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SENACTIV

SENACTIV[®]

MUSCLE ENERGY & REGENERATION

The Future Standard for Sport Nutraceuticals

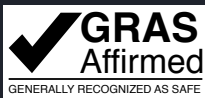
Senactiv® is clinically validated in 3 *in-vivo* and 6 published human clinical studies evaluating 9 different interventions in:

- *PLOS One*
- *Journal of Ginseng Research*
- *Journal of the International Society of Sports Nutrition*
- *Evidence-based Complementary and Alternative Medicine*
- *Journal of Functional Foods*
- *Journal of Science in Sport and Exercise*
- *Aging*

US Patent No. 10,806,764

GRAS/NDI self-affirmed

NPN 80086984



Senactiv® helps professional athletes, bodybuilders, and every fitness enthusiast in between exercise longer and harder. Experience an increased energy supply through optimal glycogen utilization in muscles, clearing unfit (senescent) cells, and regenerating with healthy new cells.

Citrate synthase is the pace-making enzyme in the first step of Krebs cycle that produces the energy (ATP) in the thousands of mitochondria inside each muscle cell to power its contraction and relaxation. Citrate synthase is a validated biomarker for the number of mitochondria in each muscle cell.

Higher concentration of citrate synthase in muscle cells indicates greater number of mitochondria and consequently muscle cell abilities to produce more energy. Senactiv® has shown in one published human trial (*PLoS One*) to increase citrate synthase concentration by 47% in exercised muscles 3 hours after a 70% VO_2max cycling exercise.

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.

Senactiv® has shown in one published human trial (*Journal of Ginseng Research*) to completely eliminate the hydrolyze enzyme SA- β -gal that is only present in senescent cells. Senactiv® has shown in another published human trial (*Aging*) to reverse the protein p16^{INK4a} (the absence of senescent cell) to baseline 3 hours after exercise. Yet in a third published human trial (*Journal of Functional Foods*), Senactiv® has shown to increase the Myf5 mRNA, a protein with a key role in regulating muscle differentiation, specifically the development of skeletal muscle.

Senactiv® effectively increases the energy production in contracting muscles so they can work longer and harder. As a result, the sport nutraceutical facilitates senescent cell clearance in contracting muscles so the unfitted muscle cell population is reduced — helping maintain muscle stem cell numbers for the regeneration of more new muscle cells. The synergistic effects lead towards a significant increase in exercise and physical activity to an unprecedented level.



Benefits

Energy

Increases energy catalyst Citrate Synthase, a pace-making enzyme in the first step of the citric acid cycle (ATP), by 47%

Endurance

Increases high-intensity endurance performance by 20% at 80% VO_2 max to exhaustion

Recovery

Clear unfit (senescent) muscle cells by eliminating senescence-associated beta galactosidase, increasing satellite muscle stem cells, glutathione, and regenerated muscle fibers

Speeds up muscle fatigue recovery by increasing glycogen accumulation rate in muscles at the end of 3rd hour by 373% after a high-intensity 60 minute exercise at 70% VO_2 max

Reduces lipid peroxidation marker TBARS by 24%

Reduces free radical damage to muscle after exercise (MDA synthesis, an oxidative stress marker) by 44% on day 4 after a heavy exercise

Reduces inflammation by decreasing IL-6 synthesis, a pro-inflammatory cytokine, by 35% on day 4 after a heavy exercise

Decreases muscle damage (Creatine Kinase) on day 4 after exercise by 69%

Regeneration

Decreasing SA- β -Gal by 63% in muscle tissue

Marked increases in p16^{INK4a} protein expression of endothelial progenitor cells in skeletal muscle tissue



Research

1. Improved inflammatory balance of human skeletal muscle during exercise after supplementations of the ginseng-based steroid Rg1. *PLoS One*. Jan 2015. (3 human trials) doi: 10.1371/journal.pone.0116387. eCollection 2015.
2. Ginsenoside Rg1 supplementation clears senescence-associated β -galactosidase in exercising human skeletal muscle. *Journal of Ginseng Research*. June 2018. (1 human trial) doi: 10.1016/j.jgr.2018.06.002.
3. Satellite cells depletion in exercising human skeletal muscle is restored by ginseng component Rg1 supplementation. *Journal of Functional Foods*. April 2019. DOI: 10.1016/j.jff.2019.04.032 (1 human trial).
4. Exercise against aging: Darwinian natural selection of fit and unfit cells inside the human body. *Journal of Science in Sport and Exercise*. June 2019. DOI: 10.1007/s42978-019-0002-y (1 human trial).
5. Aerobic exercise induces tumor suppressor p16ink4a expression of endothelial progenitor cells in human skeletal muscle. *Aging*. July, 2020. <https://doi.org/10.1016/j.jgr.2018.06.002> (1 human trial).
6. Oral Rg1 supplementation strengthens antioxidative defense system against exercise-induced oxidative stress in rat skeletal muscle. *Journal of the International Society of Sports Nutrition*. 2012. doi: 10.1186/1550-2783-9-23 <http://www.jissn.com/content/9/1/23> (in-vivo).
7. Ginsenoside Rg1 protects the liver against exhaustive exercise-induced oxidative stress in rats. *Evidence-based Complementary and Alternative Medicine*. June 2011. doi.org/10.1155/2012/932165 (in-vivo).
8. Muscle as a paracrine and endocrine organ. *Current Opinion in Pharmacology*. 2017, 34:49-55.
9. Intrinsic and extrinsic mechanisms regulating satellite cell function. *The Company of the Biologists Ltd*. *Development* (2015) 142, 1572-1581. doi:10.1242/dev.112443.

For more information visit www.nulivscience.com/ingredients/senactiv



*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.



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