

GUIDELINES

A practical guide to the use of nutritional supplements in South Africa

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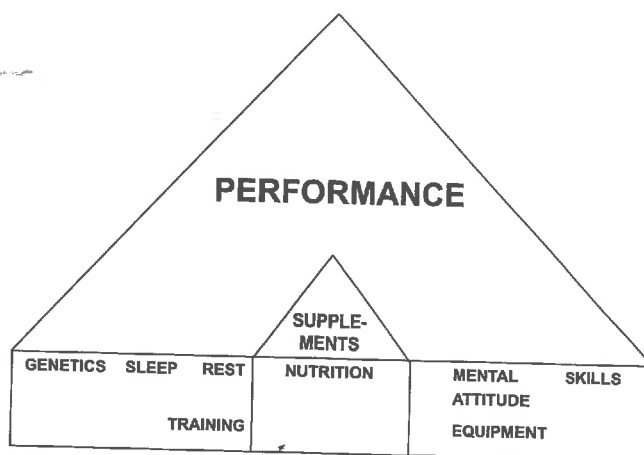
Sportspersons should ensure that their decision to use a dietary supplement is a safe one. Unlike medicines, which are regulated by the Medicines Control Council, there is currently no governing body to control and regulate the supplement industry in South Africa. As a result many supplements may contain banned substances, and there is a chance that not all the ingredients in the supplement are accurately listed on the accompanying label. National and international sporting bodies place the responsibility for using supplements on the sportsperson. The legal clause 'strict liability' means that the sportsperson is responsible for any and all substances that may appear in their urine or blood in a doping test. Thus, to protect sportspersons from using banned substances and to help them in the correct use of nutritional supplements, this practical guide can equip sportspersons with the tools to make decisions about nutritional supplements. This document will be updated periodically to include new scientific information. Brand names (other than food-based products) are not given since an independent regulatory body is unable to guarantee the contents of any supplement products.

Supplements in perspective

Supplement use should be individual-specific and sport-specific. If used correctly, certain nutritional supplements can play a small but important role in enhancing sports performance. However, it is important that the use of nutritional supplements be based on a solid foundation incorporating other factors vital in achieving peak performance. These include adequate training, recovery, nutrition, hydration, mental preparation and sporting equipment. If any of these factors are lacking, then any potential performance benefit from nutritional supplements will be lost.

Classification system

Sportspersons can make use of a classification system to establish the benefit or risk of taking a specific nutritional supplement. This system is based on the weight of scientific evidence supporting that particular supplement and has



been adapted from the system currently used by the Australian Institute of Sport. Please note, however, that new scientific evidence may emerge which could shift supplements between groups in the classification system.

Supplement grouping

Group A

This group includes supplements and sports foods that provide a performance benefit in sport-specific and individual-specific situations or provide a useful and timely source of energy and nutrients in an athlete's diet or are of medical/therapeutic benefit:

Bicarbonate, beta-hydroxy-beta-methylbutyrate (HMB), caffeine, calcium, creatine, carbohydrate powders and gels, glucosamine and chondroitin, intramuscular iron, phenylephrine, intramuscular vitamin B12, liquid meal replacements, melatonin, recovery formulas, sports and energy bars, skim-milk powder, sports drinks, specific vitamins and minerals.

Group B

This group includes supplements currently lacking substantial proof of beneficial effects or having no proof of beneficial effects in sportspersons.

This group contains the majority of supplements including many herbs and herbal extracts* promoted to sportspersons. These supplements enjoy a cyclical pattern of popularity and use, but have not been proven to enhance sport performance or health. Examples of products in this group include arginine, bee pollen, branched chain amino acids (BCAAs), colostrum, CLA (conjugated linoleic acid), carnitine, cordyceps, cytochrome C, coenzyme Q10, chromium, picolinate, choline, Echinacea, ferulic acid, ginseng, glycerol, glutamine, ginkgo biloba, gamma-oryzanol, intravenous iron,

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inosine, lysine, ornithine, pro-biotics, Protivity (Microhydrin), pyruvate, ribose, vitamin B12 injections, spirulina.

*Herbs and herbal extracts in this context refers to plants or plant extracts ingested for reasons other than caloric or culinary benefit. Currently there is a lack of dose-response data in athletes and the interpretation of studies is complicated by the varying combinations of herbal extracts and active components used as well as the variability in growing conditions. Most studies are of limited duration and it is difficult to detect small improvements in performance especially when effects may be chronic rather than acute. A further concern is that many herbals contain unstated ingredients on labels and may inadvertently contain ephedra or other herbal alkaloid stimulants.

Note that many supplement products sold by network marketing schemes contain ingredients from Group B.

Group C

Supplements that are prohibited for use by the International Olympic Committee.

This list includes prohormone supplements and stimulants. The prohormone supplements can be grouped into testosterone precursors and nandrolone precursors.

Testosterone precursors:

Testosterone precursor hormones provide the necessary materials to increase the production of testosterone in the body. **dehydroepiandrosterone (DHEA); androstenedione; androstenediol**

The ingestion of testosterone precursor hormones may result in a positive doping test. This is defined as a testosterone: epitestosterone (T:E) ratio > 4:1 and constitutes a positive test. Recent research has found that supplements in categories A and B may be contaminated with testosterone precursors. If testosterone prohormones are ingested inadvertently, the T:E ratio may remain elevated for up to 24 hours.

The effects of **tribulus terrestris**, **herbal testosterone supplements**, **zinc magnesium antioxidant (ZMA)**, **ecdysterone (suma)** on drug testing results are unknown. These substances, although by themselves not necessarily prohibited, may often be used in conjunction with androstenedione and DHEA (anabolic precursors) which are banned.

Nandrolone precursors

Nandrolone precursors may increase the production of nandrolone in the body.

19-norandrostenedione; 19-norandrostenediol

Nandrolone precursor steroids may be found in small amounts in other commonly used supplements. If a nandrolone precursor steroid is ingested, this may be converted to nandrolone by the body. The nandrolone is broken down to 19-norandrosterone which can be found in the urine. The athlete will have a positive drug test if the concentration is greater than 2 ng.ml⁻¹ in males and females. The urine may remain positive for 7-10 days.

Negative side-effects of prohormone steroids:

Water retention, gynecomastia, male-pattern balding, testicular atrophy, prostate cancer, hypertension, decreased high-density lipoprotein (HDL) cholesterol, abnormal liver function tests, mood and behavioural changes.

Stimulants

Stimulants may be detected in the urine for varying periods of time.

The FDA has notified manufacturers of its intent to ban the sale of dietary supplements containing ephedrine alkaloids but there may still be athletes with a stock of supplements (e.g. fat burners) that contain ephedrine or it may inadvertently be present in some products. Ephedrine and methylephedrine are prohibited in a concentration of ≥10 µg/ml.

Note: ingestion of dietary supplements containing Sida herbs (e.g. Sida cordifolia) may contain ephedrine alkaloids and thus may cause a positive drug test result.

- Caffeine has been removed from the banned IOC/WADA lists, however it is still advisable to be familiar with the wide range of caffeine-containing foods, beverages (e.g. energy drinks, sports drinks, tea and coffee), sports gels and drugs to avoid any undesirable side-effects. Individuals respond differently to caffeine. Performance-enhancing effects may be found at doses as low as 1 - 3 mg/kg (50 - 200 mg caffeine). There is no additional benefit from taking a larger caffeine dose and larger doses are associated with greater risks of side-effects such as nervousness, anxiety, palpitations, headaches and dehydration which may negatively affect performance.

Group A nutritional supplements

Type of supplement	Dose/composition	Rationale/sport-related use	Concerns/safety/side-effects
Broad-spectrum multivitamin and mineral supplements	1 - 1.5 x RDAs of vitamins and minerals	Support for low energy or weight-loss diets, restricted-variety diets, unreliable food supply (e.g. travel)	In absence of deficiency may not improve performance
Liquid meal replacements (e.g. Ensure, Nestle Nutren Active, Complan, Nutren 1.0)	1 - 1.5 kcal/ml, 15 - 20% protein, 50 - 70% carbohydrate, low-to-moderate fat, vitamins and minerals (500 - 1 000 ml supplies RDA)	Easily prepared meal replacement for lack of appetite, high energy requirements, weight gain, weight management for weight-making sports (1 - 3 days pre-weigh in), low bulk pre-event meals, post-exercise recovery, travel, injury	Over-reliance may lead to inappropriate replacement of whole foods. Choose lactose-free options if intolerant to lactose

High-protein meal replacement formulae	42 - 55% protein; 25 - 35% carbohydrate, low fat to fat free (varying vitamins and minerals)	Easily prepared meal replacement for athletes not able to meet protein needs via food (e.g. some vegetarians), or for athletes with additional protein requirements (e.g. growth spurts, injury)	Expensive. May inappropriately replace whole foods or may displace carbohydrates; risk of protein over-load; may lead to excess body fat
Skim-milk powders (e.g. Elite, Protea, Klim)	35% protein, 50% carbohydrate, fat-free (may have vitamins added)	Economical and ideal to use to fortify food and drinks for weight gain, recovery, lack of appetite	
High-carbohydrate supplements			
Sports drinks	Sports drinks (5 - 7% carbohydrate, 10 - 25 mmol sodium, 3 - 5 mmol potassium)	High carbohydrate requirements, e.g. heavy training, carbo-loading, pre-, during and post-exercise; weight gain; lack of appetite; convenience (portable); powders can be mixed to desired concentrations or added to food/drinks; gels provide easily digested carbohydrate for sports with lower fluid requirements or when it is impractical to eat whole foods; bars are a compact source of energy and are non-perishable; the lower fibre bars are useful for athletes who experience gastro-intestinal problems during exercise	Overuse may lead to weight gain or disturb the ratio of macro-nutrients; gastro-intestinal upset if concentrations too high (e.g. powders, some gels); gels should be consumed with adequate fluid to meet hydration needs; these products may contain other compounds that may not be safe/legal or that may cause gastro-intestinal problems (e.g. medium chain triglycerides)
High-carbohydrate sports drinks	10 - 25% carbohydrate concentration with added electrolytes		
Sports gels	Gels (30 - 40 g sachets: ~25 g carbohydrate/sachet, electrolyte, vitamin and mineral content varies)		
Powders	Powders (glucose polymers - flavoured or plain), may have added vitamins, minerals		
Sports bars (e.g. Energade bars, Powerbars)	Bars: 50 - 65 g bar: 40 - 50 g carbohydrate, 5 - 10 g protein, low fat, low fibre (may have added vitamins and minerals)		
Cereal bars (e.g. Bokomo breakfast bars)	Per 30 g bar: 16 - 25 g carbohydrate, 1.5 - 2 g protein, 1-5 g fat, 1-2 g fibre (may have added vitamins and minerals).		
Protein supplements (e.g. Whey powders)	Varying concentrations (30 - 80% protein by weight)	Weight gain (but needs to be consumed with adequate carbohydrate) Injury	Expensive, may be unnecessary if the diet is balanced and appropriate calories are consumed; inappropriately used can lead to weight gain and calcium excretion
Recovery formulas	60 - 67g carbohydrate, 10 - 30 g protein (whey, casein and soy), electrolytes (sodium and potassium), low fat	Convenient source of rapidly absorbed carbohydrate and low-fat protein to stimulate energy storage and repair of damaged muscle. Sodium and potassium help maintain electrolyte balance and improve hydration	Choose according to individual taste preference and tolerance Timing: Should be ingested within 40 - 60 minutes of completing exercise to optimise the uptake of essential nutrients
Group A supplements that require individualised specialised prescription			
Creatine	Rapid loading protocol: 20 g/d divided into 4 - 5 doses for 5 days taken with 50 - 100 g high-GI carbohydrate (e.g. a sports drink with glucose, not a low-GI fruit juice or fructose-rich drink) Slow-loading protocol 3 g - 5 g/day for 14 - 21 days with 50 - 100 g high-GI carbohydrate (e.g. a sports drink with glucose, not a low-GI fruit juice or fructose-rich drink) Additional benefit by exceeding 20 g per day	Resistance training, repeated bouts of high-intensity sprints separated by short rest periods	Weight gain initially due to water retention and later protein synthesis Reports of muscle cramps not proven No reported side-effects on liver, blood or kidney function with 2-year follow-up, however avoid if renal impairment and/or elevated BP or thermal stress
Sodium bicarbonate, lactate or citrate loading	e.g. 0.3 g sodium bicarbonate per kg body mass (~ 20 g) 1 hour pre-event + 1 - 2 litres water (can reduce subsequent doses if participating in heats or finals on same or successive days)	May benefit if performing activities near maximum intensity lasting about 1 - 7 minutes. The bicarbonate binds with hydrogen ions and prevents acid build-up	Gastro-intestinal upset: should be tried while training to assess benefits and side-effects. Side-effects may vary according to compound

HMB (beta-hydroxy-beta-methylbutyrate)	1.5 g - 3 g per day	In the early stages of training may reduce the amount of exercise-related muscle damage (mechanism unknown); small reduction in body fat %, small increase in muscle mass gain May have an additive effect on body composition when combined with creatine	No recognised side-effects; results from long-term studies still needed
Sick packs, immune boosters, anti-oxidants	Antioxidant combinations (e.g. 18 mg beta-carotene, 500 - 1000 mg vitamin C and 60 - 350 mg vitamin E) glutamine (5 - 8 g/day) and zinc (50 mg/day) To be used short-term (5 - 7 days)	Use short-term to boost immune function during periods of intense training and altitude training	Excessive and continuous intake of these nutrients may be counter-productive and damage health
Group A medical supplements			
Vitamin B12	For treatment of pernicious anaemia; may be used as a prophylactic in some vegetarians; may be necessary after gut surgery 250 - 1 000 mcg/ml	Proper assessment of risk factors; no proven performance enhancement effects unless pre-existing deficiencies	Rare allergic reactions to B12. Excessive intakes of some vitamins may impair the absorption of other nutrients; some vitamins can be toxic at high intakes
Iron	Ferrous sulphate/gluconate/fumarate 100 - 300 mg elemental iron/day for 3 - 6 months with ongoing monitoring Vitamin C increases iron absorption in gut (may be prescribed with 500 mg vitamin C and/or with folic acid)	Only if proven iron deficiency on blood tests. Risk factors for deficiency include: vegetarian diets, heavy menses, low-energy diets	Gastro-intestinal upsets, constipation, haemochromatosis, may interfere with zinc and copper absorption
Calcium	Calcium carbonate/phosphate/lactate 500 - 1 000 mg/day depending on dietary intakes, usually taken between meals or at bedtime	Calcium supplementation in a low-energy or low-dairy food diet; treatment or prevention of osteoporosis or bone-stress injuries	Calcium supplementation does not guarantee bone status in absence of adequate oestrogen/progesterone status. Will not correct poor diet
Glucosamine sulphate and chondroitin sulphate	800 - 1 500 mg/day glucosamine sulphate 200 mg chondroitin sulphate For minimum of 3 months	Repair of articular cartilage; glucosamine has mild-anti-inflammatory properties	Proven benefit in treatment of osteoarthritis (hip and knee). No evidence of benefit in athletes without cartilage damage. Long-term effects are still unknown
Melatonin	3 mg stat (for sedative effect) 3 mg daily for 5 days (to restore diurnal rhythm)	Main benefit is to restore the normal diurnal rhythm (recognition of night and day) mainly with eastward flights. Sedative effect variable and large individual differences	May cause headache and dizziness. Should not be used with sleeping pills, warfarin, or by those with a history of migraine or epilepsy. Allergic reactions occur in 1/240 users of melatonin

• RDA = recommended dietary allowance.

• Note: branded food products cited in the table are merely examples and are by no means an endorsement of the product.

Conclusions and recommendations

1. Supplements should only be taken when there is proof that the diet cannot provide the quantities of nutrients needed. A nutritional evaluation by a dietician (with sports nutrition experience) should determine if any deficiencies are present in the diet and supplements can then be supplied accordingly. This evaluation should take into account body composition goals, dietary and medical history, food practices and preferences, training and competition nutrition requirements and budgetary constraints.

2. Dosages of supplements need to be calculated to provide the correct amount, thus avoiding under or overdosing.

3. Individuals may respond differently to supplements and this needs to be taken into consideration. For example, 30% of athletes may not respond to creatine supplementation and supplements may be tolerated differently by different persons. To avoid problems, and assess responses, the supplements used should be tried and tested well before a major competition.

4. Supplements required in clinical situations require a proper medical diagnosis and again should only be prescribed by the sports physician and dietician in writing. Athletes are also reminded to request written prescriptions for supplements. Fitness coaches and conditioning staff should not prescribe any supplements.

5. Sports supplements are not any safer than vitamins and minerals and no persons under the age of 18 should take any sport-specific supplements without the advice of a sports physician or dietician.

6. All supplement labels should be carefully studied and the ingredients noted. Look for hidden relationships between ingredients (e.g. caffeine and guarana), unstated ingredients (e.g. 'fat-burning' and 'muscle building' supplements that may contain hidden banned stimulant products or anabolic agents) and avoid the prohormone supplements that are banned by sporting federations. Even small amounts of a contaminant (e.g. 0.02% nandrolone in a supplement) can cause a positive test.

7. Presently there is no way to recommend with certainty that one particular brand is safer than another. We recommend that for every supplement purchased the athlete request the supplier to provide a quality control certificate (this should demonstrate that the product and batch-specific products have been tested at an independent WADA/IOC-accredited laboratory and have been shown to be free of prohibited substances), as well as *legally binding* documentation listing all contents of ALL the different products that they produce, and that the company accepts full liability for a positive doping test as a result of the use thereof. This guarantee document should:

- Be on a company letterhead.
- Be signed by management and dated.
- Include contact details for the person responsible for issuing the guarantee.
- Address the athlete directly by name, and not be addressed generally, e.g. 'To whom it may concern'.

Erratum

The publishers apologise for technical errors beyond our control that occurred at the final/printing stage of publication affecting certain articles in the last two issues of the *Journal* (vol 17 no. 1 April 2005, and vol. 17 no. 2 June 2005).

The four defaulting fonts involved were the plus/minus sign (\pm), the degree sign ($^{\circ}$), the inverted commas, and the apostrophe.

To remedy this, corrected PDF files and 50 printed copies of each affected article, on high-quality matt paper, will be dispatched to the Editor-in Chief, Professor Mike Lambert.

The publishers apologise for any inconvenience caused to the authors and readers.