

ERGOGENIC AIDS AND NUTRIENT SUPPLEMENTS

Ergogenic aid

It is defined as “A physical, mechanical, nutritional, psychological, or pharmacological substance or treatment that either directly improves physiological variables associated with exercise performance or removes subjective restraints which may limit physiological capacity”

Types of Ergogenic Aids

I. Mechanical

Running shoes, nasal breathing strips, equipment innovations, artificial turf, etc.

II. Pharmacological

Erythropoietin, β -blockers, antihistamines, growth hormone, anabolic-androgenic steroids, caffeine, amphetamines, ephedrine, β -hydroxy- β -methylbutyrate (HMB), Androstenedione, Dehydroepiandrosterone, etc.

III. Physiological

Blood doping, saline infusion, warm-up, clothing, etc.

IV. Psychological

Hypnosis, psychotherapy, imagery, etc

V. Nutritional

A. Metabolic fuels carbohydrate, protein, pyruvate, lactate, fat, caffeine, branched chain amino acids, etc.

B. Limiting cellular components creatine, carnitine, vitamins, phosphate, NaHCO_3^- , etc.

C. Anabolic or stimulatory substances protein, chromium, vanadium, dichloroacetate, ephedrine, β -hydroxy- β -methylbutyrate (HMB), Androstenedione, Dehydroepiandrosterone, caffeine, etc.

D. Anti-Catabolic anti-oxidants, β -hydroxy- β -methylbutyrate (HMB), etc.

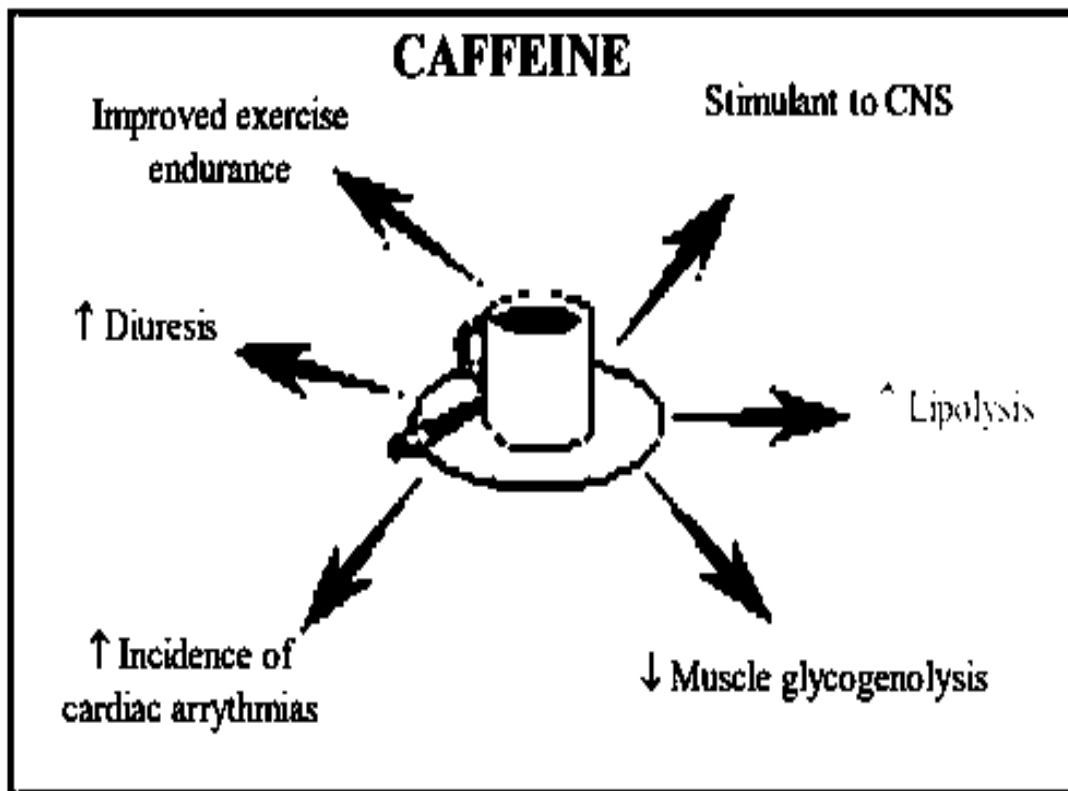
Caffeine

The most highly consumed drug in North America and Europe. 8IOC initially banned caffeine in 1962, then removed from list in 1972. 8Today, urinary caffeine $> 12 \mu\text{g/L}$ is an IOC infringement. (NCAA $> 15 \mu\text{g/L}$) 8This urinary level requires $> 13.5 \text{ mg/kg}$ caffeine, where 1 cup coffee provides 80 mg.

$$1012 \text{ mg}/80 = 12.7 \text{ cups (IOC banned dosage)}$$

$$330 \text{ mg}/80 = 4.1 \text{ cups (Ergogenic benefit)}$$

Assumes 75 kg body mass



- E. Substances that may enhance thermoregulation and/or prevent dehydration fluid, electrolytes, glycerol, sports drinks, etc.

Glycerol

Ingestion of ~1.2 g glycerol/kg body mass with sufficient volumes of water (26 mL/kg) can induce an increase in hydration, termed hyperhydration. Increased hydration can improve cardiovascular function and thermoregulation during conditions where dehydration is inevitable.

Carnitine

Molecule that transports fatty acids into mitochondria. Research indicates that carnitine provides no ergogenic benefit.

Phosphate

Some evidence for increased VO₂max and VT.

Sodium Bicarbonate

Increases blood bicarbonate and buffering potential. Increases performance during intense intermittent exercise.

Creatine

First reported supplementation – Barcelona Olympics 1992.

Creatine is the main component of creatine phosphate.

Creatine is found in meat and fish (mixed diet provides about 1 g/day), but is also synthesized in the liver, pancreas, & kidneys (1 g/day, which is suppressed with supplementation).

Dietary supplementation of creatine of at least 15 - 25 g/day for 2-7 days can increase muscle creatine by 20 - 30%. (~ 20% is in CrP form)

Physiological benefits inconsistently reported in research and changes are not large.

Some detriment – increased body water (weight), muscle cramping, possible renal damage from long term high intake.

Not banned, but in the U.S. the NCAA prevents college teams from providing it to players.

Branched Chain Amino Acids

The main BCAA's are leucine, isoleucine and valine. These amino acids decrease the ability for tryptophan to cross the blood brain barrier, impeding the formation of serotonin and the perception of fatigue (central fatigue)

Erythropoietin (EPO)

A hormone that is mainly produced in the kidney in response to hypoxia, anemia, and blood loss.

EPO stimulates increased red blood cell production (erythropoiesis).

EPO also provides central nervous system stimulation

EPO is widely used by elite endurance athletes, but has caused deaths due to organ damage resulting from excessive increases in blood viscosity.

Blood Doping

The removal of 1-4 units of blood, storage of the blood for 4-8 weeks, and the reinfusion of the red blood cells.

Reinfusion usually occurs ~1 week prior to competition.

Blood doping can double the [Hb], but typically this causes too much of an increase in blood viscosity.

References

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