NuLivScience

Cellular Aging and Sports Performance

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Introduction

Consumers may have viewed proprietary ingredient blends that claim extraordinary performance enhancement as cutting edge, but the sports food niche is maturing, and these are slowly becoming "commodities." With these becoming more mainstream the only product differentiation exists in packaging, name, and unique selling points if any.

That could explain why only 1-in-7 sports nutrition products succeed. Competing in this field calls for superior product differentiation, as such products have 5X more success than non-differentiated counterparts.

The Current Sate and Latest Trends in Sports Nutrition

The market data forecast valued the North American Sports Nutrition Market at around USD 13.93 BILLION in 2021. The research firm projected the market to expand at a cagr of 7.8%, reaching 0.28 billion by 2026.[1]

The projected growth rate is linked to:

- Consumers' surging interest in fitness, self-care, and preventative medication
- Mass marketing, increasing awareness of sports nutrition products
- Rising cases of lifestyle illnesses and their health risks relative to COVID-19
- Increasing adoption of an active lifestyle
- Increased consumption of fast food
- Introduction of new flavors, ingredients, and technology resulting in extraordinary exercise performance enhancement
- Increasing strategic partnerships leading to more potent formulations
- Ecommerce access which boosts product availability
- Increasing income among consumers
- Emerging markets in Middle East, Africa, and Latin America

Sports supplements continue to dominate the sports nutrition category. According to the referenced Grandview Research, they had an 82.2% revenue share.[2] You can attribute their dominance to increased consumption by active adults for:

- Muscle growth
- Weight management
- Immunity enhancement
- Recovery after intense workouts, etc.

Sports supplements are, however, facing significant competition from their food counterparts. That's as active consumers increasingly embrace protein and energy bars as healthy in-between-meals snacks.

Key manufacturers are launching innovative products, leveraging scientifically proven cutting-edge ingredients to gain a competitive edge. They are also implementing innovative marketing strategies — taking part in strategic collaborations — to generate a buzz around their formulations.

Study after another infers a high adoption of dietary supplements. These inferences are backed by the high sales figures in the multi-billion-dollar industry. In short, the intake of dietary supplements and sports nutraceuticals is increasing without a sign of slowing down. But before we delve deeper into that, let's explore the consumer side of things.

What are consumers looking for in sports supplements?

Active consumers want sports supplements they can trust. That means solutions from transparent companies with clean labels. 58% of average consumers won't purchase sports food if they can't understand the health claim.[3] They also crave personalized solutions. That is sports nutrition products that factor in their physical activity, calorie intake, etc. Additionally, consumers want products that will serve their long-term health goals. That means solutions with natural, anti-inflammatory ingredients, which could explain the surging demand for plant-based formulations with immunity-enhancing benefits.

In a nutshell, active consumers use supplements to:

Get energy during an exercise session
- Fill nutrient gaps that may impair their exercise performance
- Increase exercise efficiency
- Improve strength and endurance
- Achieve exercise performance goals quickly
- Optimize body-mass composition
- Enhance recovery after workout sessions
- Boost their immune system and overall health

There's also a great emphasis on mental focus, strength, and endurance. So incorporate ingredients formulated to boost memory motivation and cognitive function. Your products should also consider stress relief and weight management, prioritizing non-habit-forming, natural ingredients to enhance user wellness.

Consider non-habit-forming and natural ingredients

Active consumers know that sports nutraceutical makers don't require FDA approval. They, therefore, need to be careful when making purchase decisions. Using natural ingredients makes your products safer and more appealing to a cautious buyer.

Consumers are also increasingly well-educated and understand that sports supplements contain active substances that may have significant biological effects. That, in turn, makes them unsafe for continuous use, hence the need for non-habit forming ingredients.

Healthy Aging and Exercise Performance

Aging happens even to the best of athletes. In most sports, there is a "prime' age range, where the combination of physical, technical, and strategic abilities comes together for peak performance. One reason why performance endurance decreases with age is due to the body's inefficient use of oxygen. The body's maximal ability to utilize oxygen is measured in VO_2max, an indicator of endurance performance. VO_2max is affected by how well your body can bring oxygen from your lungs to your working muscles which need oxygen to fuel contraction. Thus, the higher the VO_2max, the more "aerobically fit" you are, or in simple terms, the more endurance work you can do for your body weight. This value declines by about 10% every 10 years after a person turns 30, however, athletes who keep up with hard training can reduce the decline by up to 5% every ten years.[6]

Aging reduces both cardiac output and oxygen delivery to the muscles, translating to a lower VO_2max and consequently lowers performance in endurance exercises. Performance decreases even more for weight-bearing and strength exercises, suggesting age-related limitations may reside in our skeletal muscles which move our bones and joints.

Longer Recovery

With age, most athletes experience a diminishing ability to recover from hard and long bouts of exercise. This can affect the intensity and volume of training, but with smarter training and recovery practices, active consumers can reduce the chances of injuries and maximize performance while minimizing the effects of aging. In simple terms, older active consumers need longer to recover and adapt to a training stimulus, so workout regime needs to change with age.

Improve aerobic capacity by involving high-intensity interval training, focusing on quality and not duration of workout. Cross-training, any form of exercise that's not running such as swimming, yoga, and boxing, can help maintain muscle mass and strength. Cross training can also improve flexibility and reduce overuse injuries in endurance exercises.

Active recovery strategies, improved sleeping and diet habits, therefore, are essential for aging athletes.

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Senescence: A Process That Negatively Impacts Healthy Aging

Cellular senescence is a process where cells stop dividing but don't die as they should. Senescent cells build up as the body ages and become less efficient. These cells also continue to produce chemicals that hurt neighboring cells and can cause inflammation and weaken the immune system, interfering with the body's ability to heal injuries as well as expose a person to diseases.

According to the MDPI journal, cellular senescence caused by aging not only makes the immune system less efficient but increases morbidity and mortality.[7] Senescence also adversely affects skeletal muscle and reduces exercise performance. However, physical activity may be used to slow down cellular senescence or reverse it for seniors.

Additionally, when body cells are damaged beyond repair, they undergo senescence. Here, the cells stop dividing and kickstart preprogrammed self-destruction. But not all damaged cells self-destruct. (Which is not necessarily a cause for alarm.) It only becomes an issue if the damaged cells start leaching out hazardous protein compounds, harming the neighboring cells.

The Shift Towards Senolytics

Senescent cells increase with age as the aging immune system – the pre-programmed self-destructive action mentioned above – becomes less efficient. (Leaving the senescent cells to accumulate and potentially taint healthy cells.[4]) That, in turn, affects one's ability to recuperate from injuries, withstand stress, withstand ailments, etc.

On the Brightside: evidence suggests that removing or reducing senescent cells in body tissues can boost healthy aging.[5] (Senolytics are drugs that aid in eliminating senescent cells from body tissues.)

It may take years before the FDA can approve senolytics. But the allure of enhancing healthy aging and possibly curing old age ailments is strong. The best part? Senolytics may move the world to address the root causes.

Senactiv® is the Future of Human Performance

Senactiv® is the first sports nutrition senolytic on the market that has shown through 3 *in-vivo* and 4 human clinical studies to increase energy supply through optimal glycogen utilization in muscles, and regenerating muscle tissue through the removal of unfit cells. It helps professional athletes, bodybuilders, and every fitness enthusiasts exercise longer and harder.

Energy

Muscle contraction requires energy, which is provided by ATP and is produced by the mitochondria (the powerhouse of the cell) inside muscle cells. Higher concentration of citrate synthase in muscle cells indicates a greater number of mitochondria and consequently muscle cell abilities to produce more energy.

- Increases energy catalyst Citrate Synthase, a pace-making enzyme in the first step of the citric acid cycle (ATP)

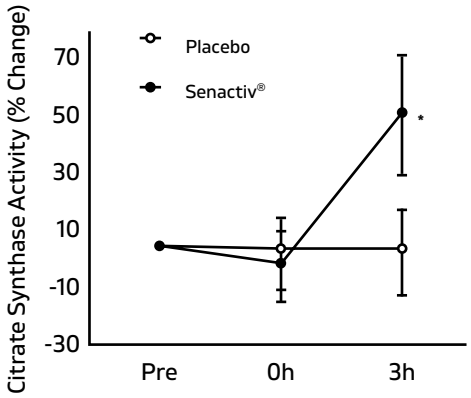

Figure 1. Increased Citrate Synthase activity by 47% after a 60-min cycling exercise at 70% VO_2max

Endurance

Increases high-intensity endurance performance by 20% at 80% VO_2max to exhaustion. (Fig. 2).

Senactiv® was proven in a randomized, double-blind crossover human trial to increase the time to exhaustion in high intensity cycling, meaning muscles can work harder for longer.

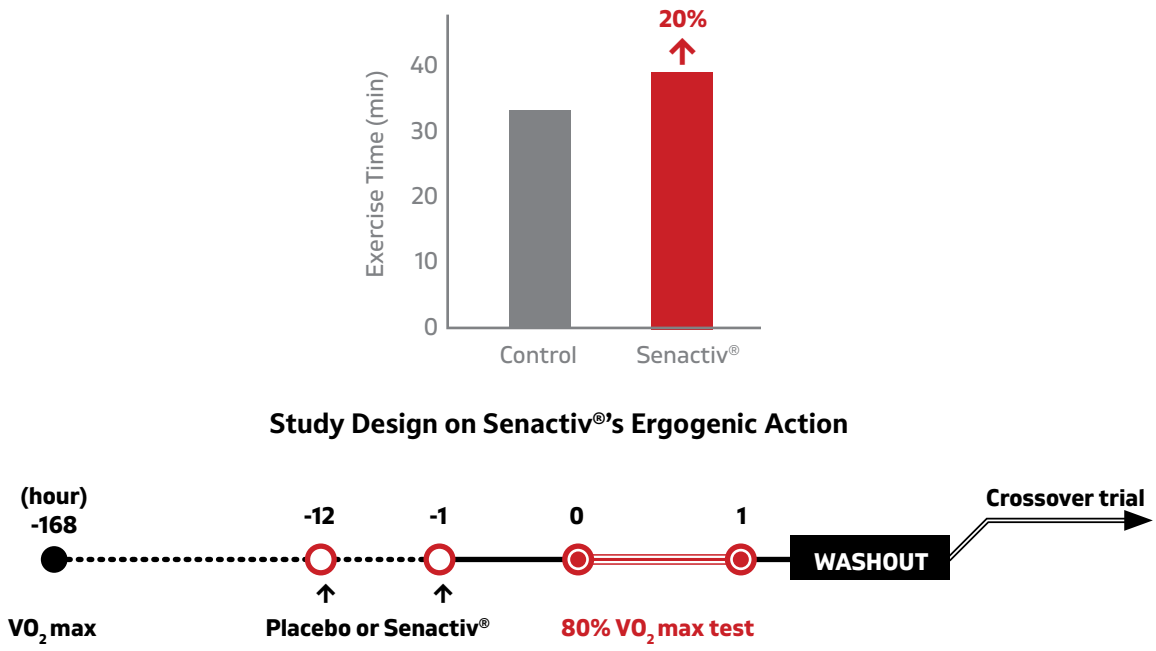

Figure 2. Time-To-Exhaustion (TTE) incrased by 20.4% in a Monark cycle ergometer exercise at 80% VO_2max

Recovery

Increased glycogen accumulation rate by 273% to provide more energy for longer workouts. In muscles, glucose is stored as an energy reserve in the form of glycogen. During physical activity muscle cells have to rely on glycogen for energy so more glycogen results in better endurance and longer lasting workouts.

Prolonged exercise increases cellular membrane peroxidation (indicated by increased biomarkers TBARS or MDA, which disrupts normal cellular functions and causes oxidative damage. Senactiv® reduces the unwanted oxidative damage during physical exertion, for faster recovery.

- Speeds up muscle fatigue recovery by reducing inflammation by decreasing TBARS, MDA, and Creatine Kinase (CK)

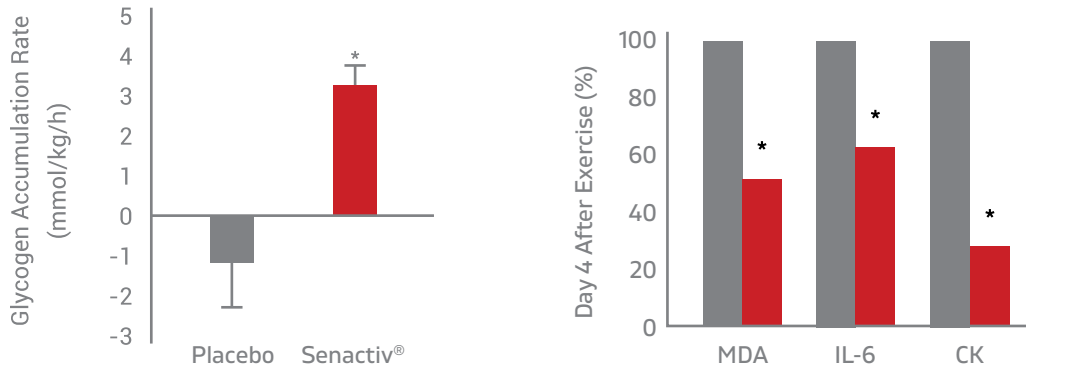

Figure 3. Decreases CK, a biomarker of damaged muscle, by 68% on day 4 after a repetition maximum (1-RM) test. Increased glycogen accumulation rate in the exercised muscle by 273% during the 3 h recovery after a 60 min cycling exercise at 70% VO_2max. Decreased lipid peroxidation marker TBARS by 24% after a 60 min cycling exercise at 80% VO_2max. Decreased free radiacal damage biomarker MDA by 44% on day 4 after a weight lifting exercise.

Senescent Cell Clearance

Senescent cells are found in people of all ages. As we age, our body's ability to clear senescent cells declines. People who do not exercise regularly have more senescent cells. Proper immune response to inflammation caused by exercise and physical activity has significant consequences in the health, stability, and integrity of exercised muscles. Phagocytosis by macrophage is a recognized mechanism to selectively eliminate senescent muscle cells.

- Eliminates biomarkers of senescent cell, SA-β-gal and $P16^{INK4a+}$ after a 60 min high-intensity exercise and increases iNOS mRNA, a macrophage enzyme to promote further clearance of sensecent muscle cells

Senactiv® completely eliminates $P16^{INK4a+}$ and SA-β-gal (SABG), reversed apoptotic nuclei content, and increased iNOS mRNA and IL-6 mRNA levels in exercised muscle, suggesting an enhanced activation of macrophage phagocytosis in exercised muscles.[3]

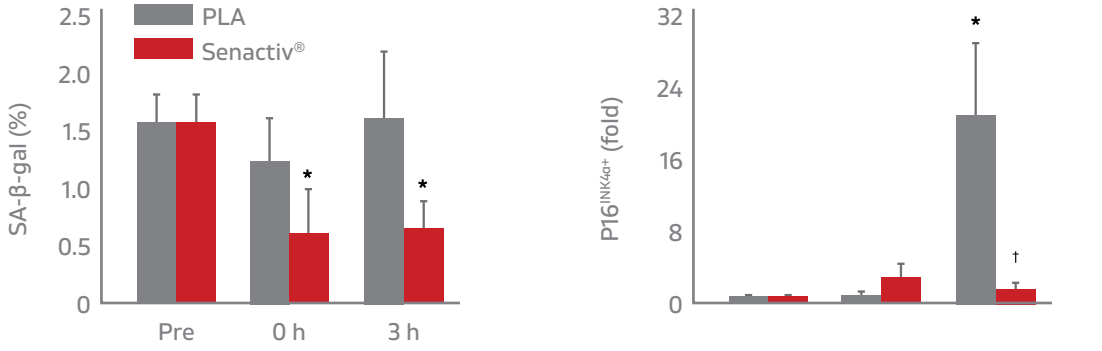

Figure 4 .Decreased SA-β-gal by 63%, $P16^{INK4a+}$ by 86%, and increased iNOS mRNA by 27% after a 60 min Monark ergometer cycling exercise at 70% VO_2max

Regeneration

Maintaining a youthful muscle population has a significant impact on physical activities at all levels and overall health. Chronological age is not the best measure of human aging and fitness as the average age of cell population in a person determines the physiological age and fitness.

Senactiv® helps generate new muscle cells by increasing Pax7 (a muscle stem cell) and Myf5 (a protein for muscle differentiation) levels in the exercised muscle immediately after high resistance and high-intensity endurance exercises. The maintenance or restoration of muscle satellite cell size and the ability to differentiate into muscle fiber or to contribute its nuclei to repair damaged muscle fiber plays a critical role in muscle regeneration/remodeling.

When used alone, Senactiv® increases endurance and energy level and decreases recovery time due to its ability to remodel the muscle to a younger population. When used with other conventional sports nutraceuticals, Senactiv® may amplify their effects in energy production, muscle pump, endurance, muscle growth, and mental acuity due to a greater amount of creatine phosphate and glucose, mitochondria, endothelial cells, etc in the younger muscle population. Published research has shown there are fewer mitochondria, creatine phosphate, and NO production in senescent cells.[10, 11, 12]

Develop your best formula today with Senactiv®!

Capitalize on Sports Nutrition Market Gaps with NuLiv Science

As discussed, consumers want products that deliver more than muscle-building benefits. That presents opportunities for limitless product innovation.

Is your company ready to tap into underserved markets? For example:

- At-home workouts
- Women
- Senior active adults
- Emerging markets like Africa, Latin America, and the Middle East

Capitalize on the existing market gaps with the aid of NuLiv Science, a company that has supplied scientifically backed ingredients to notable nutraceutical organizations globally. We provide:

- Pure, high-quality ingredients
- Safe ingredient testing
- Sustainable supply chain
- Reliable technical specifications

Contact us today to begin your cutting-edge formulation.

**These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease.*

Reference

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GRAS Affirmed
GENERALLY RECOGNIZED AS SAFE

INFORMED INGREDIENT

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