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Research Article

Effects of a Jellyfish Collagen-Based Amino Acid Supplement on Cognitive Function and Memory: A Pilot Investigation

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Abstract

Background/Aim: This beta investigation assessed the impact of a marine-sourced collagen supplement on measures of cognitive function. Systemic collagen has recently been purported to enhance brain function, but little research has explored this theory. The goal of the current study was to evaluate the effects of oral consumption of an encapsulated powder form of a proprietary jellyfish extract on global cognitive parameters during an eight-week open-label trial in middle-aged and older adults.

Material & Methods: 23 subjects between the ages of 40 and 75 years were selected from the applicant pool for the study. Individuals with specific allergic, cardiometabolic, oncologic, or neurological conditions that may cause undue risk in participation were prospectively excluded. The study consisted of supplement consumption twice daily for eight weeks with an at-home, computer-based standard cognitive battery completed at pre-study baseline and at the end of the trial. In addition, at these same time points, an EEG profile of voltage strength and wave phase pattern was measured during reaction time and trail-making testing.

Results: Five specific metrics were used from the cognitive profile, all achieving changers that were statistically significant at $P < .05$. The neurocognitive index (NCI) increased from a standard score, age and gender matched, of 90.51 to 102.07. Composite, verbal and visual memory scores combined increased from 96.80 to a mean score of 110.15. Executive function increased from 96.26 to 105.22. EEG total reaction times in the p300 decreased by 130 milliseconds and combined trail-making scores demonstrated a reduction of test time by 12 seconds. Both were statistically significant. Though not analyzable, over half the individuals throughout the study period voluntarily reported positive outcomes, especially related to alertness, energy, focus, and sleep/dream patterns.

Conclusions: This pilot investigation showed that taking a proprietary oral jellyfish collagen supplement may offer meaningful benefits for overall cognitive function and brain activity. Seven different measures of cognitive performance improved significantly over the eight-week period. The supplement, derived from marine invertebrate collagen, appears to be a promising way to support brain health in healthy middle-aged and older adults. Importantly, no adverse side effects were reported, suggesting the supplement could be safely used by a large segment of the global population.

Keywords: cognitive function; jellyfish; collagen; EEG; cognition; memory; executive function; amino acids

Introduction

Maintenance of optimal cognitive function throughout the lifespan is becoming the most dominant health concern for the public at large, perhaps surpassing the anxiety related to serious chronic illnesses such as heart disease and cancer. Prevention strategies with orally consumable supplements to avoid decline in brain health are widely touted although few, if any, hold the potential to deliver on this promise.

Collagen is the most abundant complex structural protein in mammalian and marine species and is made up of numerous molecular isoforms, possesses unique amino acid profiles, and is present as several subtypes based on predominant tissue of origin and biological function [1,2]. This compound has proven to have a broad range of applications including in cosmetics, manufacturing, food science, materials production, and the pharmaceutical and biomedical industries [3-6]. Utilization in health care

has been demonstrated in hair, skin, and nail conditions as well as wound healing, bone and joint disease, gastrointestinal health, and cognition [6-11]. The mechanisms by which collagen exerts these effects are believed to involve reductions in inflammation and oxidative stress, as well as broader anti-aging properties [12-18].

While collagen has traditionally been sourced from mammals—primarily bovine and porcine origins—there has been growing interest in marine-based collagen sources, which are beginning to noticeably impact the industry [19–20]. Most research on mammalian collagen has focused on its effects on skin, joints, and gut health, with minimal exploration into its potential role in cognitive function. In contrast, marine-derived collagen offers a range of advantages, including economic and environmental sustainability, biocompatibility, immunological safety, ease of extraction, widespread availability, chemical stability, low antigenicity, and enhanced bioavailability [21-23]. Within marine sources, invertebrate species differ significantly from the more commonly studied vertebrates, offering additional benefits in terms of their biophysical properties, processing characteristics, functional potential, and reduced allergenic risk [24-25].

Jellyfish, a marine invertebrate, has recently gained prominence across various industrial sectors and has sparked growing scientific interest, paving the way for future applications and innovations [3,26,27]. Jellyfish-derived collagen peptides are rich in mucopolysaccharides, compounds known to support connective tissue integrity, metabolic function, immune system regulation, mitochondrial performance, and neurological stability. Extraction methods for isolating these bioactive compounds continue to advance, and comparisons with bovine collagen in medical contexts have shown promising results [28-32]. Nutritionally, jellyfish offer a favorable profile: they are low in calories, virtually fat-free, and rich in essential collagen peptides, minerals, and amino acids [19,26,33,34].

Notably, jellyfish harvesting may contribute positively to environmental sustainability, particularly given climate-related changes in marine ecosystems [35,36]. As such, jellyfish collagen aligns with key objectives in economic development, social responsibility, and ecological protection [37-39]. Safety and quality profiles of jellyfish collagen are also strong. Microbiological assessments show minimal presence of harmful bacteria, yeast, or mold, while immunological risks—such as allergic reactions and the transmission of viruses or other pathogens often associated with mammalian sources—are significantly lower [5,22,23,36]. Additionally, concerns related to heavy metals, biogenic amines, or volatile nitrogen compounds are minimal, further supporting jellyfish as a clean and viable alternative collagen source [36,39].

To properly assess the value of a unique, patented jellyfish collagen supplement, this beta investigation employed techniques validated to measure global brain health status and cognitive function. A range of computerized test batteries can detect cognitive changes and related psychological and psycho-motor tasks [40-46]. This study utilized a well-known, remote evaluation tool that was self-administered and comfortable for participants to master and for whom the effects could be reliably replicated. These metrics have been shown to be of clinical value in a variety of settings and in subjects with a broad spectrum of age ranges in detecting cognitive changes [46-50].

In addition, the pilot trial incorporated electroencephalographic (EEG) electrode measurements during timed activity to further quantify brain activation and waveform patterns. EEG is noninvasive technique that records synaptic electrical activity, capturing voltage fluctuations and reproducible brain wave patterns, allowing for relevant clinical interpretation [51-53]. The technique's reliability has led to its use in numerous research and medical settings [54-56]. Cognitive domain status also utilizes EEG measurements [53-56]. In addition, specific brain wave patterns can indicate cognitive processing and function [57-59].

Moreover, the combined use of computerized cognitive assessments and EEG monitoring has a well-established track record in human clinical trials evaluating the effects of dietary supplements and other interventions [59-61]. This study leveraged both validated modalities to comprehensively assess the potential cognitive benefits of the jellyfish collagen supplement.

Materials and Methods

The study group consisted of participants of both genders (7 males, 16 females), with ages ranging from 40 to 72 years (mean age = 53). No vulnerable populations were included in this investigation. Prior to enrollment, potential participants were screened for current medication or supplement use, which was reviewed for clinical and safety considerations. They also provided information on their lifestyle and activity routines. To ensure consistent results, participants were required to maintain stable nutrition, medications, lifestyle habits, supplements, and activity levels throughout the eight-week trial.

Exclusion criteria included a personal or family history of allergies to fish, a serious cardiometabolic or oncologic health condition, a medical diagnosis of neurological disease, tremor, or cognitive impairment. In addition, subjects were queried about lifestyle factors for the study period to ensure consistency in exercise, dietary and work/life factors. The Institutional Review Board of the Colorado Center for Health and Sports Science approved the trial, and all participants indicated understanding of and signed the designated Informed Consent document.

The jellyfish supplement used in this investigation was KollaJell (Certified Nutraceuticals, Inc., Pauma Valley, CA). This collagen powder is a patented peptide formulation of collagen types I, II, and V, naturally sourced from wild Stomolophus meleagris and Acromitus Hardenbergi, two of the most studied and validated jellyfish species. This product was chosen for the study because it is a proprietary complete mixture containing 20 essential and nonessential amino acids, with minerals, trace elements, and calcium-binding proteins. This comprehensive extract supports physiological processes, gut-brain axis signaling molecules, immune system responses, glucose and lipid metabolism, mitochondrial energy, antioxidant protection, cognitive processes, and neuronal network function [8,11,12,14,18,28,62].

The patented extraction process used for the supplement preserves the collagen's unique properties without the use of harsh chemicals or solvents [26]. This method results in a clean, hydrolyzed powder that is safely encapsulated into 500 mg doses per capsule (Figure 1). Participants in the trial began by taking one capsule twice daily, in the morning and evening. After approximately two weeks, they gradually increased their dosage to two capsules twice daily, resulting in a total intake of two grams per day over the eight-week study period. Five participants reported feeling overly alert if they took their second dose in the evening, so they opted to consume it in the early afternoon instead, which resolved the issue.

Figure 1: KollaJell Edible Jellyfish Peptide Product

At baseline, the participants completed the two investigative metrics before consuming the study product and after eight weeks of supplementation. The first was a standard cognitive test battery (CNS Vital Signs, Morrisville, NC). This broad-spectrum computerized neurocognitive testing instrument has been well-validated by two decades of experience in clinical and research environments [63]. The test was self-administered at home by each subject on their computer, allowing maximum familiarity and comfort. Each subject received detailed instructions, including minimum hardware/software requirements, a quiet, isolated setting that eliminates visual or sound distraction, and a dedicated, uninterrupted period. Twelve measurements were recorded during the test.

Prior to the start of the study, individual interviews with subjects indicated a strong personal interest in overall cognitive function, i.e., "Is my brain and thinking age appropriate?" This led to the inclusion of the neurocognition index (NCI) as a key measure. When queried about other individual interest areas, all subjects specifically expressed memory function in some form. Hence, the addition of composite, verbal, and visual memory. More than half of the subjects noted information planning, problem-solving, and attention in various work and social situations as important to them. These interests most closely matched executive function [64 - 67]. All 12 metric areas combine for the NCI. Measures recorded yet not individually calculated included psychomotor speed, reaction time, complex attention, cognitive flexibility, processing speed, simple attention and motor speed.

The standard score used in this system is adjusted for age and gender, allowing comparisons of each participant's performance relative to the "normal" population. A score in this system of 100 is average, with below that number, some degree of below average, and above that number, above average. Regardless of where a participant fell within the age range, the standard score provided insight into how their results compared to age- and gender-matched norms, and how the composite score changed for the selected measurements over time. In this system, raw scores are compared to age and gender-specific norms to generate a standard score. A score of 100 represents the average for that age and gender group.

The second trial measurement was an EEG profile performed in a research laboratory center environment (WAViMed Scan EEG System, Denver, CO). This measurement permits the detection of voltage activation in different brain regions in response to simultaneous performance. The activities undertaken during the EEG session included auditory reaction time and two standard trail-making tests. The p300 total reaction time, voltage during the test, and combined trail-making scores were recorded for each subject. The p300 test is depicted in Figure 2.

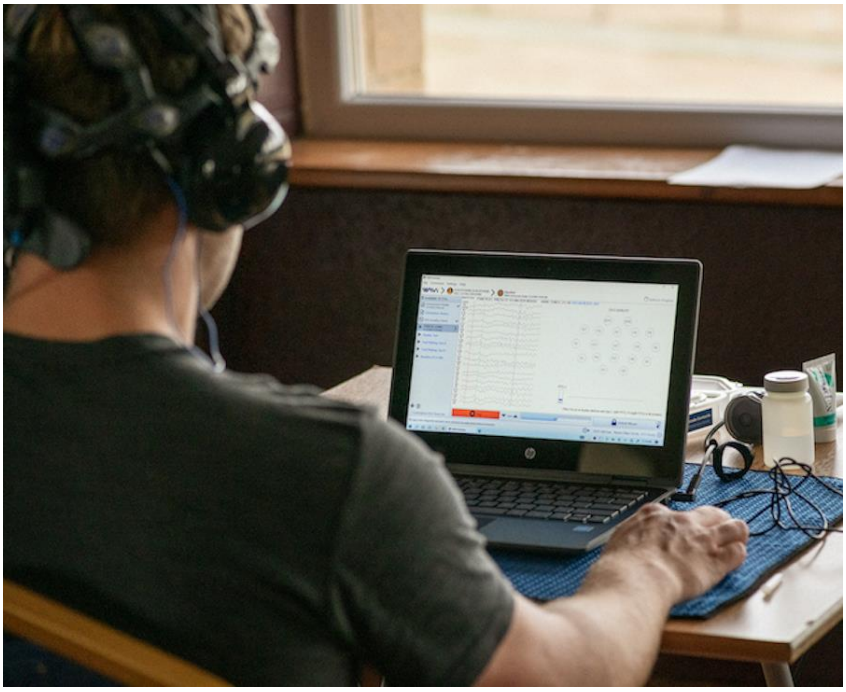

Figure 2: EEG p300 using the WAViMed System

Weekly subject contacts were made to ensure compliance with study conditions. This provided a platform for weekly subjective observations on changes in quality-of-life factors as they related to dimensions such as cognitive function, sleep, daily routine, and energy levels.

Results

Standard scores and mean outcome changes for neurocognitive index, composite memory, visual and verbal memory, and executive function are detailed in Table 1.

Neurocognition Index		Composite Memory		Verbal Memory		Visual Memory		Executive Function	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
91.05	102.41	96.90	111.57	94.68	108.30	98.83	110.58	96.26	105.22
Change	11.36		14.67		13.62		11.75		8.96
t test p	p = .042		p = .004		p = .009		p = .005		p = .042

Table 1: Standard scores and mean outcome changes for neurocognitive index, composite memory, visual and verbal memory, and executive function.

The NCI improved from 91.05 to 102.41, while composite memory started at 96.9 and increased to 111.57. With respect to isolating specific memory scores, the verbal memory values changed from 94.68 to 108.3, while visual memory scores started at 98.83 and finished at 110.58. Executive function had a starting mean of 96.26 and concluded at a mean score of 105.22. All changes were statistically significant, as noted by the test scores for each category.

All five areas improved from slightly below the average standard score of 100 to above 100. Figure 3 graphically depicts these changes.

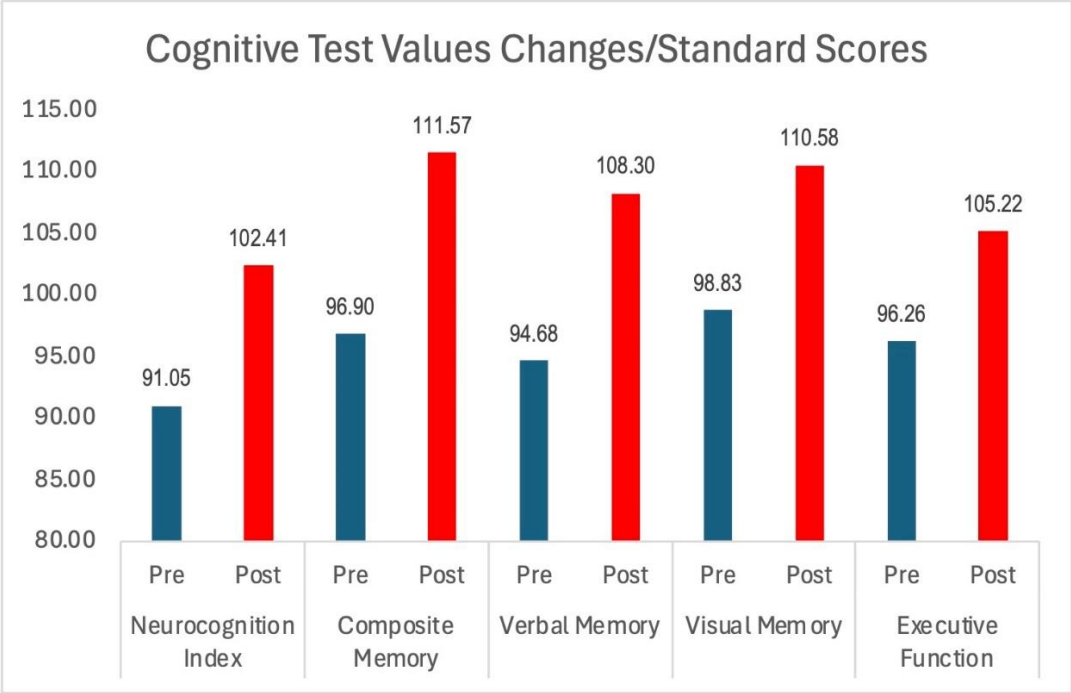

Figure 3: Graphic Depiction of Cognitive Test Changes, Pre and Post

Regarding the EEG assessments, the mean total reaction time for the p300 decreased from 300.94 milliseconds to 269.3 milliseconds, statistically significant with a P value of .004. The initial mean voltage reading was 12.27 microvolts (uV), with a final value of 11.92 uV. This change was not statistically significant at the P = .280 level. The trail-making composite test times decreased from 134.02 to 122.4 seconds, statistically significant, with a P value of .037. These results are combined in Table 2.

p300 Reaction Time		**Average Voltage uV**		**TrailMaking Combined**	
milliseconds		*microvolts*		*seconds*	
Pre	Post	Pre	Post	Pre	Post
300.94	269.3	12.27	11.92	134.02	122.4
Change	-31.64		-0.35		-11.62
t test p	p =.004		p = .280		p = .037

Table 2: All combined resuts.

The topographic maps depict in visual form the brain's activation during the p300 assessment. Cool colors, like blue and green, indicate low activation. Warm colors, such as yellow, orange, and red, scale upward, indicative of more activation. As individual topo maps vary, the subjects were combined in two pre-versus post-intervention composite graphics. This image, Figure 4, mirrors visually the changes in total reaction time and decreased trail-making score times

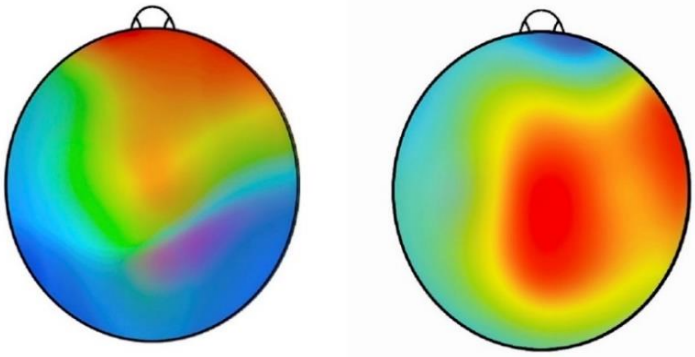

Figure 4: Combined Subject EEG Topo Map, Pre and Post

Discussion

This prospective pilot observational trial is one of the few human studies to describe the effects of a proprietary jellyfish collagen powder extract on a battery of cognitive parameters in adults. This investigation utilized two validated techniques to assess the changes in recognized, vital cognition domains. These observations have important implications for clinical relevance since the benefits were demonstrated in a broad adult population of both genders. Therefore, this attribute of the study may provide reasonable generalizability of the results to a large global audience.

The initial step in launching this beta study was identifying the optimal collagen supplement intervention that could positively impact brain health. This was accomplished by employing a product that was sourced from wild-caught, edible jellyfish (Kolla Jell™) by a patented extraction technique [26]. The resulting substance uniquely contains types I, II, and V collagen with 20 essential and nonessential amino acids, key macronutrients, calcium-binding proteins, and antioxidants. Significant amounts of glycine, tryptophan, glutamate, and tyrosine are present to produce neurotransmitters dopamine, gamma-aminobutyric acid, and serotonin, essential for neuroprotection, mood regulation, and cognitive function. Another advantage of the proprietary formulation was the relatively low dose required to detect a clinically relevant effect. The study dose of only two grams per day contrasts notably to the usual daily commercial collagen dosages of five to twenty grams.

In addition, the currently employed natural source of ingredients is critical since there are ample opportunities for deception regarding jellyfish-related compounds. For example, the naturally occurring calcium-regulating protein apoaequorin may address some aspects of age-related cognitive decline [68]. However, commercial enterprises may chemically manufacture synthetic, laboratory-created versions of this protein and claim, without proper evidence, that this artificially constructed form is equivalent to the natural protein [69]. Of course, these unsubstantiated claims are subject to criminal investigation, regulatory reprimand, penalty, scientific criticism, and public rebuke.

A strength of this pilot study was a selection of relevant clinical metrics to assess cognitive changes and employ the most appropriate methodologies to achieve the goals. The CNS Vital Signs Neurocognitive Test is a validated measure of brain health parameters that demonstrates test-to-test reliability and provides objective outcome scores comparable to the research normative values [63]. It also represents an efficient modality since the study subject can complete the assessment by self-administration in an in-home, comfortable, and familiar environment.

EEG measurement is a noninvasive method for recording the spontaneous electrical activity of the brain. This technology has been used routinely in medical and research settings to assess cortical function for almost a century and provides reliably consistent energy and wave patterns [51,52]. Due to its portability, ease of use, and virtually painless application, EEG is widely accepted in clinical settings. In this study, the EEG was especially valuable for detecting changes in brain voltage activation during three specific performance measurements.

This beta investigation showed beneficial outcomes in several parameters, including statistically significant increases in overall neurocognitive index, composite memory scores, individual verbal and visual memory, and executive function. These changes were both more expansive in the number of affected metrics and significance compared to other nutritional studies using the same or similar instruments/associated metrics [70-78].

The EEG profiles showed similar positive outcomes during the eight-week supplementation phase. Both auditory and visual responses, as well as trail-making test completion, improved to a comparable extent. While the average microvolts during the p300 wave declined slightly, they remained within the normal range. This supports the idea, proposed by some, that voltage is not necessarily the dominant predictor of cognitive function. In this study, the p300 voltage readings remained within the normal 6-15 µV range, while significant improvements were observed in total reaction time and combined trail-making scores. This was mirrored in the combined topo maps showing more activity, especially in the right side, particularly the Parietal, Temporal and Occipital regions, which combine for sensory input and processing [79-81].

Interestingly, more than half of the participants voluntarily reported benefits related to cognitive function, energy, and sleep/wake patterns, even though these aspects were not directly addressed by the study queries. With this study, the investigators were particularly mindful of the vagaries associated with clinical studies performed outside of the controlled environment of a standard trial site. Decentralized studies require constant vigilance on the investigators' part to ensure compliance with all performance aspects [82,83]. The key principles of this strategy note four distinct processes. The initial facet is the selection of the right subject, which occurs through the prospective, randomized recruitment process, eliminating those who possess any exclusion criteria. The next step involved the proper intervention, which was achieved by employing a unique natural jellyfish collagen supplement to measure the benefits. An important component, rarely addressed in nutritional studies is the consistency of lifestyle. Changes in nutritional patterns and intake, exercise, and other associated patterns can radically alter the results. The subjects had to commit to a consistent lifestyle and were monitored weekly to ensure this consistency over the eight-week period. Then, the relevant data must be used, and this was accomplished by utilizing two validated methods that assessed the necessary clinically relevant parameters. Finally, participant health and safety must be a priority. Fortunately, in this trial, no adverse side effects were reported primarily or detected secondarily.

Although the cognitive outcomes were positive, the current study did have some limitations. The open-label design without a placebo group may cause questions about the findings. However, the depth and breadth of the results in this case are compelling. The variability of the initial cognitive scores in each measurement did not affect statistical significance. An informal review of the subject starting points of those below average and those above average showed that both groups had improved in all five measures. One conclusion from this fact is the supplement worked well no matter where the subject started on the cognitive scale.

The relatively modest number of eligible subjects who completed the entire study may also engender some doubts, yet the strength of the objective data speaks for itself. All participants were personally and frequently monitored to ensure proper supplement consumption and accurate compliance with the computerized testing modalities. Future trials of longer duration and with larger subject numbers may be warranted to further confirm and more broadly generalize the current findings.

Conclusion

An eight-week trial of an orally consumed proprietary jellyfish collagen extract improved cognitive tests measured by an in-home computerized testing battery. The unique supplement also demonstrated a broad spectrum of brain activation and related performance during EEG monitoring. The systemically absorbed natural collagen product was well tolerated and did not cause any adverse side effects.

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