscript{62, 63} However, due to its poor bioavailability, it poses a big danger in its clinical manifestation and must be given due attention before its clinical usage may start\textsuperscript{64}.

**Catalpol (Rehmannia glutinosa)**

Catalpol, is an iridoid glucoside of Rehmannia glutinosa which is an herbal medicine practiced in the treatment of “inflammation, liver impairments and neurodegenerative diseases”\textsuperscript{65}. The blood amylase and serum lipase activities improved when treated with Catalpol\textsuperscript{66}. In addition, to it catalpol reduced the neutrophil migration\textsuperscript{67}. But if catalpol is to be checked clinically, extensive preclinical studies are needed to be done to see promote its translation to the bedside.

**Conclusion**

This review describes the clinical applications of various herbal nutritional supplements, with focus on some of them. As in metabolic syndrome, prevention and frailty requires diet/ exercise, behavioral changes and usage of primary health facilities. As the age progresses the paradigm alters at both individual and society levels. Many of the antioxidants and herbal supplements mentioned above are the important candidate for treatment of sarcopenia. Galen was one of the prior scientist to indicate that diet is one of the important parameter in management of ageing and muscle wasting process.

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