REPORT – ALTITUDE CONFERENCE

Tokyo, 2004

INTRODUCTION

I was privileged to have been invited to the 8th International Conference on Altitude Training, held at the JISS (Japanese Institute for Sports Science) on the 20th and 21st October in Tokyo. There were mainly sports scientists in attendance and Dr Randall Wilber, chief sports scientist for the USA Olympic Training Centre in Colorado, and myself were the only international guest speakers. The main language was Japanese, which made it relatively difficult to follow some of the presentations given by the Japanese scientists. However, I was able to get a good impression of the work done by the Japanese scientists on altitude training in general terms. In this report I will first outline the facilities and services available at the Japanese Institute of Sports Science. Secondly I will try to give a summary of the key points presented at the conference.

THE JAPANESE INSTITUTE OF SPORTS SCIENCE (JISS)

Following the disappointing results at the Sydney Olympic Games, the Japanese Olympic Committee, with the assistance of the government constructed the JISS to coordinate and direct Japanese sports science and sports medicine programmes. Funding came from the Japanese government and major corporations.

The building utilised is 7 stories high and houses an impressive array of sports science and sports medicine equipment, as well as specialist areas for training in specific sports. The abundance of state of the art sports science and sports medicine equipment is overwhelming. Two MRI scans and one CT scan, in the sports medicine department were complemented by two x-ray machines and a fully equipped biochemistry laboratory (including a facility for DNA testing). Two full time sports medicine physicians and two full time orthopaedic specialists are employed, with visiting specialists in dentistry, ear/nose/throat, cardiology and ophthalmology. I noticed on our guided tour that most sports training areas seemed to have multiple cameras, as well as in built force measuring platforms. Our guide estimated there were approximately 30-40 platforms sprinkled throughout the building, including in the swimming pool. Currently a hypoxic tent-like structure is being constructed along the length of one 50metre lane in the swimming pool, to enable the swimmers to train at artificial altitude. The kayak and rowing flumes were most impressive with extensive biomechanical analysis equipment.

Altitude training features high in the research interest of the JISS and much work is done in that area. On the 5th floor 72 dormitory rooms are set up as normobaric altitude rooms for athletes to stay in. In addition there is a hypobaric room, as well as a normobaric hypoxic room for the purpose of sports science research. In the sports medicine area there is also a hyperbaric chamber, which is used for research and for the treatment of acute injuries. As far as altitude research is concerned the Japanese are especially interested in the live low/train high model (which goes directly against the international trend of living high and training low). There is an environmental room to research the effects of heat, cold and humidity. An extra large treadmill (3 X 4m) is built in the human performance laboratory, surrounded by mirrors and cameras. This is used in particular, by speed skaters (on roller blades) and cross-country skiers, to analyse technique and also for (indoor) training.

A full list of all facilities is attached as an appendix.

SUMMARY OF PAPERS PRESENTED AT THE CONFERENCE

The emphasis of altitude training in the United States is on the live high/train low model, as was presented by Dr Randall Wilber, chief sports physiologist at the US Olympic Training Centre at Colorado Springs. He presented all the evidence currently available on the benefits of living high and training low. In his particular facility, located at 1800m, athletes do their hard training sessions with the assistance of supplemental oxygen to mimic the live high/train low model. His research thus far suggests a significant performance improvement when competing at sea level and few or no side effects.

Four cases of experience with altitude training were presented by different Japanese sports.

The first was a 400m track athlete who finished 7th at the 400m hurdles at the World Championship Athletics this year. He had done several stints of conventional altitude training, mainly in the United States, in the previous years, and presented his results and training experience. He felt altitude training benefited him through…

1. an improvement in the aerobic metabolic system - through stimulation of the anaerobic metabolism.
2. lower air resistance - higher speeds could be acquired over sprint distances, with a subsequent improvement in technique.
3. an efficient amount of high intensity training of a shorter duration.

The second presentation was by a coach/sports scientist with the Japanese Swimming Team. In Athens they won 8 medals, including 3 gold, 1 silver and 4 bronze medals. This result was their best in 50 years. Six of the athletes who won medals in Athens had done conventional altitude training prior to the Games. The Japanese Swimming Team have refined their altitude training methods in the years prior to the Athens Olympic Games by using altitude facilities at Flagstaff (Arizona), as well as in Spain. Their swimmers, on average, trained 100 days per year at altitude, divided up over three sessions - two camps of 4 weeks and one camp of two weeks. At the third and fourth camps they tended to be able to sustain their sea level speed.

The third presentation was on hypoxic training using a normobaric hypoxic room. 30 minutes high intensity training in a hypoxic environment, 3 days per week for 3-5 days resulted in a reduced oxygen uptake at a certain workload (improved energy efficiency) and substantially reduced accumulation of lactic acid in blood, doing the same loads of high intensity exercise, in a group of competitive cyclists.

The fourth presentation was made by an ice speed skater who started to sleep in a hypoxic tent (16.4%) in 1995. He also did stints of hypoxic training using a bicycle. Initially he had difficulties sleeping and breathing. At that time he felt it affected his general training because of fatigue. In the second year, things improved when he adjusted his hypoxic training by using a stepwise training method and controlling his heart rate. He would bike at 3 X 10 minute stages of progressive intensity. Stage 1 was 3kp, stage 2, 4kp and stage 3, 5kp – all with 60 rpm at an artificial altitude of 2,200m. He felt his power improve through this type of training. In 1996 he won the National Japan Championships with a new record and finished 2nd in the World Championships in the 10,000m (long track). In 1997 he tried to reduce his oxygen percentage in the tent to 15.4% but felt that it delayed his recovery. He went back to 16% following that. He fell sick prior to the Nagano Olympic Games. Prior to the Salt Lake Olympic Games he stuck to 16.4% of oxygen in his tent and only trained twice in the tent, just prior to the Games. He stayed at (2,200m above sea level) until one week prior to the race and then went down to Salt Lake City (1,400m). As a consequence, he finished 4th in the 10,000m at these Olympic Games.

There was a presentation on the construction of the altitude tent, along the length of a swimming lane, over one of the 50m lanes. They have just about completed the construction. Difficulties were encountered with trying to control the accumulation of CO2 and chlorine in the tent during use. Unfortunately this was a rather technical presentation done completely in Japanese, so I am unable to give more information.

An interesting presentation was given by an occupational physician on the dangers of hypoxia. Apparently in the workplace, in Japan, it is illegal to work in an environment where the oxygen concentration in the air is less than 18%. This is the same as an altitude of approximately 1,600m, which in altitude training terms, is a very safe altitude.

A presentation was given on the benefits of sleeping in an altitude tent as preparation for an altitude climb. Eight males slept at a simulated altitude equivalent to between 3,000m and 4,000m, for 8 hours sleep per day. Several improvements were observed in hematological values and physiological responses, indicating acclimatisation effects.

There was a most interesting lecture on the effect of oxidative stress on hypoxia induced erythropoietic response. The hypothesis was made that individual response to altitude training depends on the production of erythropoietin. The mechanisms behind stimulation of EPO through the hypoxia inducible factor 1 was outlined and the processes that can interfere with this.

A study on the quality of sleep in athletes at a simulated altitude of 2,000m shows a poor quality of sleep. Interestingly, at 1,500m no changes in sleep patterns were found (as measured by EEG recordings). This confirms the safety of training at 1500m, opposed to 2000m.

There were several presentations on the physiological effects of living low and training high (in altitude chambers). Training was done for varying durations and intensities. In general, performance improvements were found, sometimes with accompanying hematological changes as well.

There was a lecture on the effect of living high/training low on performance during supra-maximal exercise, e.g. anaerobic exercise. Three independent studies were presented where small improvements (1%) were found in events lasting approximately 50 seconds to 16 minutes. There was also an improvement in mean power during supra-maximal exercise with 30 seconds (Wingate test) after 7 days of live high/train low. The results suggest that live high/train low increases anaerobic capacity and/or muscle buffering capacity with a resulting improvement during anaerobic exercise.

There was an interesting presentation from a mountaineer who had done an elaborate 3 months pre-climb period of altitude acclimatization, through a mixture of sleeping in altitude tents, as well as exercising at artificial altitude. No altitude sickness was experienced and he was able to climb three successive mountains within 3 weeks that were over 3,000m high.

I did a presentation on the effects of intermittent hypoxic training on performance, health and acclimatisation.

CONCLUSION

The JISS is an impressive facility with the latest, state of the art sports medicine and sports science equipment, available for research and testing. If used well, this facility is going to enhance Japan's chances at the Beijing Olympics greatly.

New Zealand is not in a position to replicate a similar sports science sport centre. Sport science and sports medicine services in New Zealand are currently somewhat fragmented and coordinated and structured research programmes in support of specific sports are almost non-existent. This applies in particular for the method of altitude training.

Worldwide, different forms of altitude training are now accepted to have a performance enhancing benefit. It is interesting that two opposing methods, the live high/train low method practiced by most USA athletes and the live low/train high method researched by the Japanese, seem to have almost equal benefits. To me, as a coach, this makes sense. We need to subject our athletes to different forms of stress to enable them to adapt their systems to a maximum efficiency level.

I will continue to advocate the application of the different forms of altitude training throughout the year, by different sports. Access to altitude training and simulation programmes in New Zealand is currently somewhat limited and an ongoing research programme, non-existent.

A coordinated approach is required towards supporting individual sports with altitude training and simulation programmes, support by ongoing research.

My recommendation to SPARC is that a small committee of experts is appointed to discuss issues regarding altitude training and simulation for New Zealands High Performance Sports. The committees task would be to come up with a set of recommendations and practical applications and research needs regarding altitude training and simulation.

APPENDIX

New Spirit of Challenge Facilities

CLASSIFICATION	FACILITIES	AREA AND FUNCTIONS
Training Facilities	50m Swimming Pool	50mX21m 8 courses; water depth 0-2m;movable floor
	Synchronised Swimming Pool	30mX25m Deepest 4m shallowest 2.5m
	Shooting/Archery	270m2 (3 shooting booth)
	Wrestling/Judo	699m2 (2 wresting, 1 judo)
	Fencing	240m2 (4 pists)
	Boxing	215m2 (2 rings)
	Weightlifting	185m2 (5 platforms)
	Gymnasium	2 volleyball, 2 basketball, 6 badminton, table tennis, rhythmic gymnastics etc.
	Gymnastics	960m2
	Training Gym	832m2 (machine, free weights)
	Normobaric Hypoxia Lab	Control range of oxygen concentration 17.4-13.6%
Sports Sciences Facilities	Physiology Lab	Evaluation of respiratory and circulatory functions, muscle activities etc.
	Biochemistry Lab	Evaluation of immunity, chemical characteristics of tissues etc.
	Biomechanics Lab	Real time 3D motion analyzer
	Psychology Lab	Biofeedback system, psychological testing etc.
	Morphology Lab	Morphological measurements body composition measurements
	Human Performance Lab	Evaluation of physical capabilities through aerobic and anaerobic exercise, measurement of muscle strength Large-sized treadmill (3m X 4m), rowing ergometer etc
	Environmental Research Lab	Temp/Humid Control Lab, Hypobaric Hypoxia Lab
	Track and Field	Indoor 100m track, urethane covered force platform
	Rowing/Canoe	Rowing tank (circulating water chanel – water velocity 0-5.5m/sec)
Sports Medicine Facilities	Sports Medicine Clinic	Internal medicine, orthopedics, dentistry, ophthalmology, otolaryngology, gynaecology and dermatology
	Rehabilitation	Physiotherapy, hydropathic therapy
	Counselling Room	Psychological counselling
	Nutritional Consulting Room	Calorie calculation, Nutritional consulting
	MRI Room	Diagnosis of bones and joints using MR-images and MR-spectrosocpy
	CT Room	Diagnosis of bones and joints using CT-images
	X-ray Room	CR (Computed radiology), Digital-fluoroscopy
	Clinical Lab	Clinical examination by electrocardiogram
Sports Information Facilities	Sports Information Service Room	Video, Internet, sports periodicals
	Video Editorial and Analysis Room	Non-linear image editing, satellite TV, game analysis etc.
	Virtual Training Room	Virtual training system for the improvement of decision-making in a game
Service Facilities	Conference Room	150 seats (294m2)
	Meeting Room (2)	20 seats (35m2)
	Normobaric Hypoxia Dormitory Rooms	76 (western style rooms); 72 (adjustable to normobaric hypoxia control range of oxygen concentration 16.8-14.4%); 4 (Japanese style rooms)
	Dining Hall	112 seats (495m2)
	Café	31 seats (light meals and drinks)
Others	Nishigaoka Soccer Stadium etc	Soccer stadium, tennis courts, Toda boat house, athletic fields