The Use of Treated Plant Extracts to Safely and Legally Reduce Recovery Indices after Exercise.

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Introduction;

Athletes and those involved in sporting activities that involve sustained muscular activity, such as cycling, running or swimming for example, are more than aware that this can lead to painful muscular cramps that are debilitating and can prevent further participation in that sport for a period of time.

Any muscular activity requires energy for the muscles to function and work; as this energy is burnt during exercise, waste products build up in the bloodstream and in the muscles being exercised. These waste products can build up to such a concentration that the blood supply to these muscles is unable to wash these products out of the tissue to be metabolised in the liver. Over a critical concentration, these waste products will prevent further muscle activity, and contraction of the muscle fibres result in cramps, pain and loss of function. If there is insufficient oxygen being supplied to the tissues, this critical concentration is reached more quickly.

At all levels of sport, from the amateur to the professional sports person, there are a multitude of ways to increase performance and reduce recovery times. However, the majority are deemed to be illegal and this is known as ‘Doping’. Doping is a serious offence and can lead to life-time bans from further participation at any level within the chosen sport if caught. Blood testing is now routine at professional levels, and references to the results of a positive dope test can be found in most National and International Press coverage of any country.

Lactic Acid and Muscle Function.

Muscle recovery after exercise determines overall athletic performance and sustained muscle functioning over time. The formation of lactic acid in muscle as a result of muscle function and a lack of oxygen. The gradual build up lactic acid is a process that every sports man and women know only too well. Excessive lactic acid leads to cramp and intense pain and may bring to a premature end any sports activity for a variable time, leading to loss of competitive position, income and recognition.

The expression "lactic acid" is common amongst athletes and sports people to describe the intense pain or cramps felt during intense and prolonged exercise. Muscle activity derives energy from the breakdown of adenosine triphosphate (ATP). Resynthesis of ATP is essential, due to the small store found in the human body of about 85 grms.

The process of lactic acid removal takes approximately one hour after exercise, but this can be accelerated by undertaking an appropriate cool down that ensures a rapid and continuous supply of oxygen to the muscles.

The lactic acid system is capable of releasing energy to resynthesise ATP without the involvement of oxygen (anaerobic glycolysis). Glycolysis (breakdown of carbohydrates) results in the formation of pyruvic acid and hydrogen ions (H+). The pyruvic acid molecules undergo oxidation in the mitochondrion and the Krebs cycle begins. A build-up of H+ results in the muscle cells becoming acidic and interferes with their function. Carrier molecules, called nicotinamide adenine dinucleotide (NAD+), remove the H+ ions. The NAD+ is reduced to NADH.
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that deposit the H+ at the electron transport gate (ETC) in the mitochondria to be combined with oxygen to form water (H2O).

If there is insufficient oxygen then NADH cannot release the H+ and H+ ions accumulate in the cells. To prevent the acidity increase, pyruvic acid accepts H+ forming lactic acid; this dissociates into lactate and H+. Some of the lactate diffuses into the blood stream, reducing the H+ ion concentration, so reducing the muscle cellular H+ concentration. The normal pH of the muscle cell is 7.1 but if the build-up of H+ continues and pH is reduced to around 6.5 then muscle contraction is impaired and resultant acidity stimulates the free nerve endings in the muscle resulting in the perception of pain. This point is often measured as the lactic threshold or anaerobic threshold (AT) or onset of blood lactate accumulation (OBLA).

The breakdown of glucose or glycogen produces lactate and hydrogen ions (H+) - for each lactate molecule, one hydrogen ion is formed. The presence of hydrogen ions, not lactate, makes the muscle acidic that will eventually halt muscle function. As hydrogen ion concentrations increase the blood and muscle become acidic. This acidic environment will slow down enzyme activity and ultimately the breakdown of glucose itself. Acidic muscles will aggravate associated nerve endings causing pain and increase irritation of the central nervous system. The athlete may become disorientated and feel nauseous.

Astrand et al found that the normal amount of lactic acid circulating in the blood is about 1 to 2 millimoles/litre of blood.[1] The onset of blood lactate accumulation (OBLA) occurs between 2 and 4 millimoles/litre of blood. In non-athletes this point is about 50% to 60% VO2 max and in trained athletes around 70% to 80% VO2 max. Lactate, which is produced by the body all day long, is resynthesized by the liver (Cori Cycle) to form glucose that provides further energy supplies.

Aerobic Capacity; Given that high levels of lactate/hydrogen ions will be detrimental to performance, one of the key reasons for endurance training is to enable the body to perform at a greater pace with a minimal amount of lactate. This can be done by long steady runs, which will develop the aerobic capacity by encouraging the formation of more small blood vessels, thus enhancing oxygen transport to the muscles (capillarisation). This also creates greater efficiency in the heart and lungs. If the aerobic capacity is increased, there will be more oxygen available to the working muscles, delaying the onset of lactic acid at a given work intensity.

Anaerobic Threshold; lactic acid will accumulate in muscle tissue once the athlete begins to operate above their anaerobic threshold. This is normally somewhere between 80% and 90% of their maximum heart rate (HRmax) in trained athletes.

For sports people with a low lactate threshold (LT), reached at a low exercise intensity, oxygen is not reaching the muscle cells effectively, there are inadequate concentrations of the enzymes necessary to oxidize pyruvate at high rates, the numbers of mitochondria in the muscle cells is low, and the individuals muscles, heart, and other tissues are poor at extracting lactate from the blood.

Improving your Lactate Threshold; it is possible to improve the LT. The aim is to saturate muscles with lactic acid to ‘educate’ the body's buffering mechanism to change the cellular acidity to one of alkaline conditions so that muscular function is not impeded by acidity in the cells. The accumulation of lactate in working skeletal muscles is associated with muscle fatigue after 50 to 60 seconds of maximal effort. The aim is to reduce muscle fatigue and achieve recovery as fast as possible.

Sodium Bicarbonate; energy production via anaerobic glycolysis, which is particularly important for events lasting between 30 seconds and 15 minutes, increases muscle cell and circulating blood acidity. This is a major factor in muscle fatigue and its longevity.
Sodium bicarbonate is an alkalising agent and can be used to reduce the acidity of the blood (known as a buffering action). By buffering the acidity in the blood, bicarbonate may be able to reduce the level of acidity within the muscle cells themselves. This could delay the onset of fatigue.

Van Montfoort et al conducted research with 15 competitive male endurance athletes who performed a run to exhaustion 90 minutes after ingestion of a sodium agent.[2] Their results show that sodium bicarbonate supplementation may be beneficial. Currently (August 2015) bicarbonate is not contrary to the International doping regulations.[3]

Does massage help remove lactic acid? Less contentious, research has been conducted into muscle and limb massage. A study by McMurray compared the effects of massage, passive recovery, and mild bicycle riding (about 40% of max oxygen uptake) on lactate metabolism after an exhaustive treadmill run.[4] The subjects were trained runners who performed a maximal treadmill run to elevate the level of blood lactate and induce exhaustion after 4-6 minutes. Researchers sampled the subjects' blood lactate for up to 20 minutes after exercise and found that passive recovery (lying down supine) and massage had no effect on blood lactate levels, while mild bicycle riding caused a better removal of blood lactate 15-20 minutes after exhaustive exercise. The McMurray study does not suggest that massage is of no benefit to athletes; the study showed that massage does facilitate lactic acid removal and muscle recovery. This result is echoed in the study by Ali Rasooli S et al (2012), Robertson A et al (2004), and Martin NA et al (1998).[5-7]

The Role of Ozone in Exercise.

In animal experiments, Di Filippo et al (2015) showed rats administered an oxygen/ozone mix in exercise improved their performance over a number of markers, compared to the controls on oxygen only. These researchers argued a beneficial effect of the ozone molecule was to combat fatigue induced by prolonged high intensity exercise.[8] In contrast, Frampton et al (2015) showed ozone inhalation immediately decreased lung function in human athletes.[9] By decreasing lung function, the availability of tissue oxygen is decreased.

It is important to remember that whilst there are various methods to improve muscle tone, performance, and exercise longevity, the sports community is aware that any form of chemical input into improving performance may be considered doping. The problem of doping in athletes has become an almost daily issue. It is often carried out with dangerous compounds which may improve the physical performance but unavoidably have side effects. Bocci alleges bicycle racers have used ozone gas to improve performance.[10] Whilst this would be undetectable, he concludes that it is a form of doping and must be prohibited.

In competitive sports, doping refers to the use of banned athletic performance-enhancing drugs by athletic competitors, where the term doping is widely used by organizations that regulate sporting competitions. The use of drugs to enhance performance is considered unethical by most international sports organizations.

Historically speaking, the origins of doping in sports go back hundreds of years. From ancient usage of substances in chariot racing to more recent controversies in baseball and cycling, popular views among athletes have varied widely from country to country over the years. The general trend among authorities and sporting organizations over the past several decades has been to strictly regulate the use of drugs in sport. The reasons for the ban are mainly the health risks of performance-enhancing drugs, the equality
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of opportunity for athletes, and the exemplary effect of drug-free sport for the public. Anti-doping authorities state that using performance-enhancing drugs goes against the "spirit of sport".

Ozone therapy is a form of alternative medicine treatment that purports to increase the amount of oxygen to the body through the introduction of ozone into the body. Various methods have been suggested on how to introduce ozone into the body, and the purported benefits of this therapy include the treatment of various diseases.

There is controversy about the use of ozone by athletes in an attempt to increase their performance. The Belgian doping-related investigation of Dr Chris Mertens has expanded to include a number of professional and recreational athletes, including cyclists.[11] The Belgian doctor is under investigation for the alleged practice of ozone therapy, an undetectable form of blood doping in which blood is extracted, mixed with ozone and then re-injected.

Under the WADA code, any manipulation of blood is considered a doping offense.[3] The code is very clear that the ‘Administration or reintroduction of any quantity of autologous, allogenic (homologous) or heterologous blood, or red blood cell products of any origin into the circulatory system’. Further, any artificial enhancement of ‘the uptake, transport or delivery of oxygen’ including, but not limited to ‘any form of intravascular manipulation of the blood or blood components by physical or chemical means’; these methods are banned.

Cycling is considered by some researchers to offer specific issues not found in other sports. Faria EW et al (2005) suggests the unique breathing pattern found in professional cyclists, and peripheral adaptations in working muscles play a more important role for enhanced submaximal cycling capacity than central adaptations.[12] They conclude ‘Overuse and over-training disabilities common to the competitive cyclist, if untreated, can lead to delayed recovery’.

A Way Forwards; a Proposal;

Despite research showing massage has no beneficial effect of muscle recovery, and the use of ozone gas is considered to be doping, the use of massage oils has been part of health care for thousands of years. And recent research has shown if those oils contained an ozonoid, the recovery period can be reduced significantly.

Massage oils are used throughout health care, and their application is determined by their ‘slip’ and ‘draw’. These factors determine the ease of the oil to flow across skin surfaces, and the heat generated when massaged into the skin surface. If the oil too thin, ie a large ‘slip’ factor, or if they have no resistance or friction, the ‘draw’ factor, no heat will be generated. If the draw is too high or the viscosity too great, it will be impossible and painful to use as a massage oil, and heat generation will be too high. The balance of slip and draw is critical to the success of any new massage oil product.

In 2013, Paoli A et al concluded their findings suggest the use of ozonised oil during sports massage increases blood lactate removal, improves performance and reduces the perception of fatigue in cyclists from 3 Wingate tests.[13] Their study examined the effects of passive rest and sports massage with and without ozonised oil on sports performance psycho-physiological indices in competitive amateur cyclists after 3 pre-fatiguing Wingate cycle and post-recovery ramp tests. The researchers examined the subjects' power output, heart rate, Visual Analogue Scale score and blood lactate clearance. The subject’s passive rest, and sports massage with and without ozonised oil recoveries were compared.
Their results show there were no significant differences in cyclists' heart rate patterns in the three experimental conditions (p > 0.05). However, after sports massage with ozonised oil, athletes showed a higher power output maximum (p < 0.05) and a lower perceived fatigue Visual Analogue Scale score (p < 0.033) in the ramp test. Blood lactate decreased more at the mid-time point of treatment and at the final time point of treatment, than at the beginning of treatment, compared to passive rest and sports massage without ozonised oil.

The vast majority of research published on ozone and ozonoids has looked at the efficacy of these products against infective organisms, and increasing the bodies healing potential.[14] Cyclic 1,2,4-Trioxolanes or ozonoids are formed when ozone gas is bubbled through a plant oil containing carbon-carbon double bonds as part of the omega oil series. Ozone unlocks the carbon double bonds, and inserts itself as a stable byproduct. These Cyclic 1,2,4-Trioxolane compounds are stable for long time periods of time, over 15 years.[15] When these compounds come into contact with human and animal tissue, the Cyclic 1,2,4-Trioxolane decomposes into a carbonyl compound (aldehyde or ketone) and a zwitterion (II) that quickly leads to a hydroxy-hydroperoxide (III) stage that, in turn, decomposes into a carbonyl compound and hydrogen peroxide. It is via this mechanism that Paoli A et al observed their beneficial effects for sports persons.

The New Product;

It is proposed to offer a new product, possibly called TriCycle-1,2,4; this product could be offered in two strengths; as TriCycle221-Max, and TriCycle156-Gentle, packaged in 60 or 100ml pump dispensers.

TriCycle221-Max would be based on ozonated linseed oil, and TriCycle156-Gentle based on an ozonated oil blend of linseed and olive oils. Both oils offer skin protection and tissue recovery from exercise and trauma, and have modified ‘slip & draw’ characteristics for ease of application.

The use of these oils is of course not just in cycling, but could be extended into every facet of sports where increased power output, reduced fatigue, and enhanced muscle recovery is required.

Conclusion;

Cycle221-Max and Cycle156-Gentle contain Cyclic 1,2,4-Trioxolanes or ozonoids that have been shown in published research to offer increased power output, reduced fatigue, and enhanced muscle recovery. Unlike other banned substances, these products are not banned by WADA, and are not considered to be doping. The use of these oils could be extended into every facet of sports.

References


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