

IOC Handbook of Sports Medicine and Science: Cross Country Skiing

Adjustments to travels across time zones

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Cross-country Skiing

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FROM CHAPTER 5
SPECIAL AND PRACTICAL ISSUES IN CROSS COUNTRY SKIING

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Adjustments to travels across time zones

Circadian rhythms

International athletes often travel to several continents and across many time zones for training and competitions. This poses a challenge for both mind and body to make sudden changes in the 24-h activity schedule, since intercontinental air travels do not leave enough time to undergo a gradual adjustment to a new local time. It is generally suggested that if more than 3-4 time zones are crossed, certain biological functions are disturbed and temporary impairment in performance may arise. Therefore, it is important for an athlete to know what biological (physiological and mental) functions that undergo rhythmic changes and what factors that governed this rhythmicity. This will perhaps make the athlete more aware of the factors that may disturb performance and more motivated to follow the guidelines for optimizing time acclimatization given later on in this section.

Picture: Ch3sB-P1

Many of the biological process necessary to uphold human life undergo rhythmic transitions. The menstrual cycle is one of these biological rhythms and normally has a 28-30 days periodicity. Another biological rhythm is the change in body temperature from a morning low at ca.36.5 C to a peak of ca. 37.5 C in the evening. This biological rhythm has a cycle of ca. 24 h and is therefore referred to as *circadian* rhythm, from Latin expression “circa diem” meaning about 24 h. As listed in box 1, there are several other biological functions and with measurable parameters that undergo circadian rhythmicity.

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BOX:

Biological functions related to circadian rhythms

1. Body temperature: rectal temperature
2. Cardiovascular: heart rate, blood pressure
3. Respiratory: ventilation rate, forced expiratory volume and peak expiratory flow
4. Metabolic: oxygen consumption
5. Gastrointestinal: gastric pH and emptying, intestinal motility and absorption
6. Hormonal: adrenaline, noradrenaline, cortisol, growth hormone, testosterone, thyroxin, melatonin, etc.
7. Psychological: wakefulness, alertness, fatigue and other mood states

Circadian rhythmicity of biological functions (like intestinal motility) and physiological parameters (like oxygen consumption) are influenced by both internal and external factors. The most important internal “governor” of these functions is found in the hypothalamus region of the brain (supra-chiasmatic nuclei). This part of the brain functions as a “pacemaker” or “biological clock” for most circadian rhythms. However, external factors like light and darkness, temperature, visual and auditory input, meals and physical activity are also important regulators of these biological functions. It is not fully understood how environmental and behavioral factors impact biological rhythmicity. So far it has been shown that both neural and hormonal changes from variations in light, physical, mental and social activity, have an input back to the biological clock of the brain. For example, the change between light and darkness during a 24 hours cycle has a direct impact on concentrations of the hormone melatonin secreted by the hypothalamus, which governs wakefulness and sleep. Thus, biological functions that follow circadian rhythmicity undergo regulation from both

our interior and exterior milieu and there is a two-way communication between the internal biological clock and the external environment.

However, the essence of circadian rhythms is that they are persisting to a certain degree even in the absence of external stimuli like food, visual experiences or exercise. In other words, 24h fluctuations in body temperature, heart rate, hormonal levels, etc will remain despite total isolation in a dark room for several days. Or translated into the issue of long distance travel; the biological functions that undergo circadian rhythmicity will follow the “body clock” of our home setting and not the “time clock” of our new location when we travel across several time zones. The extent of this desynchronization between ”body clock” and “time clock” is of-course dependent on how many time zones that we cross and how fast it is done.

“Jet-lag”

The problems (signs and symptom) associated with desynchronization between the ”body clock” and “time clock” caused by air traveling over several time zones has been named “jet-lag”. However, traveling in eastward or westward direction may cause different problems. *Westward* traveling usually happens during daytime and results in an extension of the day with a certain number of hours before retiring early evening at new local time (late night “body time”). Waking up next morning is not difficult, because it is late morning “body time”. However, most long distance travels in an *eastward* direction results implies spending a short night on the plane, often with a minimum of sleep. Starting the next morning at an hour corresponding to bed time at home and with little or no sleep during the night-flight often results in considerable uncomfot and tiredness during the next few days.

BOX

Signs and symptoms associated with jet lag

- 1) General feeling of malaise and discomfort
 - 2) Fatigue during parts of the day and wakefulness during parts of the night
 - 3) Disturbed appetite, digestive problems, nausea and headache
 - 4) Disturbed mental functions like concentration and vigilance
 - 5) Decreased psychomotor functions like balance and coordination
 - 6) Decreased endurance capacity and stamina
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The problems associated with “jet lag” may of course vary from one athlete to another and there may also be different signs and symptoms than indicated above. A rule of thumb is that the problems should not last for a greater number of days than the number of time zones crossed; i.e. complete acclimatization to 8 h difference in local time should not take longer than 8 days. Anyone having experienced a change in time of 8 h or more, going east or west, has learned that the first 2-4 days are the worst. From the list of symptoms one can easily understand that most any sport performance, that be endurance, power or technically oriented, may be affected by traveling across several time zones. However, in sports where concentration and fine motor skills are crucial, the athlete’s performance may be particularly susceptible to the physical and mental disturbances associated with jet lag.

Optimizing acclimatization

The obvious question then arises: How we can alleviate and minimize these problems and have the athletes training or competing at an optimal level as soon as possible. A list of common guidelines gathered from the scientific literature is presented, especially as an aid to

relatively inexperienced travelers. The guidelines are assuming a change in time of 6 hours or more.

BOX

Guidelines for long distance air travels

Before the flight

- Schedule the arrival date at new location several days prior to first day of competition (Eastward: 1 day for each hour change. Westward: 0.5-1 days for each hour change)
 - Try to find the most convenient flight schedule, preferably a direct flight to the destination, or a minimum of stopovers, especially if traveling at night.
 - During the last 4 days before departure the athletes should try to adjust 2 hours towards the new local time. Approximately, 0.5 h pr day earlier mornings (eastward) or later nights (westward).
 - Get plenty of sleep the night before departure
 - Eat and drink well before the flight. Bring your own food and water if you don't like the airline foods and drinks
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BOX

On the flight

- Set your watch to local destination time as soon as possible and synchronize your meal and sleeping pattern on the plane to local time.
- Drink plenty of fluids, but avoid drinks with alcohol, caffeine and tea, which have a dehydrating effect.
- If starting the flight when local destination time shows late night or early morning, try to get a short nap at the beginning of the flight

- If flying during daytime or evening, get up and move around as much as possible and include some stretching.
 - Use of surgical stockings and/or elevation of legs may prevent swelling and edema.
 - If starting the flight when local destination time shows late evening, try to get a carbohydrate rich meal before going to sleep. Sleeping pills may be taken if prescribed for you by the team physician
 - Do not go to sleep when feeling drowsy if local time shows daytime.
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BOX

After arrival

- Stick to the schedule of synchronizing your body clock to local day and night time routines, including sleep, meals, physical activity and training.
 - A short sleep before noon may be OK if arriving in the early morning after eastward flight. No extra naps during daytime!
 - A carbohydrate rich meal is recommended 1-3 h before going to bed the first day
 - Use the *daytime* hours that both body clock (home time) and local time have in common as time for training the first few days (late evenings if moved 8 h east and mornings if moved 8 h west)
 - Bright in the room in the morning (going eastward) or evening (westward) is recommended. Special light therapy may also be helpful when performed at correct hours, but should only be used in close cooperation with special therapists.
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Melatonin

Melatonin is a hypothalamic (brain) hormone where secretion is influenced by light and darkness in our environment. It peaks during the night and regulates the sleep- and wakening

cycle of the body, but is also involved in other physiological functions mainly as an anti-oxidant. After discovering its time-regulating abilities it has been commercially produced and made available as a nutritional supplement or prescription drug. Even though it may be sold “over the counter” in some countries, it is recommended that athletes only use it under supervision of a (team)-physician. One reason is the potential side effects that may arise (nausea, headache, etc.); another is the concern for contamination with IOC banned drugs. Normally, it is taken when darkness arrives at local destination, usually between 20:00-22:00 PM. If embarking on an eastward journey, melatonin could be taken before boarding the flight (corresponding to evening/night time local destination). After arrival in the east, it should be continued the next 6-8 nights if 8 time zones have been crossed, and 8-10 nights if even larger time leaps have been made.

When traveling westward --which normally means during daytime at local destination-- melatonin should not be used during the flight. After arrival and change to local time, tiredness is quite evident when evening comes and most people go to sleep very easily. However, waking up quite early the next morning is quite customary, and therefore it might be wise to take melatonin *immediately* before going to bed that first night. The purpose for this is to supply the brain with its “night” hormone at the time when the brain’s own production is turned down because it is morning in the home country. The supplemented melatonin will then provide high levels in the brain during the night at the new location and thus provide sleep a little longer into the morning hours. The number of nights that melatonin is recommended vary, but generally it may correspond to the number of time zones crossed minus two.

The scientific basis for using melatonin to reduce jet-lag symptoms is fairly solid, but from clinical experience there is a definite history of responders (those who benefit) and non-

responders (those who don't benefit). This means that an individual approach has to be taken for each athlete, including a close follow-up on the course of time adjustment as well as possible side effects. The impact of melatonin on specific performance outcomes is not well documented. However, the rationale is that if melatonin reduces some of the mental and physical problems associated with jet lag, consequently it will affect training quality and ultimately sports performance during the acclimatization period.

Traveling back home

So far we have focused on adjustments to travels from "home base" to an eastbound or westbound destination for training camps or competitions. The inevitable fact is that some day a *return journey* to "home base" is coming up. This must be planned and executed with the same optimal travel routines as the arrival trip. For the most part, it simply means that the guidelines of going in the *opposite* direction of the arrival journey must be applied.

Nevertheless, it is a common experience that both team staff and athletes have a tendency to "take out the slack" when returning home and disregard many of the guidelines of time adjustments. If there is limited time for effective home base training, it is wise to comply with the established routines --both on the return flight and the following days at home. Since the athletes may be exceedingly stressed and tired after a hard training camp or series of competitions, it might also be wise to ensure that the necessary measures of preventing infections are taken on the return journey. Additional travel stress and exposure to infectious sources through new people and places --while the immune system might be suppressed-- could easily result in a respiratory infection after returning home. Therefore, implementing good a strategy for travel routines and time adjustments when going home is as important as when arriving to an event.

Summary

1. It is generally suggested that if more than 3-4 time zones are crossed, certain biological functions are disturbed and temporary impairment in performance may arise.
2. Examples of biological functions with circadian rhythmicity (ca 24 h cycles) are: body temperature, heart rate, blood pressure, ventilation rate, oxygen consumption, gastric emptying, intestinal motility and mood-states like wakefulness, alertness, fatigue
3. Hormones that undergo circadian rhythmicity are: adrenaline, noradrenaline, cortisol, growth hormone, testosterone, thyroxin, melatonin, etc.
4. Most circadian rhythms are governed by a region in the brain (supra-chiasmatic nuclei of the hypothalamus). However, external factors like light and darkness, temperature, visual and auditory input, meals and physical activity also influence this “biological clock” rhythmicity
5. “Jet-lag” is a condition associated with desynchronization between the internal “body clock” and external “time clock” and characterized by: malaise, fatigue, headache, loss of appetite, decreased concentration, balance, coordination, endurance capacity
6. Optimizing time acclimatization should involve actions taken before, during and after a flight to a new destination including pre-travel time adjustment, diet and drinks, physical activity, regulation of exposure to light and sleeping patterns possibly involving sleeping pills and melatonin.
7. Athletes should only use sleeping pills and melatonin under supervision of a physician.

8. Guidelines for time adjustments is as important when going home as when arriving to an event.

Suggested readings

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Figure legends: “Adjustments to travels across time zones”

Ch3-sB-P1

Athletes are forced to make sudden changes in their regular 24-h activity schedule when traveling to foreign continents and across several time zones for Olympic Games or other international competitions. The adjustment to a new local time schedule is improved by certain changes in life-rhythms and activities both before departure, on the flight, and during the first days after arrival. A quick adjustment may improve the athletes' quality of training and ultimately their sports performance during the first days after arrival.

Ch3-sB-P2

Changing the time for sleep to the night-hours at local destination time is one of the most important measures to achieve rapid time adjustment. In practical terms this may imply dark sunglasses and earplugs to shut out light and sound in order to sleep at a new schedule.