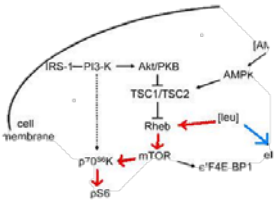
MaxQ Nutrition® Pre-Workout White Papers

INTENSITY | PERFORMANCE | STRENGTH

BCAA

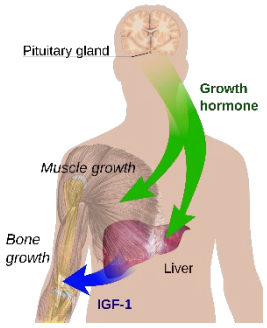
Branched Chain Amino Acids
Scientific Article Summary: Muscle Recovery | Endurance
Source: https://www.ncbi.nlm.nih.gov/pubmed/18974721



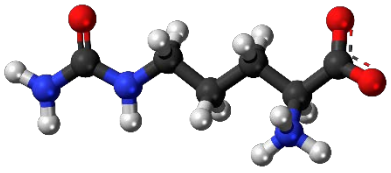
Research targets the effects of BCAA on the muscle protein matrix and the immune system. Data show that BCAA supplementation **before and after** exercise has beneficial effects for decreasing exercise-induced muscle damage and promoting muscle-protein synthesis. Muscle damage develops delayed onset muscle soreness: a syndrome that occurs 24-48 h after intensive physical activity that can inhibit athletic performance.

L Citrulline Malate

Scientific Article Summary: Fatigue | Aminos
Source: https://www.ncbi.nlm.nih.gov/pubmed/20499249



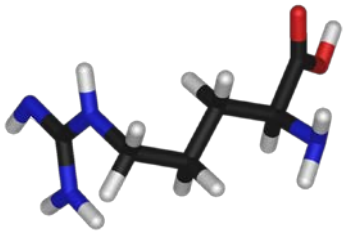
Exhaustive exercise induces disturbances in metabolic homeostasis which can result in **amino acid catabolism and limited L-arginine availability**. Oral L-citrulline supplementation raises plasma L-arginine concentration and augments NO-dependent signaling. Research reviewed the effects of diet supplementation with L-citrulline-malate prior to intense exercise. Seventeen voluntary male pre-professional cyclists were randomly assigned to one of two groups: control or supplemented (6 g L-citrulline-malate 2 h prior exercise) and participated in a 137-km cycling stage. Blood samples were taken in basal conditions, 15 min after the race and 3 h post race (recovery). **Most essential amino acids significantly decreased their plasma** concentration as a result of exercise; however, most non-essential amino acids tended to significantly increase their concentration. **Citrulline-malate ingestion significantly increased the plasma concentration of citrulline, arginine, ornithine, urea, creatinine and nitrite** ($p < 0.05$) and significantly decreased the isoleucine concentration from basal measures to after exercise ($p < 0.05$). **Insulin levels significantly increased** after exercise in both groups ($p < 0.05$) returning to basal values at recovery**. Growth hormone increased** after exercise in both groups, although the increase was higher in the citrulline-malate supplemented group ($p < 0.05$). **L-citrulline-malate supplementation can enhance the use of amino acids, especially the branched chain amino acids during exercise**



and also enhance the production of arginine-derived metabolites such as nitrite, creatinine, ornithine and urea.

L Arginine A Ketoglutarate

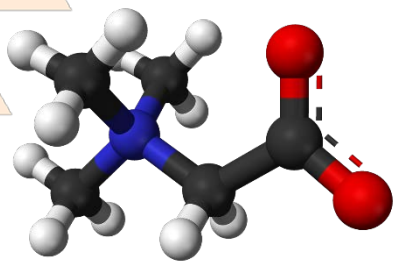
Scientific Article Summary: Blood Flow| Oxygen | Muscle Performance
Source: https://www.ncbi.nlm.nih.gov/pubmed/22251130



l-Arginine (L-arg) is an amino acid precursor to nitric oxide (NO). Dietary supplements containing L-arg have been marketed with the purpose of **increasing vasodilation,** thereby elevating blood flow to the exercising muscle and enhancing the metabolic response to exercise. Our goal was to identify the acute effect of L-arg supplementation on biceps strength performance, indicators of NO production (nitrite and nitrate - NOx), **and muscle blood volume (Mbv**) and oxygenation (Mox) during recovery from 3 sets of resistance exercise. Fifteen males participated in a randomized, double-blind, placebo-controlled study. After withdrawing resting blood samples, the subjects were supplemented with 6 g of L-arg (ARG) or placebo (PLA). Monitoring of Mbv and Mox with near-infrared spectroscopy began 30 min after supplementation and lasted for 60 min. The exercise protocol (3 sets of 10 maximal voluntary contractions of isokinetic concentric elbow extension at 60°·s(-1), 2-min rest between sets) was initiated 80 min after supplementation. Blood samples were drawn at 30, 60, 90, and 120 min after supplementation. Repeated measures **ANOVA showed that Mbv significantly** ($p \leq 0.05$) increased in ARG compared with the PLA during the recovery period of each set of resistance exercise. NOx, Mox, peak torque, total work, and set total work were not significantly different between groups. **We found that acute L-arg supplementation increases Mbv** during recovery from sets of resistance exercise with no increase in strength performance.

BETAINE Anhydrous

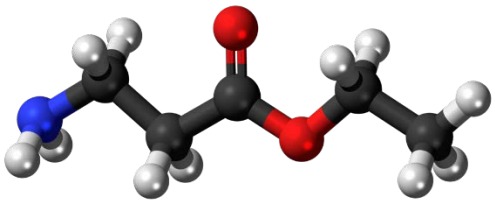
Scientific Article Summary: Strength | Lean Mass
Source: https://jissn.biomedcentral.com/articles/10.1186/1550-2783-10-39
Journal of the International Society of Sports Nutrition



Betaine (trimethylglycine) is an organic osmolyte found in many foods, including spinach, beets, and whole grains[1]. Administration of supplemental betaine for 10–15 days has enhanced performance in several studies but with varying results: Lee et al.[2] **reported increased power output and force production**, whereas others[3, 4] reported **improvements in muscular endurance but not power.**
This hypothesis was supported by significant increases in lean mass, and decreases in fat mass and body fat percentage with betaine compared to placebo**. Increases in arm CSA were found to be greater with betaine than placebo**; however, thigh CSA did not increase in either group. We also expected strength and power performance to improve with betaine supplementation. While back squat 1 RM increased for both groups, there were no differences in improvement between betaine and placebo.

CarnoSyn Beta Alanine

Scientific Article Summary: Performance | Endurance
Source: https://www.ncbi.nlm.nih.gov/pubmed/16868650
Source: http://www.carnosyn.com/carnosyn

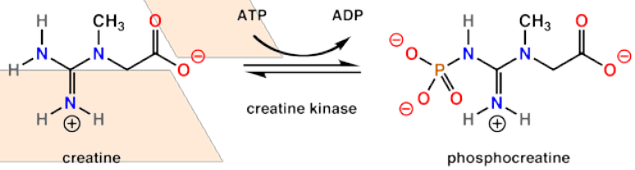


Dr. Roger Harris, who changed the sporting world with groundbreaking research and inventions involving creatine, discovered the benefits of using beta-alanine as a human dietary supplement to support an increase in muscle carnosine and athletic performance.

Muscle carnosine synthesis is limited by the availability of beta-alanine. Thirteen male subjects were supplemented with beta-alanine (CarnoSyn) for 4 wks, 8 of these for 10 wks. A biopsy of the vastus lateralis was obtained from 6 of the 8 at 0, 4 and 10 wks. Subjects undertook a cycle capacity test to determine total work done (TWD) at 110% (CCT(110%)) of their maximum power (Wmax). Twelve matched subjects received a placebo. Eleven of these completed the CCT(110%) at 0 and 4 wks, and 8, 10 wks. Muscle biopsies were obtained from 5 of the 8 and one additional subject. **Muscle carnosine was significantly increased by +58.8% and +80.1% after 4 and 10 wks beta-alanine supplementation.** Carnosine, initially 1.71 times higher in type IIa fibres, increased equally in both type I and IIa fibres. **No increase was seen in control subjects**. Taurine was unchanged by 10 wks of supplementation. 4 wks beta-alanine supplementation resulted in a significant increase in TWD (+13.0%); with a further +3.2% increase at 10 wks. TWD was unchanged at 4 and 10 wks in the control subjects. The increase in TWD with supplementation followed the increase in muscle carnosine.

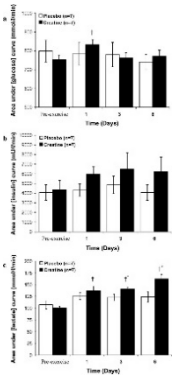
Creatine Magna Power

Scientific Article Summary: Strength | Muscle Mass
Source: https://www.ncbi.nlm.nih.gov/pubmed/27193231
Source: http://www.creatinemagnapower.com/creatine-magnapower



Magnesium creatine chelate (magnapower)—Creatine, as well as arginine, **is the most effective of all the legalized anabolic agents.** This fact has been confirmed by numerous scientific studies and long-standing use in sport. However, the full potential of creatine as a supplement stimulating strength and muscle mass is limited by the lactamation reaction, which transforms a major part of the creatine consumed into inert creatinine. This reaction binds the amino group of creatine with its acid group. This locks up the creatine molecule, turning it into creatinine and makes it anabolically inert. **The reaction is accelerated by the high acidity of ready-to-consume creatine solutions, as well as the acidity of the upper gastrointestinal tract.** Research labs have tried to eliminate this disadvantage by either securing the reactive chemical groups with alcohol or acid molecules, which can result in creatine malate or creatine ethyl ester, or by mixing creatine with alkali metal compounds. Magnapower's chelate with magnesium as a carrier permits creatine to avoid gastric destruction and continue to the intestine where it is absorbed and used by the body.

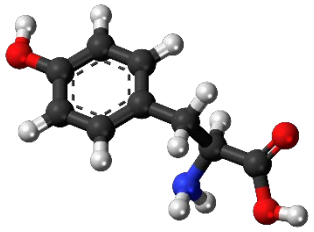
Creatine: Muscle glycogen availability can limit endurance exercise performance. We previously demonstrated 5 days of creatine (Cr) and carbohydrate (CHO) ingestion augmented post-exercise muscle glycogen storage compared to CHO feeding alone in healthy volunteers. Here, we aimed to characterise the time-course of this Cr-induced response under more stringent and controlled experimental conditions and identify potential mechanisms underpinning this phenomenon. Fourteen healthy, male volunteers cycled to exhaustion at 70 % VO2peak. Muscle biopsies were obtained at rest immediately post-exercise and after 1,

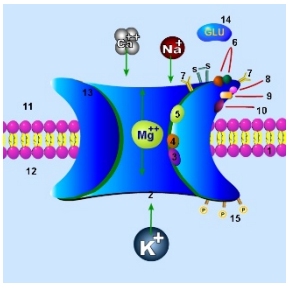


3 and 6 days of recovery, during which Cr or placebo supplements (20 g day(-1)) were ingested along with a prescribed high CHO diet (37.5 kcal kg body mass(-1) day(-1), >80 % calories CHO). Oral-glucose tolerance tests (oral-GTT) were performed pre-exercise and after 1, 3 and 6 days of Cr and placebo supplementation. Exercise depleted muscle glycogen content to the same extent in both treatment groups. **Creatine supplementation increased muscle total-Cr, free-Cr and phosphocreatine (PCr) content** above placebo following 1, 3 and 6 days of supplementation (all $P < 0.05$). **Creatine supplementation also increased muscle glycogen content noticeably above placebo after 1 day of supplementation** ($P < 0.05$), which was sustained thereafter. **This study confirmed dietary Cr augments post-exercise muscle glycogen super-compensation, and demonstrates this occurred during the initial 24 h of post-exercise recovery** (when muscle total-Cr had increased by <10 %). This marked response ensued without apparent treatment differences in muscle insulin sensitivity (oral-GTT, muscle GLUT4 mRNA), osmotic stress (muscle c-fos and HSP72 mRNA) or muscle cell volume (muscle water content) responses, such that another mechanism must be causative.

L-Tyrosine

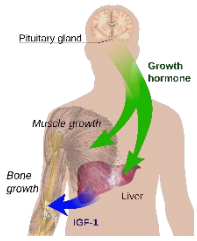
Scientific Article Summary: Neurotransmitters | Thyroid/Metabolism
Source: http://umm.edu/health/medical/altmed/supplement/tyrosine



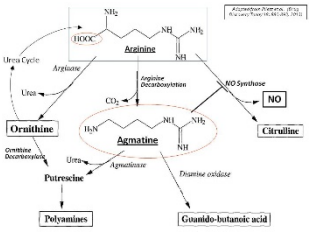


Tyrosine is a nonessential amino acid the body makes from another amino acid called phenylalanine. It is an essential component for the production of several important brain chemicals called neurotransmitters, including epinephrine, norepinephrine, and dopamine. Neurotransmitters help nerve cells communicate and influence mood. Tyrosine also helps produce melanin, the pigment responsible for hair and skin color. It helps in the function of organs responsible for making and regulating hormones, including the adrenal, thyroid, and pituitary glands. **Tyrosine is a precursor to thyroid hormone.** It is involved in the structure of almost every protein in the body.

Agmatine Sulfate



Scientific Article Summary: Endurance | Performance | Metabolism
Source: 1, 2 and https://examine.com/supplements/agmatine/



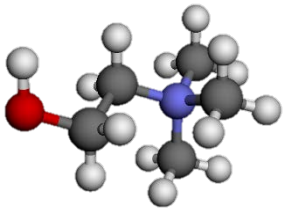
Studies suggest that agmatine may be responsible for the production and release of several peptide hormones, **including the growth hormone (GH),** luteinizing hormone (LH), and pituitary hormone[1]. It also reduces neuropathic pain and drug addiction symptoms. As a neurotransmitter, agmatine is released through the process of membrane depolization to block NMDA receptors and other cation ligand-gated channels[2]. This poses the potential for increased learning and memory functions[2].

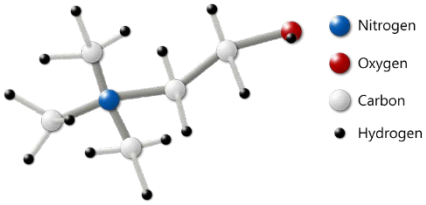
1. Kim, J. H.; Yenari, M. A.; Giffard, R. G.; Cho, S. W.; Park, K. A.; Lee, J. E. (2004). "Agmatine reduces infarct area in a mouse model of transient focal cerebral ischemia and
protects cultured neurons from ischemia-like injury". Experimental Neurology 189
2. Tijen Utkan, Semil S. Gocmez, Soundararajan Regunathan, Feyza Aricioglu, Agmatine, a metabolite of L-arginine, reverses

scopolamine-induced learning and memory impairment in rats, Pharmacology Biochemistry and Behavior, Volume 102, Issue 4, October 2012, Pages 578-584.

Choline Bitartrate

Scientific Article Summary: Focus | Endurance | Strength
Source: https://www.ncbi.nlm.nih.gov/pubmed/3748109

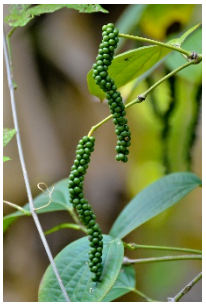




Similar to B Vitamins. Choline is used for liver disease, including chronic hepatitis and cirrhosis. It is also used for depression, memory loss, Alzheimer's disease and dementia, Huntington's chorea, Tourette's disease, a brain disorder called cerebellar ataxia, certain types of seizures, and a mental condition called schizophrenia. Athletes use it for bodybuilding and **delaying fatigue in endurance sports.**

Black Pepper Fruit Extract (BioPerine®)

Scientific Article Summary: Promotes Nutrient Absorption
Source: https://examine.com/supplements/black-pepper/

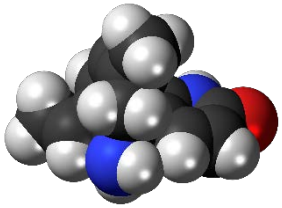


Black Pepper is a spice commonly used in many areas of the world for flavor. Through its active component Piperine, Black Pepper is able to modify supplement and **drug metabolism**.

Piperine is known for changing metabolism of various drugs and supplements, most notably increasing Curcumin bioavailability by 2000%.[2] A process in the liver called glucuronidation, which attaches a molecule (glucuronide) to drugs to signal for their urinary excretion, is inhibited with piperine. This process prevents excessive levels of drugs and supplements in the body, but sometimes inhibits all uptake and renders some supplements useless. In the scenario of piperine ingestion, excretion of supplements is hindered and certain drugs and supplements can bypass this regulatory stage (as not all are subject to it).

Huperzine A 1%

Scientific Article Summary: Endurance | Strength
Source: https://examine.com/supplements/Huperzine-A/



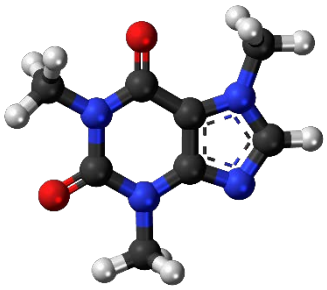
Huperzine-A is a compound extracted from the herbs of the *Huperziceae* family. It is known as an acetylcholinesterase inhibitor, which means that it stops an enzyme from breaking down acetylcholine which results in increases in acetylcholine.

Acetylcholine is known as the **learning neurotransmitter**, and is involved in muscle contraction as well. Increasing levels of acetylcholine is routinely used as a technique amongst weight-lifters and scholars. Huperzine-A appears to be a relatively safe compound from animal studies of toxicity and studies in humans showing no side-effects at dosages routinely supplemented with. Huperzine-A is in preliminary trials for usage in fighting Alzheimer's Disease as well.

Acetylcholine is also involved in **muscle contraction.** Increasing levels of acetylcholine is routinely used as a technique amongst weight-lifters and scholars.

Caffeine Citrate 50 mg

Scientific Article Summary: Energy | Oxygen Consumption
Source: https://www.ncbi.nlm.nih.gov/pubmed/2056905



Caffeine ingestion prior to the start of exercise has been shown to have an effect on ventilatory parameters and substrate utilization. Changes in either substrate utilization or ventilatory parameters may influence the determination of the lactate threshold (LT) and/or the ventilatory threshold (VT). Therefore, it was the purpose of this investigation to determine whether the VT and LT occur at similar metabolic rates and what effect caffeine ingestion will have on these two measures. Ten male subjects completed two maximal exercise bouts on the treadmill using a single blind procedure. One trial was performed 45 min after the ingestion of caffeine citrate (CC) in an amount equal to 7.0 mg of anhydrous caffeine.kg-1 body weight. The second trial was performed 45 min after the ingestion of a gelatin powdered placebo (P). Ventilatory parameters were monitored on a breath-by-breath basis, and blood for lactate determination was obtained from an antecubital vein every minute. During the CC trial, VO2 values at the VT (44.4 +/- 6.6 ml.kg-1.min-1) and the LT (39.7 +/- 5.8 ml.kg-1.min-1) were significantly different. When comparing the VO2 at the LTs between the CC and P trials, there was no significant difference. **There was, however, a significant difference in VO2 at the VTs when comparing the two trials.**