Role of dietary supplements and ergogenic aids in sports nutrition

Article · June 2018

CITATIONS
0

READS
123

1 author:

Sonal Jain
Lupin Diagnostics
11 PUBLICATIONS **10** CITATIONS

SEE PROFILE

Role of dietary supplements and ergogenic aids in sports nutrition

MUHAMMED MAJEED [1, 2 ^]
SHAHEEN MAJEED [1, 2 °]
SONAL JAIN [1 #]

1. Sami Labs Limited
19/1 & 19/2, I Main, II Phase
Peenya Industrial Area
Bangalore – 560 058, Karnataka, India

2. Sabinsa Corporation
20 Lake Drive
East Windsor, NJ 08520, USA

^ mail1@samilabs.com

° shaheen@sabinsa.com

sonal@samilabs.com

Approximately 85% of the athletes use dietary supplements as part of their strenuous routine. These dietary supplements commonly used include vitamins, minerals, protein, creatine, and a number of "ergogenic" compounds. Besides the different types of food eaten by athletes to maintain ability for continuous rigorous training and exercise without crumbling to chronic fatigue, injury, and illness, the timing and quantity of food intake are also crucial to have specific health benefits (1). The recovery mechanism during performance sports assures for trophic regeneration, refurbishing the homeostasis (balance) of the internal environment as well as the functional systems before effort and even brings them to an optimal state (2). A common belief amongst most of the athletes is that a normal diet will not be adequate for best performance and dietary supplements can help in gaining competitive edge during exhaustive exercises (1). The use of pharmacotherapies like anabolic steroids and amphetamines in the past led to the development of anti-doping regulations and protocols to help discourage their use. Therefore, sports supplements gained interest by athletes, which they assume to be effective, safe and legal (3).

Statistics on the use of dietary supplements by athletes

- **International survey:** Approximately two-thirds (2,591/3,887) of adult and adolescent elite athletes were on one or more dietary supplements containing ingredients as minerals, aminoacids and micronutrients. The percentage was directly correlated to increased age and was significantly more frequent among women than men (4).
- **National survey:** Approximately 21,000 US college athletes were on dietary supplements; the highest percentage was of protein products (41.7%). This was followed by energy drinks and shots (28.6%), creatine (14.0%), amino acids (12.1%) and multivitamins with caffeine (5,6).

KEY RECOMMENDATIONS FROM ASCM AND ISSN ON THE DIETARY INTAKE OF SPORTS FOOD AND SUPPLEMENT REQUIREMENTS

The evidence-based sport nutrition guidelines are vital part of any athlete's competitive and training programme. The proposed recommendations in these guidelines provide a connection between nutrition, exercise and well-being. Based on concrete scientific evidence, these guidelines provide recommendations about the adequate quantity, structure and timing of food intake to assure an effective training programme to reduce the risk of injury and illness for athletes. Given below are key recommendations from some International guidelines to delineate the role of dietary supplements in sports nutrition (7).

American College of Sports Medicine (ACSM)

"Counselling for athletes should be conducted regarding the appropriate use of ergogenic aids. These products should only be used after careful evaluation for safety, efficacy, potency, and legality" (7,8).

International Society for Sports Nutrition (ISSN)

The nutritional supplements are categorised into four classes (Table I) based on safety and efficacy.

Apparently effective	Possibly effective	Effectiveness too early to tell	Apparently ineffective
Weight-gain powders, creatine, protein, low calorie foods, caffeine, water and carbohydrate-electrolyte solutions, sodium phosphate and bicarbonate and beta-alanine (9)	β-Hydroxy β-Methylbutyrate (HMB), branched chain amino acids (BCAA), calcium, conjugated linoleic acid (CLA) and green tea extract (9)	α-ketoglutarate, α-ketoisocaprate, ecdysterones, growth hormone-releasing peptides and secretogues, ornithine, α-ketoglutarate, zinc-magnesium aspartate, chitosan, phosphatidyl, choline, betaine, *Coleus forskohlii*, dehydro-epiandrosterone (DHEA), psychotropic nutrients or herbs and medium-chain triglycerides (9)	Glutamine, Smilax, isoflavones, sulphopolysaccharides, boron, chromium, CLA, gamma oryzanol, prohormones, *Tribulus terrestris*, vanadium, calcium pyruvate, chitosan, L-carnitine, phosphates, herbal diuretics, ribose and inosine (9)

Table I – Four different categories of nutritional supplements on the basis of safety and efficacy.

CLINICAL EVIDENCES

Efficacy of Multienzyme Complex in the Management of Delayed Onset Muscle Soreness after Eccentric Exercise (DOMS Study)

DigeZyme®, is an "off-white to creamy white powder of a multi-enzyme complex blend." The main components are α-amylase, neutral protease, lipase, cellulase and lactase. This prospective, double blind, randomized, and placebo controlled clinical trial was conducted to highlight the efficacy of multienzyme complex in the management of delayed onset muscle soreness after eccentric exercise compared to placebo. The study participants included twenty healthy males who were administered with a placebo or multi-enzyme complex capsule (50 mg) thrice a day for a period of 3 days (10).

The primary efficacy endpoint was the analysis of the Delayed Onset Muscle Soreness-quality of life throughout the study period. The secondary efficacy endpoints were the evaluations of inflammation, muscle damage, flexibility, and the amount of energy expended before exercise (10).

The analyses included subjective and objective parameters by appropriate methods. Subjective parameters were pain scoring by McGill pain questionnaire, muscle soreness by Muscle Soreness Questionnaires (MSQ) using algometer, muscle strength and power by Hand-Held Dynamometer (HHD) and agility by Illinois agility run test. The objective parameters were biomarkers creatine kinase and lactate dehydrogenase observed pre exercise and 72 hours post exercise (10).

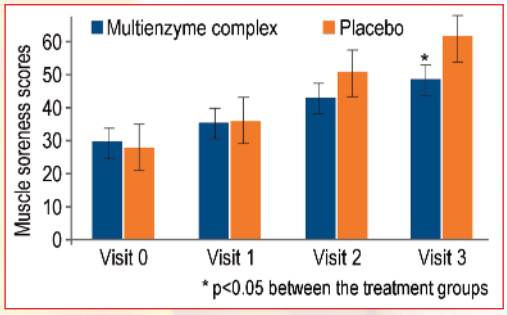

Figure 1 – Muscle Soreness Questionnaires (MSQ).

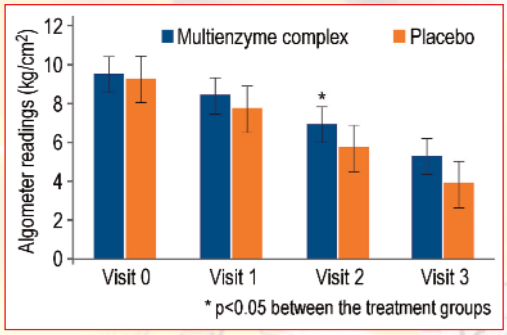

Figure 2 – Quantification of pressure pain threshold (ppt) of thigh muscle by Algometer.

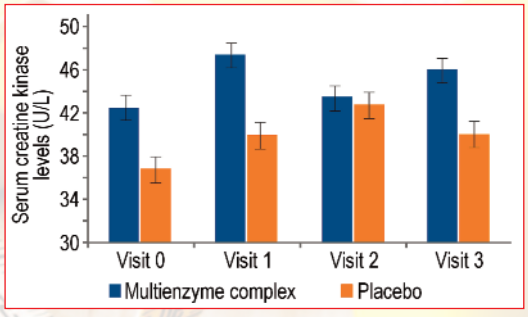

Figure 3 – Effect of multienzyme complex on the serum creatine kinase from visit 0 to visit 3.

A significant difference was observed with multienzyme complex compared to placebo in subjective parameters. McGill Pain scores were significantly reduced between multi-enzyme complex and placebo – 48.7 vs. 61.3, 72 hours post exercise, p=0.0061 (Figure 1). Significantly less tenderness post 72 hours of exercise in subjects taking multienzyme complex was reported compared to placebo (p=0.042). Algometer readings of thigh muscle showed statistical significance for muscle soreness with multi-enzyme complex compared to placebo – 5.3 vs. 3.9 kg/ cm², 72 hours post exercise, p<0.043 (Figure 2). The Creatine Kinase response was less in the multienzyme complex group indicative of that the membrane integrity was maintained to greater extent than the placebo group (Figure 3) (10).

Betalains for Cardiovascular Health and Exercise Performance

Sabeet® (*Beta vulgaris*), is a water-soluble product containing betalains, which are highly bioactive phytochemicals. These contain phenol and cyclic amine groups which are good electron and proton donors. Clinical data support that beetroot extract supplementation reduces blood pressure, prevents oxidative stress, diminishes inflammation, conserves endothelial function and reinstates cerebrovascular hemodynamic. According to clinical studies, a significant

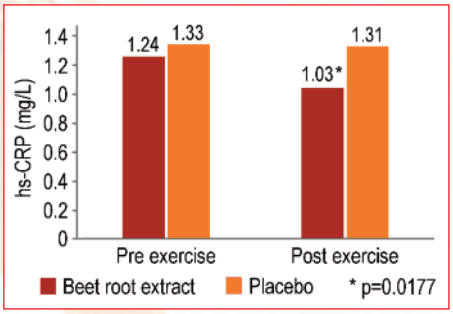

Figure 4 – Effects of beet root extract on pre-exercise and post-exercise on hs-CRP levels.

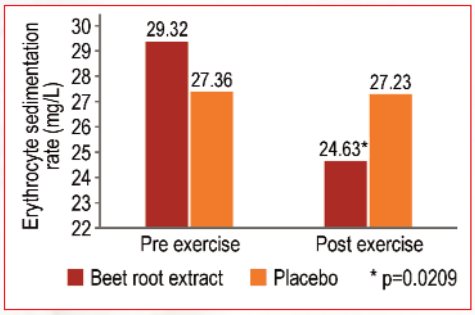

Figure 5 – Effects of beet root extract on pre-exercise and post-exercise ESR levels.

reduction in LDH from pre exercise to post exercise – 300.87 (66.75) vs. 268.76 (61.11) IU/L, p=0.0189 – was observed on beet root extract supplementation. This suggests that beet root extract supplementation might reduce the muscle damage associated with endurance exercise. Similarly, a significant change was observed in inflammatory biomarkers – C-reactive protein (CRP) and ESR – pre-exercise to post exercise (Figure 4 and 5). These findings suggest that beet root extract might aid in lowering the inflammatory status of healthy adults. A statistical significance difference between active and placebo groups was observed in cardiac output also – 5.58 (0.80) vs. 5.34 (0.78) L/min, p= 0.0048 (11).

Other Dietary Supplements for Sports Nutrition

Cococin™ (*Cocos nucifera*), a water-soluble product that is rich in proteins, amino acids, sugars, vitamins, minerals, growth hormones and other essential micronutrients. It acts as a nourishment factor and described as an isotonic sports

Micronutrients	Sports drink (mg/100ml)	Coconut water (mg/100ml)
Potassium	11.7	312
Sodium	41	105
Chloride	39	183
Magnesium	7	30

Table II – Micronutrient composition of a sports drink vs. coconut water.

drink due to similarity of electrolyte (ionic mineral) content to human plasma (12).

Comparative analysis of coconut water and any other sports drink has demonstrated high concentrations of potassium, sodium, chloride and magnesium (Table II).

FUTURE PROSPECTS

Polysaccharides of *Boswellia serrata*

Management of tissue injury is one of the crucial parameters for sports performance. In sports medicine, the symptomatology after soft tissue or bony injury is generally represented by inflammatory responses. An ingredient named Polybos®, is the water soluble polysaccharide fraction from the gum oleoresin exudates of *Boswellia serrata* and contains a minimum of 70% polysaccharides – galactose, arabinose and D-glucuronic acid. It blocks pro-inflammatory cytokines, Tumor Necrosis Factor (TNF-α) and Interleukin (IL)-1β. In preclinical studies it showed a dose dependent anti-inflammatory potential. In the murine neutrophils, it has been found to decrease intracellular TNF-α expression at the multiple doses. A maximum decrease was observed at 200 µg/ml which was 29.31 % (*in vitro* findings). A maximum decrease was observed at 200 mg/kg (104.67 µmol/L compared to 149.22 µmol/L at control) (*in vivo* findings) (13 17).

An acute oral safety for Polybos® (single dose) was found to be more than 2000 mg/kg b.w. It is considered to be safer than non-steroidal anti-inflammatory drugs (NSAIDs) and its long-term usage does not cause stomach ulcers (14).

Ashwagandha Extract *(Withania somnifera)*

There are many standardized Ashwagandha extracts from the dried roots of *Withania somnifera* on the market today. The standardized 2.5% withanolides, containing minimum of 0.25% withaferin A, can be classified as an "adaptogen", helping the body adapt to stress. Ashwagandha has been reported to rejuvenate the body on a cellular level and help increase the stamina and endurance (15,16).

In one clinical study, the cardiorespiratory endurance capacity (aerobic capacity) of Ashwagandha Extract was evaluated in elite Indian cyclists. A significant improvement was observed in the Ashwagandha treated group in all outcome measures like maximal aerobic capacity (VO_2 max), Metabolic Equivalents (METs) and time for exhaustion on treadmill ($p < 0.001$) compared to placebo (17).

CONCLUSIONS

Maintaining an adequate diet to excel in sports performance is one of the vital factors in the athletic community. Athletes find dietary supplements and ergogenic aids as promising agents to improve their exercise performance and endurance. These supplements have been shown to have cardiovascular benefits, reduction in muscle soreness, nourishment quotient, tissue injury management and elevation in cardiorespiratory endurance capacity. Sabinsa has an umbrella of these products for sports nutrition like multienzyme complex and beet root extracts with proven efficacy and safety. The future prospects include development of polysaccharides for tissue injury management and Ashwagandha extract for increased aerobic capacity for sports performance.

DISCLAIMER

These statements have not been evaluated by the Food and Drug Administration, EFSA or other government medical agencies. These products are not intended to diagnose, treat, cure, or prevent any disease. DigeZyme®, Sabeet®, Cococin™, PolyBos®, are all registered trademarks of Sabinsa Corporation and have respective patents or other intellectual property.

REFERENCES

1) Maughan RJ., Depiesse F., Geyer H. *Journal of Sports Sciences* **2007**, *25* (S1), S103-13.
2) Apostu M. *Procedia – Social and Behavioral Sciences* **2014**, *117*, 329-34.
3) Williams M.H. *Journal of the International Society of Sports Nutrition* **2004**, *1* (2), 1-6.
4) Tscholl P., Alonso J.M., Dollé G., Junge A., Dvorak J. *Am. J. Sports. Med*. **2010**, *38* (1), 133-40.
5) *NCAA National Study of Substance Use Habits of College Student-Athletes*, 2014.
6) https://ods.od.nih.gov/factsheets/ExerciseAndAthleticPerformance-HealthProfessional.
7) Potgieter S. *S. Afr. J. Clin. Nutr*. **2013**, *26* (1), 6-16.
8) Rodriguez N.R., Dimarco N.M., Langley S. *J. Am. Diet Assoc*. **2009**, *109* (3), 509-27.
9) Kreider R.B., Wilborn C.D., Taylor L., Campbell B., Almada A.L., Collins R. *et al. Journal of the International Society of Sports Nutrition* **2010**, *7*,7.
10) Majeed M., Siva K.A., Shaheen M., Priti V., Kiran K.V. *Sports Nutr. Ther*. 2016, *1*,113.
11) Majeed M., Majeed S., Lad P.S., Vuppala K.K. *IJIRMS* **2016**, *1* (9), 376-83.
12) Tulecke W. *et al. Contributions from Boyce Thompson Institute* **1961**, *21*, 115-28.
13) Sabinsa Corporation, Unpublished data.
14) Polybos™, Sabinsa Corporation, Unpublished data.
15) Ashwagandha extract. Sabinsa Corporation
16) Bucci L.R. *Am. J. Clin. Nutr.* **2000**, *72* (Suppl), 624S–36S.
17) Shenoy S., Chaskar U., Sandhu J.S.; Paadhi M.M. *J. Ayurveda Integr. Med*. **2012**, *3*, 209-14.