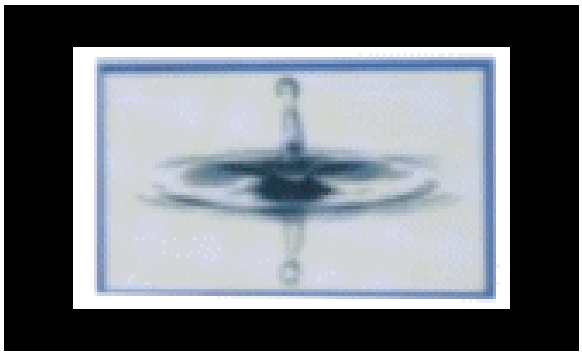
Product Efficacy Report: Cellfood®

OXYGEN FOR LIFE®



SPORT INSTITUTE UNIVERSITY OF PRETORIA

INTRODUCTION

Athletes of various ages and levels of participation explore the use of ergogenic aids. Attempts to enhance athletic performance are not new. The Olympic games date back 2700 years, which means that seeking advantage in sport likely dates back just as far. The winner of the 1920 Olympic 100m dash, Charlie Paddock, drank sherry with raw eggs before the race. In 1960, the Danish cyclist Knut Jensen died during a road race from taking amphetamines (Voy and Deeter, 1991). The use of drugs to enhance performance is not limited to Olympic athletes only. Many adolescent athletes experiment with anabolic steroids. Caffeine is widely used as an ergogenic aid by runners, cyclists and triahtletes and creatine is a popular supplement amongst university strength and power athletes (Eichner, 1997; Sinclair and Geiger, 2000) Considerable literature exists on the topic of ergogenic aids and the athletic performance. It includes studies of the potential performance benefits of alcohol, amphetamines, epinephrine, aspartates, red cell reinfusion, caffeine, steroids, protein, phosphates, oxygen-rich breathing mixtures, gelatin, lecithin, wheat-germ oil, vitamins, sugar, ionized air, music, hypnosis, and even marijuana and cocaine (McCardle, Katch and Katch, 1991)

The ever-growing quest among sports participants to perform better and the abundance of ergogenic supplements makes it the responsibility of the scientific community to ensure that the public are well informed. Knowledge is necessary to lead us into the right direction. The prudent approach should not only focus on issues like efficacy, health-related safety of these substances requires urgent research.

The industry of ergogenic supplementation has become a massive commercial enterprise. A series of products manufactured by Oxygen for Life are currently on the market for use as ergogenic aids in sport relying on aerobic energy provision. These include, Cellfood® and Switch®. The efficacy of these products and their dosage response within the context of improved aerobic performance falls within the scope of this report.

In cognisance of the foregoing the purpose of the study was two fold:

- Firstly, to determine whether Cellfood® has a more positive effect on the physical performance of endurance athletes than a placebo; and
- Secondly, to determine at which dosage Cellfood® tend to be most effective.

The word ergogonic relates to the application of a nutritional, physical, mechanical, psychological, or pharmacological procedure or aid to improve physical work capacity or athletic performance (McArdle et al., 1991). An ergogogenic aid, simply defined, is any substance, process, or procedure that may, or is perceived to, enhance performance through improved strength, speed, response time, or the endurance of the athlete. Another area of interest in ergogenic aids is to hasten recovery. The nature of the action of any supposed ergogenic aid may be elicited through the following:

- Directly act on muscle fiber;
- Counteract fatigue products;
- Supply fuel needed for muscular contraction;
- Affect the heart and circulatory system;
- Affect the respiratory system; and
- Counteract the inhibitory affects of the central nervous system on muscular contraction and other functions

Frequently ergogogenic aids are thought of only as pharmacological agents that may be consumed to give the athlete an advantage. Pharmacological agents constitute only one of several classes of ergogenic aids. Others include nutritional (carbohydrates, proteins, vitamins, minerals, water, and electrolytes), physiological (oxygen, blood boosting, conditioning, and recovery procedures), psychological (hypnosis, suggestion, and rehearsal), and mechanical (improved body mechanics, clothing, equipment, and skill training) components.

In its broadest sense, one could call anything that can be related to an improvement in work or performance an ergogenic aid. Ergogenic aids affect different people differently, as might be expected. For some, studies show a positive influence on work performance and for others, no affect whatsoever. What might prove effective with the athlete may prove inconsequential to the nonathlete and vice versa. Certain ergogenic aids may influence a person's endurance performance but may have little or no effect on activities requiring short bursts of strength and power (Fox and Bowers, 1993; Williams, 1983).

METHODS AND PROCEDURES OF THE STUDY

Subjects

Forty-five marathon runners between the ages of 20-51 years (mean age = 38,4 ± 8.2 years) volunteered to take part in the study. All of the participants were members of marathon clubs in and around Pretoria. They were all briefed on the nature of the research project and possible risks involved. They were not allowed strenuous training the day before each test.
The following specific exclusion criteria were applied:

a) haematology results not within the normal physiological limits
b) taking any other ergogenic supplement or aid
c) medication usage

Study Design

The primary aim of the study was to determine the efficacy of Cellfood® as an ergogenic aid for endurance athletes. In order to reach this goal a pre-test – post-test, experimental design, was adopted for the study. Subjects were randomly assigned to one of two groups.

Each of these groups underwent an intervention period of four weeks. After each four-week period the subjects stopped taking the supplementation and underwent a two-week wash out period during which they took no supplementation. The

dosage taken for the product varied throughout the whole study depending on the cycle in which the product or placebo was taken.

	Cycle 1		Cycle 2		Cycle 3	
Group	**Product**	**Dosage**	**Product**	**Dosage**	**Product**	**Dosage**
A	Cellfood	28ml	Cellfood	39.2ml	Cellfood	44.8ml
B	Placebo	28ml	Placebo	39.2ml	Placebo	44.8ml

VARIABLES MEASURED

The following variables were measured:

1. Anthropometry
    - Stature
    - Body mass
2. Haematology
    - Full blood count
    - Ferretin values
    - Fasting glucose
    - Blood type
3. Oxygen utilization and related spirometry
4. Pulse oximetry
5. Capillary blood lactate concentrations
6. Rate of perceived exertion
7. Heart rate

Stature

The stature was measured with a calibrated stadiometer. The subject stood barefoot, feet together and heel, buttocks and upper part of the back touching the gauge, with the head in the Frankfort plane, not necessarily touching the gauge. The Frankfort plane was considered as the orbital (lower edge of the eye socket) being in the same horizontal plane as the tragion (notch superior to the tragus of the ear). When so aligned the vertex was the highest point on the skull. The measurement was taken to the nearest 0.1 cm at the end of a deep inhalation

Body Mass

Body mass was measured using a Detecto beam balance scale. The measurement was taken to the nearest 0,1 kg, with the subject barefoot, clothed only in appropriate running clothes, and taking care that the:

- Scale was reading zero;
- Subject stood on the centre of the scale without support;
- Subject's weight distribution was even on both feet; and
- Subject's head was held up and the eyes looked directly ahead.

Haematology

The blood analysis was performed by a professional pathology laboratory namely AMPATH (a division of Du Buisson and Partners pathologist).

The following reference ranges were utilized:

Haemoglobin	14.0 – 18.0 g/dL
Red blood cell count	4.60 – 6.00 10^12/L
Hematocrit	42 – 52%
Fasting glucose	3.5 – 6.0 mmol/L
Ferretin	22 - 322 ng/mL (men)
Ferretin	22-291 ng/mL (women)

Maximal Oxygen Uptake

The maximum oxygen uptake ($V0_2$ max) was determined through direct/ open circuit spirometry, using a Schiller CS-100 gas analyser and a Quinton motorized treadmill (model 24-72). The gas analyser was calibrated before each test with the appropriate gas mixtures supplied by Air Products. The tests were conducted within an air-conditioned laboratory at a temperature of 20°C and barometric pressure of more or less 655 mmHg. The treadmill protocol started at a running speed of 8km/h and the elevation remained constant at 2% throughout the test. The speed was increased every two minutes until a running speed of 16km/h was reached. After this point, the treadmill speed was increased with 1 km/h every

two minutes until exhaustion. The athletes were verbally encouraged and the tests were terminated when the athletes could not maintain the running speed.

Gas values were sampled every ten seconds. The following gas analysis values were recorded during the $V0_2$ max test, presented in their abbreviated and defined format as defined by the Schiller CS 200 user manual:

- METS: Metabolic Equivalents- Oxygen uptake required for a given task expressed as multiples of resting oxygen uptake.
- RR: Respiration rate- Number of breaths per minute
- VT: Tidal volume- The volume of air actually breathed per breath in ml.
- VE: Minute ventilation- The volume of air taken into or exhaled from the body in one minute. This is conventionally expressed at body temperature, saturated with water at atmospheric pressure (BTPS)
- $V0_2$: The amount of oxygen extracted from the inspired gas in a given period of time, expressed in millilitres or liters per minute, standard pressure and temperature, dry (STPD). This can differ from oxygen consumption under conditions in which oxygen is flowing into or being utilized from the body's stores. In the steady-state, oxygen uptake equals oxygen consumption
- $V0_2$ relative: $V0_2$ expressed in ml/kg/min.
- $VC0_2$: The amount of carbon dioxide ($C0_2$) exhaled from the body into the atmosphere per unit time, expressed in millilitres or liters per minute, STPD. This differs from $C0_2$ production rate under conditions in which additional $C0_2$ may be evolved from the body stores or $C0_2$ is added to the body stores. In steady state, $C0_2$ output equals $C0_2$ production rate. In rare circumstances, appreciable quantities of $C0_2$ can be eliminated from the body as bicarbonate via the gastro-intestinal tract or by haemodialysis.
- RQ: The respiratory quotient is the rate of carbon dioxide production to oxygen consumption. This ratio reflects the metabolic exchange of gasses in the bodies' tissue and is dictated by substrate utilization.

- $VE/V0_2$: Respiration equivalent for oxygen is the actual ventilation against absolute oxygen uptake. This parameter indicates how much air (l) must be inhaled to obtain a liter of oxygen.
- $VE/VC0_2$: Respiration equivalent for carbon dioxide is the actual ventilation against absolute carbon dioxide exhaled. This parameter indicates how much air (l) must be exhaled for one liter of carbon dioxide to be expelled. The smaller this parameter the better the carbon dioxide exchange efficiency.
- $et0_2$: End tidal expired oxygen partial pressure (mmHg) is the partial oxygen pressure ($P0_2$) determined in the respired gas at the end of an exhalation. This is typically the lowest Po2 determined during the alveolar portion of the exhalation
- $etC0_2$: End tidal expired carbon dioxide partial pressure (mmHg) is the partial carbon dioxide pressure ($PC0_2$) of the respired gas determined at the end of an exhalation. This is commonly the highest $PC0_2$ measured during the alveolar phase of exhalation

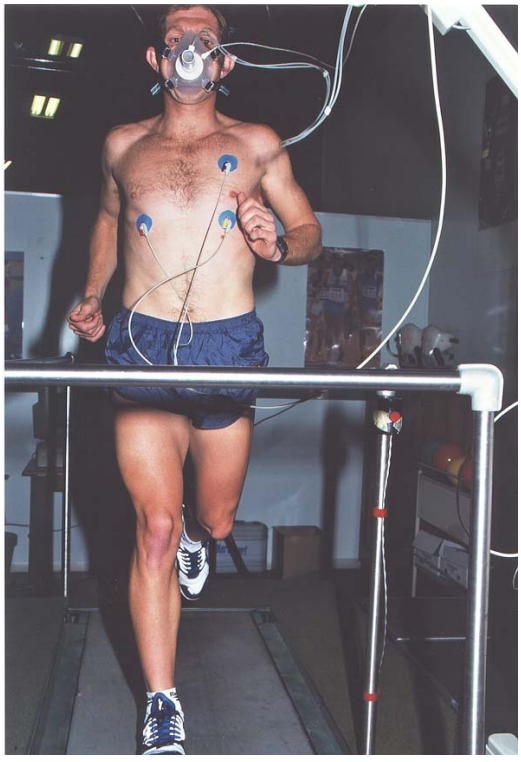


Figure 1: Athlete connected to gas analyser, performing a test

Capillary Blood Lactate Concentration

Incremental capillary blood lactate measurements were taken during the treadmill test by using an Accurex BM lactate meter (Roche diagnostics). This required a puncture of the fingertip to obtain a peripheral blood sample. These samples were taken at the end of each two-minute stage during the treadmill test. The values were reported in mmol/l.

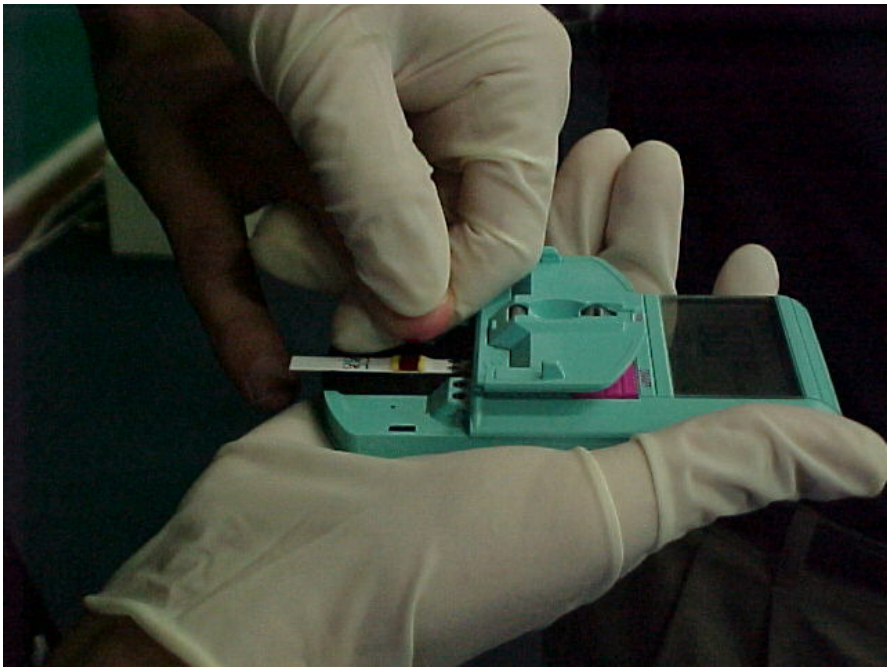


Figure 2: Accurex BM Lactate Meter

Pulse Oximetry

Incremental haemoglobin oxygen saturation levels were taken using a Datex-Ohmeda TuffSat hand-held pulse oximeter. The measurements were taken using a finger probe (ClipTip -sensor). These measurements were taken at the end of each two-minute stage directly after the blood samples were taken, expressed as a percentage.

Figure 3: Datex-Ohmeda Tuffsatt hand-held pulse oximeter

Rate of Perceived Exertion

The original Borg scale (6-20) was used to determine the perceived rate of exertion (RPE) for each subject (Borg, 1973). They were asked to indicate their perceived level of exertion on the scale at the end of each two-minute stage during the treadmill run.

Heart Rate

Heart rates were recorded using a Polar Accurex Plus heart rate monitor. Heart rates were recorded continuously during the entire test.

Figure 4: Polar Accurex Plus heart rate monitor

Summary of variables measured

All the variables mentioned before have an influence on the performance of an endurance athlete; some contribute more to the achievement of success than others. If one had to emphasize a few of these, one could single out the following:

- Haematology
- Haemoglobin saturation
- Blood lactate accumulation
- Gas analysis ($V0_2$ max)

All the above-mentioned variables affect the performance of an endurance athlete, no matter what their conditioning level or potential for the sport. Next we will have a look at how both Cellfood and Switch influenced these variables during our experiment

RESULTS AND DISCUSSION

Haematology (Figure 1-8 and Table)

Iron (ferretin) has two very important exercise related functions. Firstly, about 80% of the iron in the body is in functionally active compounds combined with haemoglobin in red blood cells. This iron-protein compound increases the oxygen carrying capacity of the blood about 65 times. Secondly, iron (about 5%) is a structural component of myoglobin, which aids in the transport and storage of oxygen within muscle cells (McCardle, Katch and Katch, 1991) About 20% of the iron in the body is found in the liver, spleen and bone marrow in the forms of hemosiderin and ferretin. Since ferretin is present in the plasma it is an excellent indicator of the iron stores of the body (Meyer and Meij, 1996) Normal iron levels are crucial in preventing conditions such as iron deficiency anaemia (McArdle et al., 1991). Iron deficiency anaemia is characterized by sluggishness, loss of appetite and a reduced capacity for sustaining even mild exercise (McArdle et al., 1991). Keeping the above-mentioned in mind one can see why it would be beneficial if either one of the products would be effective in increasing the iron stores in the body.

Haemoglobin is essential for the transport of both oxygen and carbon dioxide. Haemoglobin also serves the important function of acting as an acid base balance buffer (Meyer and Meij, 1996). Oxygen is not very soluble in fluid substances, only about 0.3ml gaseous oxygen dissolves in each 100ml of plasma. Although this is a very small amount it serves an important physiological purpose in establishing the $P0_2$ of the blood and the tissues. This pressure plays a role in the regulation of breathing and also determines the loading and release of oxygen from haemoglobin in the lungs and tissues respectively (McCardle, Katch and Katch, 1991). This means that the majority of oxygen is carried through the body in chemical combinations. This takes place with the help of haemoglobin. Haemoglobin contributes to about 34% of the volume of a red blood cell. Haemoglobin increases the blood's oxygen carrying capacity with about 65 to 70 times compared to that of the dissolved oxygen in the plasma. Thus for each liter of blood about 197ml of oxygen are carried through the body in chemical combination with haemoglobin (McCardle, Katch and Katch, 1991) Men have approximately 15-16 g of haemoglobin in each 100ml of blood. The

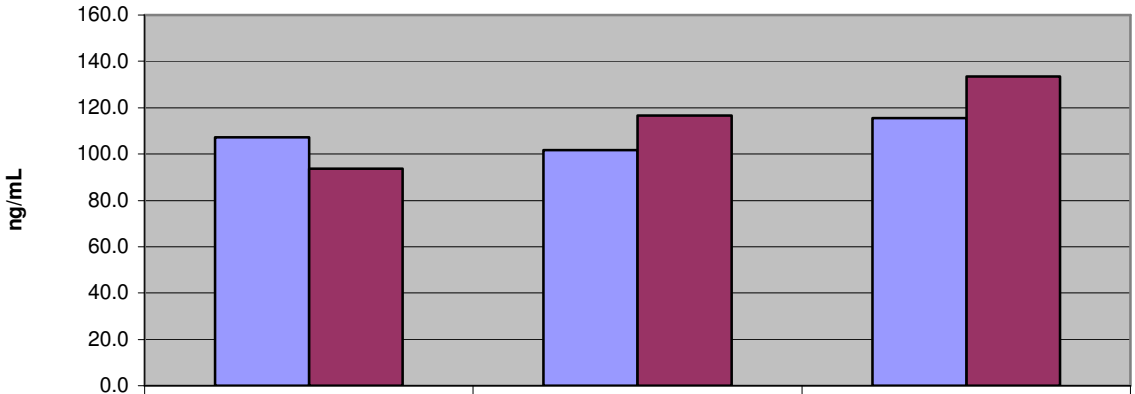
blood's oxygen carrying capacity changes only slightly with normal variations in haemoglobin values, while a significant decrease in iron content of the red blood cells will lead to a decrease in the blood's oxygen carrying capacity and corresponding reduced capacity for sustaining even mild aerobic exercise (McCardle, Katch and Katch, 1991).

It is possible to determine the amount of red blood cells per volume unit of blood. The average count for adults males vary from 4.6 to 6.2 x 10^{12} /l blood and adult woman from 4.2 to 5.4 x 10^{12} /l. The red cell count is higher in newborn babies as well as people who live at high levels above sea level. The values could also be higher or lower during certain illnesses (Meyer and Meij, 1996). Three of the main functions of red blood cells include the following: firstly they are responsible for the transport of oxygen from the lungs to the tissue and transport of carbon dioxide from the tissue to the lungs. Secondly, red blood cells help to maintain pH homeostasis within the body. Thirdly, red blood cells contribute just as much to the viscosity of the blood as plasma proteins.

Hematocrit refers to the contribution of cells to a certain volume of blood. White blood cells contribute less than 0.08% to the hematocrit. The contribution of cells is higher in newly born infants and people who live at high levels above sea level as well as people that is dehydrated and people with high red cell counts. The values are lower in people who suffer from anaemia (Meyer and Meij, 1996).

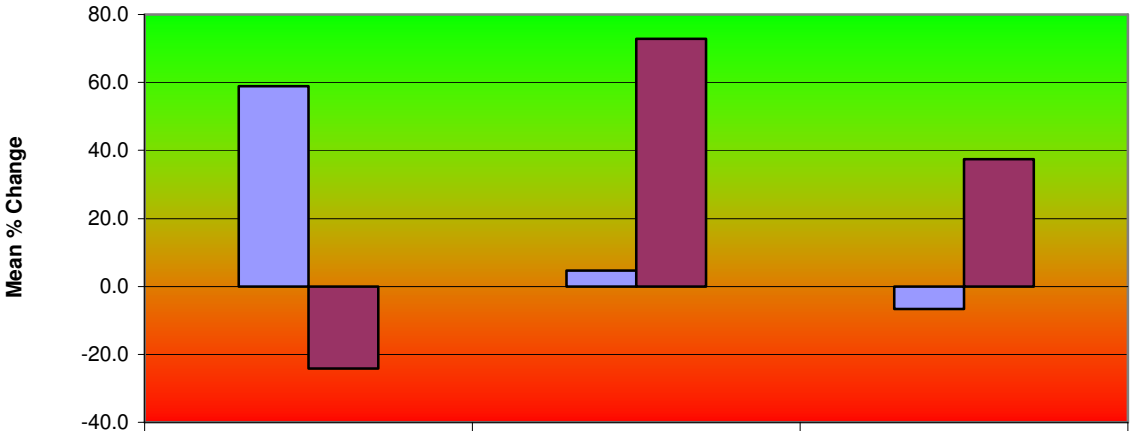
After using Cellfood at a dosage of 15 drops once a day the athletes showed increases in all of the above mentioned haematology variables. It is important to note that all the values remained within the physiological limits although there were increases.. All the mentioned changes (increases) will aid the athlete's in their ability to transport oxygen through their bodies to their working muscles.

Figure 1: Ferretin Values



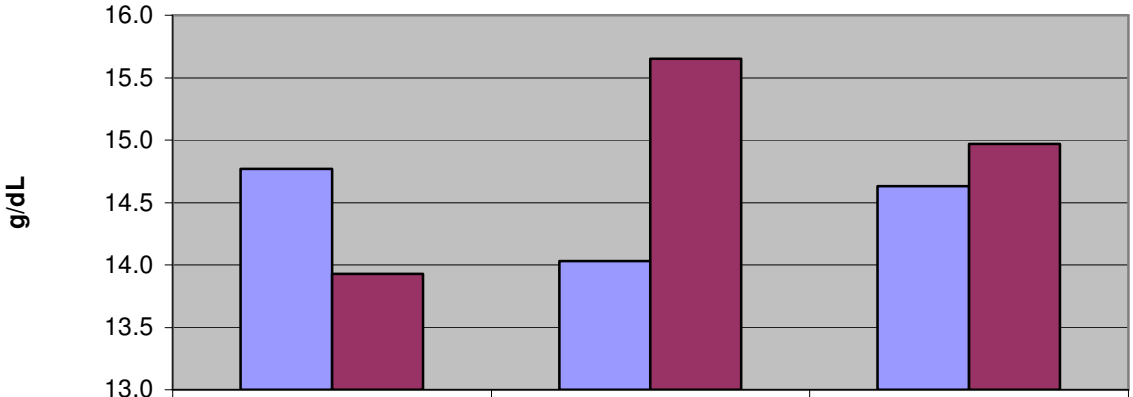
	Dosage 1	Dosage 2	Dosage 3
Placebo	107.2	101.7	115.6
Cellfood	93.7	116.7	133.5

Figure 2: Ferretin Values - Relative Change



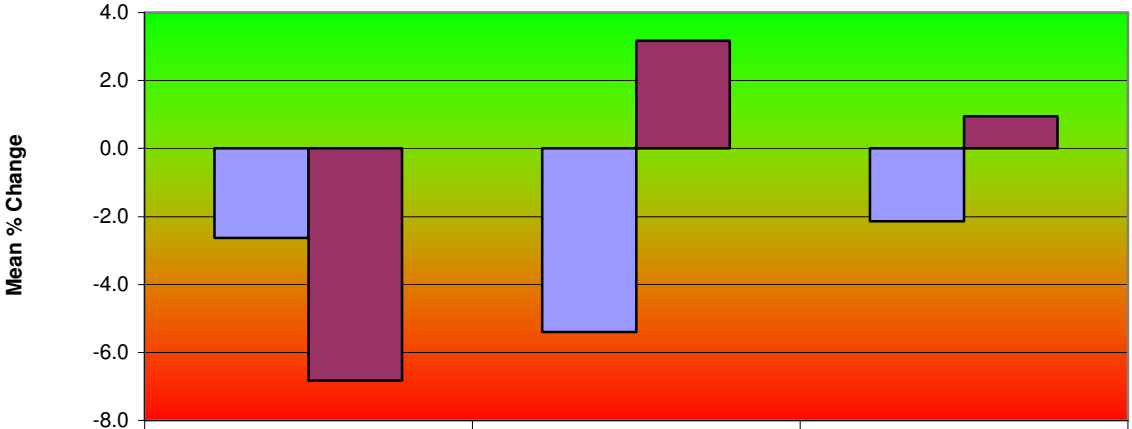
	Dosage 1	Dosage 2	Dosage 3
Placebo	58.8	4.7	-6.6
Cellfood	-24.2	72.9	37.4

Figure 3: Haemoglobin Values



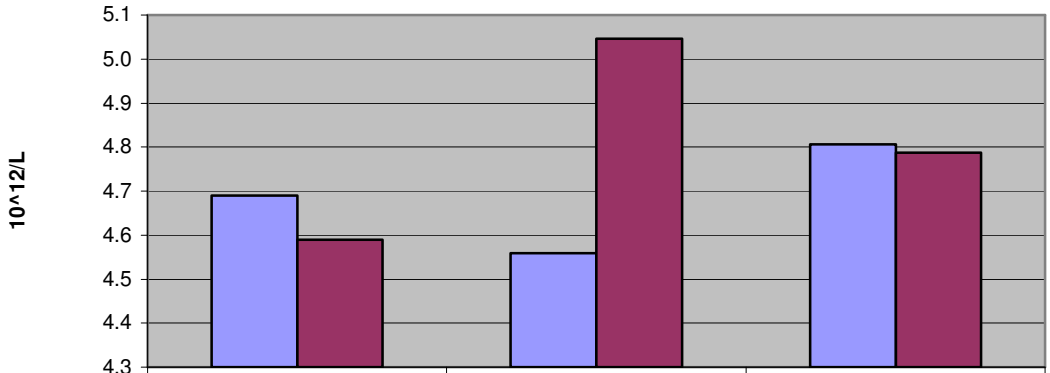
	Dosage 1	Dosage 2	Dosage 3
Placebo	14.8	14.0	14.6
Cellfood	13.9	15.7	15.0

Figure 4: Haemoglobin Values – Relative Change



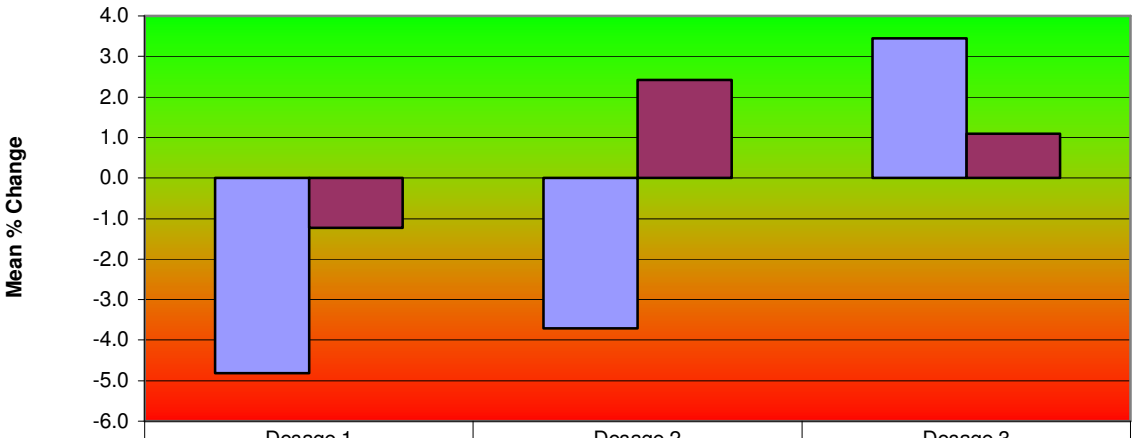
	Dosage 1	Dosage 2	Dosage 3
Placebo	-2.6	-5.4	-2.1
Cellfood	-6.8	3.2	0.9

Figure 5: Red Blood Cell Values



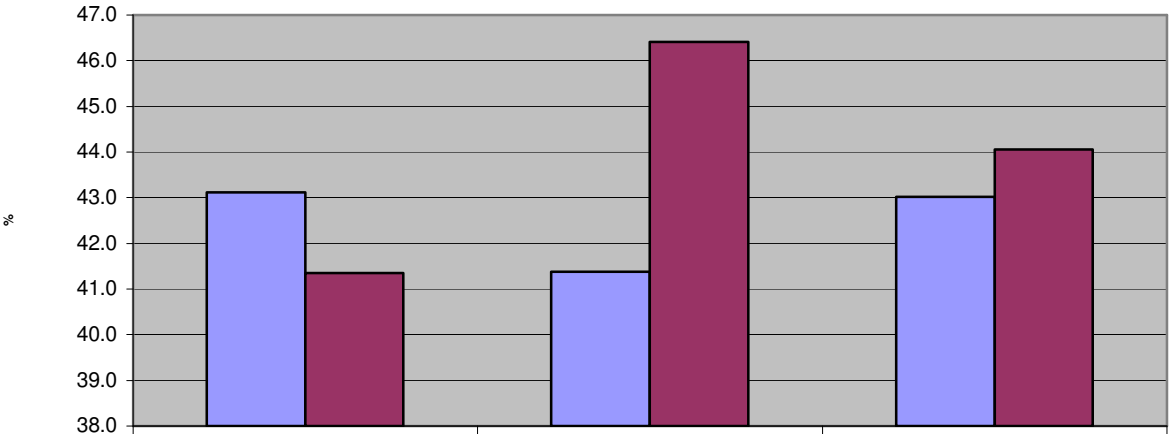
	Dosage 1	Dosage 2	Dosage 3
Placebo	4.7	4.6	4.8
Cellfood	4.6	5.0	4.8

Figure 6: Red Blood Cells Values – Relative Change



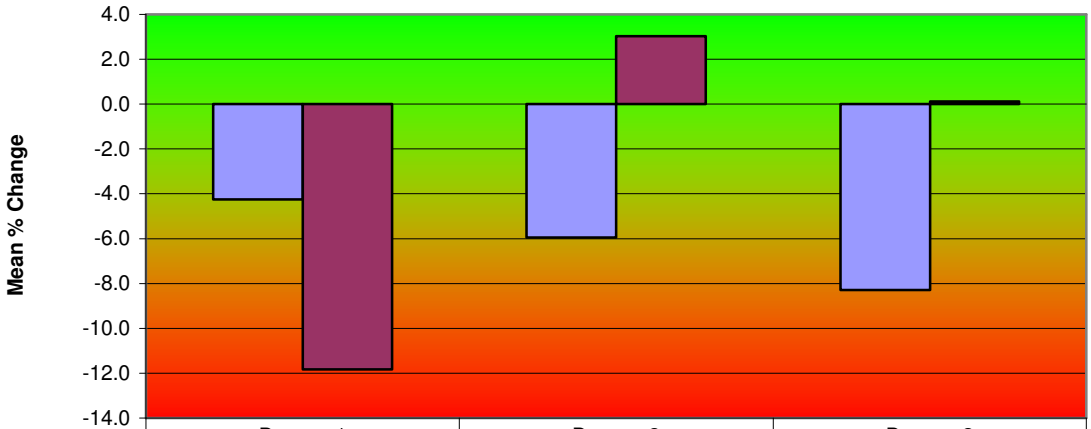
	Dosage 1	Dosage 2	Dosage 3
Placebo	-4.8	-3.7	3.4
Cellfood	-1.2	2.4	1.1

Figure 7: Haematocrit Values



	Dosage 1	Dosage 2	Dosage 3
Placebo	43.1	41.4	43.0
Cellfood	41.4	46.4	44.1

Figure 8: Haematocrit Values – Relative Change



	Dosage 1	Dosage 2	Dosage 3
Placebo	-4.3	-6.0	-8.3
Cellfood	-11.8	3.0	0.1

Haemoglobin Saturation (Figure 9and Table II)

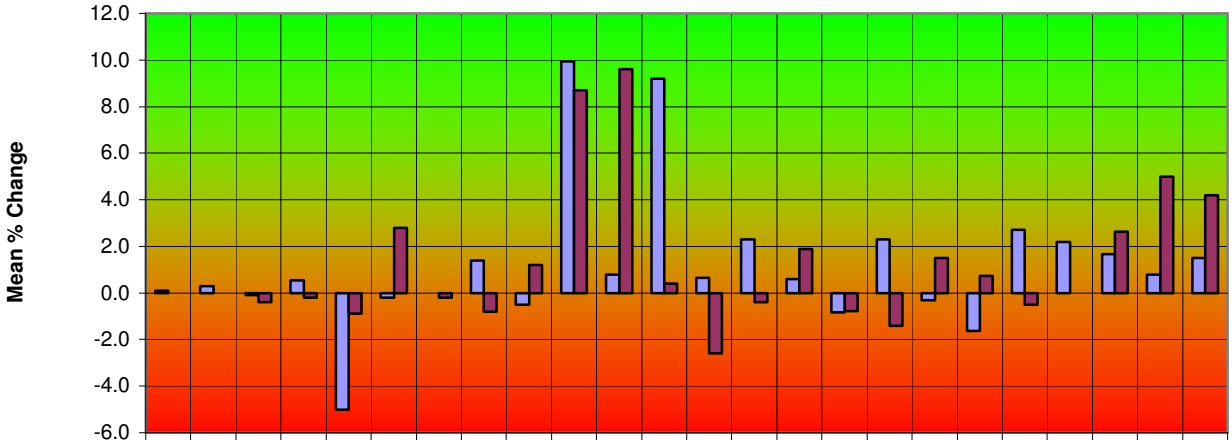
One molecule of Hb is capable of combining with maximally four molecules of oxygen. In terms of amount this turns out to be 1.34ml of oxygen per gram of Hb. Thus one gram of Hb becomes saturated with oxygen when it combines with 1.34ml of oxygen. At rest and at sea level, about 15 grams of Hb are present in every 100ml (for males, 16 grams per 100ml and for females, 14 grams per 100ml). Therefore under these conditions, the oxygen capacity of Hb is 15 x 1.34 =20.1ml O_2/ 100ml blood, or 20.1 volumes percent (volumes percent in this case means millilitres of O_2 per 100ml blood). With exercise the Hb concentration of blood increases anywhere from 5 – 10%. This is due, at least in part, because fluid shifts from the blood into the active muscle cells, and hemoconcentration results. A 10% hemoconcentration during exercise means that there will be about 16.5 grams of Hb per 100ml of blood instead of 15 grams. The oxygen capacity of Hb would in this case increase from 20.1 to 22.1 volumes percent, a definitely advantageous change. The last important concept regarding Hb is the percent saturation of Hb with oxygen. The percentage saturation of haemoglobin with oxygen (%SO_2) was measured incrementally throughout the treadmill tests. This values relates the amount of oxygen actually combined with haemoglobin (content) to the maximum amount of oxygen that could be combined with haemoglobin (capacity):

%SO_2 = (O_2 content of Hb/ O_2 capacity of Hb) x 100

A saturation of 100% means that the oxygen actually combined with the Hb is equal to the oxygen capacity of Hb. The use of %SO_2 takes into account individual variations in Hb concentrations (Fox et al., 1993).

Cellfood had the most beneficial influence on the saturation of haemoglobin (with oxygen) while taken at a dosage of 17 drops once a day. Cellfood increased the saturation levels at all the running speeds during the treadmill test. Again this is beneficial to the athlete since more oxygen is available for transport through the body

Figure 9: Haemoglobin Saturation Values – Relative Change



	1 Rest	2 Rest	3 Rest	1 8km	2 8km	3 8km	1 10km	2 10km	3 10km	1 12km	2 12km	3 12km	1 14km	2 14km	3 14km	1 16km	2 16km	3 16km	1 17km	2 17km	3 17km	1 18km	2 18km	3 18km
Placebo	0.1	0.3	-0.1	0.5	-5.0	-0.2	0.0	1.4	-0.5	9.9	0.8	9.2	0.7	2.3	0.6	-0.8	2.3	-0.3	-1.6	2.7	2.2	1.7	0.8	1.5
Cellfood	0.0	0.0	-0.4	-0.2	-0.9	2.8	-0.2	-0.8	1.2	8.7	9.6	0.4	-2.6	-0.4	1.9	-0.8	-1.4	1.5	0.7	-0.5	0.0	2.6	5.0	4.2

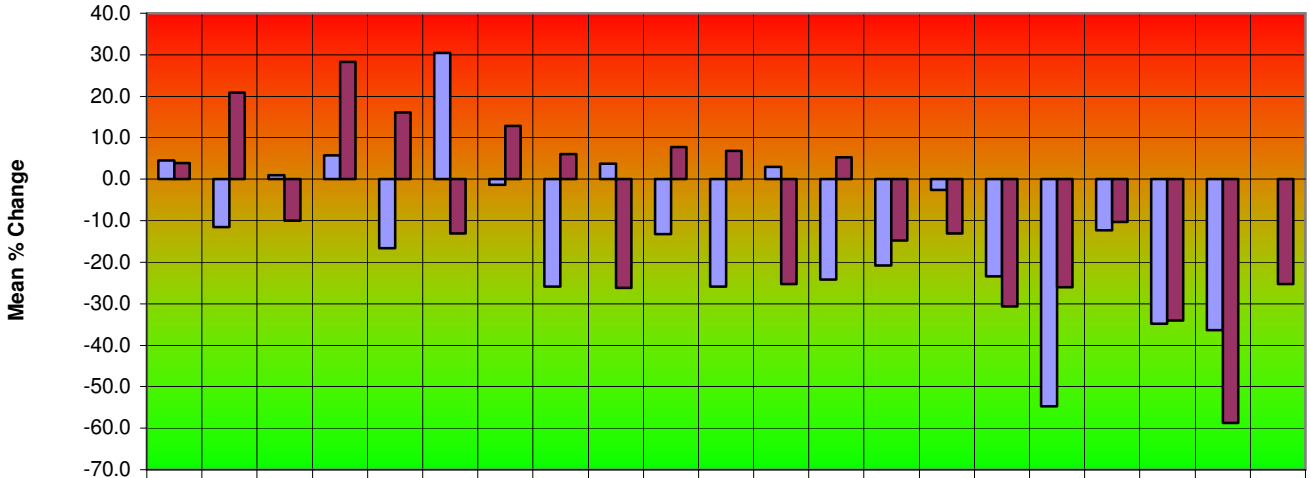
Blood Lactate Accumulation (Figure 6 and Table III)

Lactate is one of the products of glycolysis. It is both produced and used by the muscles. It's rate of production increases as the exercise rate increases and as more carbohydrates is used to fuel exercise (Noakes, 1992) Glycolysis refers to the process where carbohydrates are broken down to pyruvic acid or lactic acid (Meyer and Meij, 1996). Lactic acid does not necessarily accumulate at all levels of exercise. During light and moderate exercise the energy demands are adequately met by reactions that use oxygen. In biochemical terms, the ATP for muscular contraction is made available predominantly through energy generated by the oxidation of hydrogen. Any lactic acid formed during light exercise is rapidly oxidized. As such, the blood lactic acid levels remains fairly stable even though oxygen consumption increases. Lactic acid begins to accumulate and rise in an exponential fashion at about 55% of the healthy, untrained subject's maximal capacity for aerobic metabolism. The usual explanation for the increase in lactic acid is based on the assumption of a relative tissue hypoxia (lack of adequate oxygen) in heavy exercise (McCardle, Katch and Katch, 1991). For this reason it would be beneficial to the athlete if either one of the products could help the oxygen supply to the muscle and surrounding tissue, preventing or rather delaying the onset of hypoxia due to increased exercise intensity. An untrained individual who fasted overnight and who has a sample of blood collected in the morning from an arm

vein before any exercise, has a lactate level ranging from 0.44 to 1.7 mmol/L. Martin and Coe (1997) also found the equivalent of 0.3 to 0.6 mmol/L to be true for trained individuals, providing that they are not over trained. Within an hour after an intensive training session during which blood lactate levels reach the highest achievable values (15mmol/L), muscle lactate levels will return to normal (Noakes, 1992). Lactic acid produced in working muscles is almost completely dissociated into H+ and lactate within the range of physiological pH, which contributes to the metabolic acidosis (Hirokoba, 1992).

Cellfood was very effective in decreasing lactate values during the test. The most effective dosage was at 15 drops once a day. Cellfood made for lower lactate values at all the comparative running speeds during the test. Lower lactate values would definitely be beneficial to the endurance athlete. Decreases ranged between 10 and 25%.

Figure 10: Lactate Values - Relative Change



	1 8km	2 8km	3 8km	1 10km	2 10km	3 10km	1 12km	2 12km	3 12km	1 14km	2 14km	3 14km	1 16km	2 16km	3 16km	1 17km	2 17km	3 17km	1 18km	2 18km	3 18km
Placebo	4.5	-11.6	0.9	5.7	-16.6	30.4	-1.4	-25.9	3.7	-13.3	-25.8	2.9	-24.1	-20.8	-2.6	-23.4	-54.7	-12.3	-34.8	-36.3	0.1
Cellfood	3.9	20.8	-10.0	28.4	16.1	-13.0	12.8	6.1	-26.2	7.8	6.9	-25.2	5.3	-14.8	-13.1	-30.7	-26.0	-10.3	-34.1	-58.7	-25.3

Gas Analysis ($V0_2$ max)

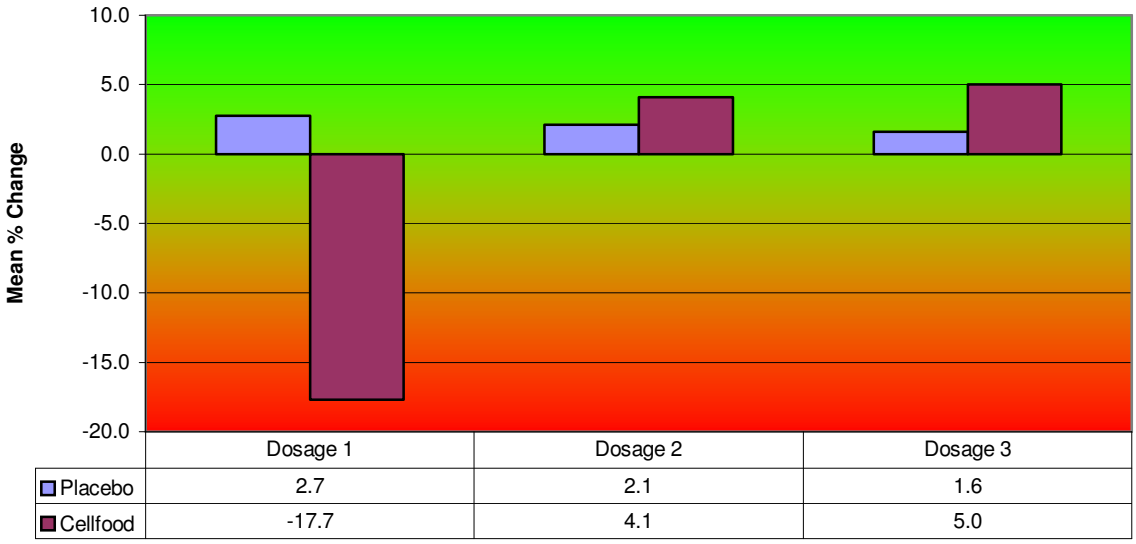
- $V0_2$ max (absolute)

  As can be expected there is an increase in oxygen consumption with an increase in running speed. This occurs as follows. As exercise increase in

intensity, the muscles recruit more myofibrils to produce ever more powerful contractions. This demands increased amount of energy, and this in turn demands a greater oxygen supply. Thus $V0_2$ max is the maximum rate of oxygen flow and is usually expressed relative to body weight (millilitres of oxygen per kilogram of body weight per minute) (Noakes, 1992). Higher oxygen consumption values would be beneficial to the endurance athlete by increasing the amount of oxygen utilized by the body to supply energy to the working muscles. $V0_2$ max is to a great extent determined by genetics and only a small percentage increase is possible by the correct training methods.

The working of Cellfood on various systems in the body made it possible to detect an increase in the absolute $V0_2$ max of the athletes. The most effective dosage again was that of 17 drops a day, which resulted in an increase of 5%.

Figure 11: Absolute Oxygen Consumption – Relative Change



	Dosage 1	Dosage 2	Dosage 3
Placebo	2.7	2.1	1.6
Cellfood	-17.7	4.1	5.0

PRODUCT COMPARISON REGARDING DOSAGE EFFICACY

Summary: Cellfood®

It is clear that a certain pattern exists regarding the optimal dosage for performance when using the Celfood® product. Concerning the haematology and the lactate accumulation Cellfood® was the most effective using a dosage of 39.2ml (35 drops

once per day) while Cellfood® showed the best results in all the other variables when the subjects took a dosage of 44.8ml (40 drops once per day). This indicates that Cellfood® is more effective when it is administered at the higher of the tested dosages. Further studies could possibly answer the question if Cellfood® would reach an upper "threshold" dosage where after the efficacy would show a decline. In conclusion it would be best for athletes to make use of Cellfood® at a higher dosage to ensure better performance.

GLOSSARY OF TERMS

METS: This term is used as an equivalent for maximal oxygen uptake. One MET is equal to 3.5ml/0_2/kg/min. This value is often used to determine a person's relative working intensity.

RR: Respiration rate refers to the number of breaths taken per minute. Respiration rate multiplied by tidal volume is an indication of a person's minute ventilation.

VT: This refers to tidal volume, which is an indication of the volume of air inspired per breath in ml. or liters.

VE: This refers to the minute ventilation, which is an indication of the amount of air that is ventilated per minute (ml. or liters)

$V0_2$: The maximum amount of oxygen that the body can take in, use and transport through the body to the working muscles. This is an accurate predictor of a person's potential to perform well at endurance events that make use of the aerobic energy system in the body.

$VC0_2$: The amount of carbon dioxide that is exhaled from the body per minute.

RQ: The respiratory quotient refers to the rate of carbon dioxide production to that of oxygen consumption. This value is a good indication of a person's work rate and also indicates what type of substrate is being utilized as energy, fat, protein or carbohydrates.

VE/V0$_2$: The breathing equivalent for oxygen indicates the amount of air that needs to be inhaled to obtain one liter of oxygen. The lower this value during maximal effort the better the person's ability is to extract oxygen from ambient air.

VE/VC0$_2$: The breathing equivalent for carbon dioxide indicates the amount of air that needs to be exhaled for one liter of carbon dioxide to be expelled. The lower this value the better the person's ability to rid the body of excess carbon dioxide.

et0$_2$: End tidal expired oxygen partial pressure (mmHg) is the partial oxygen pressure (P0$_2$) determined in the respired gas at the end of an exhalation.

etC0$_2$: End tidal expired carbon dioxide partial pressure (mmHg) is the partial carbon dioxide pressure (PC0$_2$) of the respired gas determined at the end of an exhalation.

TABEL I: HAEMATOLOGY

Groups			Group A: Placebo (N=10)					Group B: Cellfood (N=10)				
VARIABLES	Cycle	UNITS	PRE (Mean)	Std. Dev.	POST (Mean)	Std. Dev.	%	PRE (Mean)	Std. Dev.	POST (Mean)	Std. Dev.	%
Ferretin	1		67.5	54.5	107.2	127.8	**58.8**	123.7	152.1	93.7	72.7	**-24.2**
Ferretin	2		97.2	65.9	101.7	122.3	**4.7**	67.5	54.5	116.7	81.6	**72.9**
Ferretin	3		123.7	152.1	115.6	120.4	**-6.6**	97.2	65.9	133.5	131.3	**37.4**
Glucose	1		4.7	0.6	4.6	0.4	**-1.1**	4.6	0.6	4.6	0.5	**2.0**
Glucose	2		4.5	0.5	4.7	0.4	**5.3**	4.7	0.6	4.7	0.5	**0.4**
Glucose	3		4.6	0.6	4.5	0.5	**-0.7**	4.5	0.5	4.7	0.6	**3.3**
Haemoglobin	1		15.2	1.6	14.8	1.5	**-2.6**	15.0	1.4	13.9	1.2	**-6.8**
Haemoglobin	2		14.8	1.3	14.0	1.2	**-5.4**	15.2	1.6	15.7	1.6	**3.2**
Haemoglobin	3		15.0	1.4	14.6	1.2	**-2.1**	14.8	1.3	15.0	1.6	**0.9**
Red Blood Cell	1		4.9	0.6	4.7	0.5	**-4.8**	4.6	1.1	4.6	0.5	**-1.2**
Red Blood Cell	2		4.7	0.4	4.6	0.4	**-3.7**	4.9	0.6	5.0	0.6	**2.4**
Red Blood Cell	3		4.6	1.1	4.8	0.5	**3.4**	4.7	0.4	4.8	0.5	**1.1**
Heamatocrit	1		45.0	4.3	43.1	4.3	**-4.3**	46.9	10.6	41.4	3.7	**-11.8**
Heamatocrit	2		44.0	4.1	41.4	3.8	**-6.0**	45.0	4.3	46.4	4.5	**3.0**
Heamatocrit	3		46.9	10.6	43.0	3.7	**-8.3**	44.0	4.1	44.1	4.8	**0.1**

$\%\Delta$ = Relative change

TABEL II: HAEMOGLOBIN SATURATION

Groups			Group A: Placebo (N=10)					Group B: Cellfood (N=10)				
VARIABLES	Cycle	UNITS	PRE (Mean)	Std. Dev.	POST (Mean)	Std. Dev.	%	PRE (Mean)	Std. Dev.	POST (Mean)	Std. Dev.	%
Rest	1	%Sp02	95.4	1.6	95.5	0.7	**0.1**	95.6	1.3	95.6	1.0	**0.0**
Rest	2	%Sp02	95.5	1.6	95.8	1.1	**0.3**	95.4	1.6	95.4	1.1	**0.0**
Rest	3	%Sp02	95.6	1.3	95.5	1.2	**-0.1**	95.5	1.6	95.1	1.3	**-0.4**
8km	1	%Sp02	94.1	2.2	94.6	1.3	**0.5**	94.6	1.4	94.4	1.4	**-0.2**
8km	2	%Sp02	92.5	5.2	87.9	21.1	**-5.0**	94.1	2.2	93.3	2.8	**-0.9**
8km	3	%Sp02	94.6	1.4	94.4	1.3	**-0.2**	92.5	5.2	95.1	1.5	**2.8**
10km	1	%Sp02	94.2	1.4	94.2	1.5	**0.0**	94.5	1.8	94.3	1.6	**-0.2**
10km	2	%Sp02	92.6	3.9	93.9	2.6	**1.4**	94.2	1.4	93.4	2.2	**-0.8**
10km	3	%Sp02	94.5	1.8	94.0	1.7	**-0.5**	92.6	3.9	93.7	2.0	**1.2**
12km	1	%Sp02	84.6	28.7	93.0	3.5	**9.9**	85.1	26.8	92.5	2.2	**8.7**
12km	2	%Sp02	92.2	3.0	92.9	3.3	**0.8**	84.6	28.7	92.7	1.8	**9.6**
12km	3	%Sp02	85.1	26.8	92.9	1.1	**9.2**	92.2	3.0	92.6	2.1	**0.4**
14km	1	%Sp02	91.8	1.7	92.4	3.4	**0.7**	92.9	2.2	90.5	2.9	**-2.6**
14km	2	%Sp02	90.3	5.1	92.4	2.1	**2.3**	91.8	1.7	91.4	2.7	**-0.4**
14km	3	%Sp02	92.9	2.2	93.5	1.4	**0.6**	90.3	5.1	92.0	2.3	**1.9**
16km	1	%Sp02	91.0	2.6	90.3	4.0	**-0.8**	92.0	2.8	91.3	1.8	**-0.8**
16km	2	%Sp02	89.9	2.8	92.0	2.3	**2.3**	91.0	2.6	89.7	2.9	**-1.4**
16km	3	%Sp02	92.0	2.8	91.7	1.3	**-0.3**	89.9	2.8	91.2	2.5	**1.5**
17km	1	%Sp02	92.0	4.0	90.5	4.4	**-1.6**	91.0	2.8	91.7	2.3	**0.7**
17km	2	%Sp02	88.0	2.7	90.4	1.3	**2.7**	92.0	4.0	91.5	3.5	**-0.5**
17km	3	%Sp02	91.0	2.8	93.0	1.0	**2.2**	88.0	2.7	88.0	1.0	**0.0**
18km	1	%Sp02	89.5	3.5	91.0	0.0	**1.7**	88.7	4.2	91.0	1.4	**2.6**
18km	2	%Sp02	87.3	2.1	88.0	2.8	**0.8**	89.5	3.5	94.0	0.0	**5.0**
18km	3	%Sp02	88.7	4.2	90.0	3.1	**1.5**	87.3	2.1	91.0	0.0	**4.2**

% Δ = Relative change

TABEL III: BLOOD LACTATE

Groups			Group A: Placebo (N=10)					Group B: Cellfood (N=10)				
VARIABLES	Cycle	UNITS	PRE (Mean)	Std. Dev.	POST (Mean)	Std. Dev.	%	PRE (Mean)	Std. Dev.	POST (Mean)	Std. Dev.	%
8km	1	mmol/L	2.2	0.8	2.3	0.4	**4.5**	2.3	0.5	2.4	0.7	**3.9**
8km	2	mmol/L	2.5	1.1	2.2	0.6	**-11.6**	2.2	0.8	2.7	0.3	**20.8**
8km	3	mmol/L	2.3	0.5	2.3	0.5	**0.9**	2.5	1.1	2.3	0.5	**-10.0**
10km	1	mmol/L	2.1	0.8	2.2	0.5	**5.7**	1.9	0.7	2.5	1.1	**28.4**
10km	2	mmol/L	2.7	1.0	2.3	0.7	**-16.6**	2.1	0.8	2.5	0.4	**16.1**
10km	3	mmol/L	1.9	0.7	2.5	0.4	**30.4**	2.7	1.0	2.3	0.6	**-13.0**
12km	1	mmol/L	3.0	0.7	2.9	0.6	**-1.4**	2.7	0.9	3.1	1.6	**12.8**
12km	2	mmol/L	3.4	1.2	2.5	0.6	**-25.9**	3.0	0.7	3.1	0.8	**6.1**
12km	3	mmol/L	2.7	0.9	2.8	0.6	**3.7**	3.4	1.2	2.5	0.5	**-26.2**
14km	1	mmol/L	4.4	0.9	3.8	0.6	**-13.3**	3.7	1.1	4.0	1.5	**7.8**
14km	2	mmol/L	4.6	1.4	3.4	1.2	**-25.8**	4.4	0.9	4.7	1.1	**6.9**
14km	3	mmol/L	3.7	1.1	3.8	1.2	**2.9**	4.6	1.4	3.5	0.9	**-25.2**
16km	1	mmol/L	6.4	1.7	4.9	1.0	**-24.1**	5.0	1.4	5.3	1.5	**5.3**
16km	2	mmol/L	5.5	1.4	4.4	1.0	**-20.8**	6.4	1.7	5.5	1.8	**-14.8**
16km	3	mmol/L	5.0	1.4	4.9	1.6	**-2.6**	5.5	1.4	4.8	1.1	**-13.1**
17km	1	mmol/L	7.6	2.4	5.9	0.9	**-23.4**	7.1	1.1	4.9	2.0	**-30.7**
17km	2	mmol/L	6.8	2.9	3.1	1.9	**-54.7**	7.6	2.4	5.7	2.6	**-26.0**
17km	3	mmol/L	7.1	1.1	6.2	1.8	**-12.3**	6.8	2.9	6.1	1.1	**-10.3**
18km	1	mmol/L	9.2	2.8	6.0		**-34.8**	7.4	1.5	4.9	0.4	**-34.1**
18km	2	mmol/L	9.5	4.6	6.1	2.8	**-36.3**	9.2	2.8	3.8	0.0	**-58.7**
18km	3	mmol/L	7.4	1.5	7.4	1.9	**0.1**	9.5	4.6	7.1	0.0	**-25.3**

$\% \Delta$ = Relative change