



1-800-55MEDCO ▲ www.medco-athletics.com

Jet Lag: A Modern Athletic Problem

List of Objectives:

1. Participants will be able to increase an understanding of symptoms and causes of jetlag.
2. Participants will be able to have a working knowledge of preventative measure of jetlag.
3. Participants will be able to understand the physiological cause and effect of trans-meridian travel..

A reality in modern athletics is frequent long distance air travel. It is assumed that long distance or international air travel can hinder athletic performance if certain precautions are not taken. Many varied theories exist among coaches, athletes and health care providers on how to prevent this problem. It is stated that over 90% of all long distance travelers suffer from some form of jet leg.⁸ Jet lag, or circadian dyschronism, is a term utilized to describe the feeling of being worn out and tired due to a broken routine or sleep pattern with concomitant mental disorientation, which can last for days after long distance air travel. It can mean fatigue, disorientation, a lack of concentration or motivation, loss of normal sleep patterns, dehydration and general physical discomfort. Any one of these symptoms may hinder simple daily activities such as driving, reading, and concentrating. Circadian rhythms are the bodies built-in clock or biological phenomena, which are disrupted when crossing time zones. A disruption of circadian rhythm can effect body temperature, blood pressure, pulse rate and physiological patterns leading to disorientation, with mental and physical fatigue. These hindrances often vary by individual, extent and situation. Jet-lag, paired with an adjustment to differing environments, climate and diet, can have adverse effects on athletic performance, work efficiency and travel enjoyment.

Athletic performance may be poorer, at least initially, after trans-meridian, or time zone crossing, flights. Changes in time of training not coinciding with an athlete's circadian rhythm, loss of motivation to train, effects of mood changes, and discouragement from recent poor performance have all been reported factors in athletes.⁷ There is however, little compelling evidence that sleep loss, in itself, can impair athletic performance.^{3,8} Mougín et al. and others have stated that there are no clear or consistent effects on the first 72 hours of sleep loss in regard to muscle strength, endurance VO_2 max, or physiological responses to work rate. It has been shown that sleep loss, even partial, over several days is associated with significant alterations of endocrine function, including disturbances of temporal organization.^{1,2} These alterations in endocrine function may be caused by variations in the body's ability to control the levels of melatonin, cortisol, thyrotropin, growth hormone, and prolactin, all of which can be altered with circadian dyschronism.¹

Jet lag can be caused by several factors. They include but are not limited to rapid trans-meridian flights, the instances of take-off, the travelers pre-flight condition, the dry atmosphere and poor air quality in flight travel, cabin pressure, the consumption of alcohol and lack of physical activity.

Crossing multiple time zones is the primary, but not the only, cause of jet lag. It is said to take one day of adjustment for each time zone crossed on a trans-meridian flight. According to this theory, a time difference of four hours will require four days of adjusting.⁸ This is often a major factor in athletic team travel itinerary. Although any long distance air travel may cause jet lag, traveling west to east is considered to be worse than east to west. This is thought to be due to the fact that travelers are "losing" time traveling east while "gaining" time traveling west. Children, usually less set in their ways, and adults who are more adaptive to routine changes are less susceptible to jet lag. Generally, symptoms are worse, the older the traveler is.⁷ Individuals who are set in a fixed routine often suffer the worst bouts.

Often travelers state “ I’ll catch up on my rest on the flight”, but rarely do, and feel the effects for days. Being overly tired, stressed, apprehensive or feeling the after-effects of alcohol will worsen jet lag. The best advice for pre-flight conditioning is a good night of rest, avoiding alcohol and hydrating well with water before take-off.

Typically, jet aircraft have very dry and stale air. This varies among airlines and seat-class, as it is an in-flight cost issue. The lack of good air can make you tired, irritable and may cause headaches. Adding to this dilemma is the effect that this dry air has on the body. Dry air can cause headaches, dry skin, dry nasal and mucous membranes as well as cause dehydration. Anecdotally, this creates an environment conducive to colds, influenza, sore throats and coughs. Avoiding this problem can be as simple as asking the flight attendant to turn up the fresh air (they will in many airlines). Avoiding caffeine or alcoholic beverages and drinks such as juices, which you normally do not drink, will often prevent any adverse reactions or effects. Hydrating with water is a wise preventative measure. Many experienced travelers will bring bottled water, especially when riding in economy class.

Altitude changes at each landing and take-off can upset body systems and attribute to the severity jet lag. The greater the frequency of these changes, the greater the jet leg. Although airline cabins are pressurized, the atmosphere is much different than what the average individual is accustomed to. At a cruising altitude of 30,000 feet, the cabin is pressurized to 8,000 feet. A typical individual may suffer from swelling, tiredness and disorientation from flights at this elevation. Some travelers report the inability to wear normal shoes for 24-hours post-flight due to this swelling.⁸ Unless individuals are accustomed to higher altitudes this may be an unavoidable factor in air travel.

Alcohol may be 2-3 times more potent at flight altitude. By nature, alcohol is a diuretic. These facts, accompanied by the aforementioned problem with dehydration, can create a more severe hangover, only compounded by the effects of jet lag. The best advice is to avoid alcohol before and during flights.

Long distance flights are often cramped and uncomfortable for passengers. It is best to take any opportunity to stretch or walk in the aisle or get off the plane when possible on layovers. Any instance, in which blood flow, especially to the legs, can be increased, can reduce the severity of jet lag. Many individuals will increase blood flow by exercising or showering as soon as they have the opportunity in an attempt to reduce this severity. Being physically fit, rested and healthy may make you less susceptible than other passengers on the same flight.

Circadian rhythm, a biological phenomenon, is the bodies internal “clock”, which runs synchronously on a 24-hour rotation. This clock is actually a paired group of nuclei in the base of the hypothalamus- the suprachiasmatic nuclei.¹ It is continually adjusted by what are known as Zeitgebers, or time-givers, which are rhythms resulting both directly and indirectly from the environment. The two, best known Zeitgebers are light and melatonin.⁷ Any of the aforementioned causes can adversely effect these Zeitgebers, and cause varying degrees of jet lag.

Circadian rhythms are run on this 24-hour clock which is controlled by the light-dark cycle. Light information is transmitted via a direct retino-hypothalamic pathway. Neural outputs control biological and behavioral rhythms. Under normal synchronization to the light-dark cycle, a normal wake-sleep cycle is promoted. When a problem occurs with this wake-sleep cycle, such as changes in time zone, a change in circadian rhythm occurs and alters sleeping, waking and mood patterns. Although indoor or artificial light is thought to have some effect in the light-dark cycle, natural light is a much stronger Zeitgeber.

Melatonin is a hormone synthesized primarily in the pineal gland and to a lesser extent the retina. In normal circadian rhythm, melatonin secretion is highest in the hours of darkness or sleep (9pm-8am).^{6,7} It’s level is disrupted when a change occurs in the light- dark or circadian cycle. Reports in the exogenous administration of melatonin in assisting sleep quality for long distance travelers have been widespread. Studies suggest that correctly timed melatonin administration will alleviate the symptoms of jet lag in a majority of subjects.⁶ Melatonin can advance or delay the body’s clock. Taken in the afternoon it will advance the clock, while in the evening it will delay it.⁷ In order to administer melatonin properly, a health care provider must have a knowledge of an individuals circadian phase in order to achieve the desired effects.

Medications, such as melatonin and other homeopathic substances, have been utilized with mixed reviews for efficacy in preventing or minimizing the effects of jet lag. Introducing a foreign substance into the body may not be advisable, when many other physical adjustments are already required in this type of travel, and the goal is maximal athletic performance.

Common sense through sound planning and communication can aid athletes who require long distance travel in order to compete. A few, simple considerations can be utilized by athletic health care providers, in an effort to minimize jet lag and maximize performance of athletes who cross multiple time zones.

Considerations in Preventing Jet-Lag

- Drink plenty of water and bring a surplus if necessary, especially after competition
- Avoid alcohol both during and prior to flights
- Avoid caffeine or other fluids you normally do not drink, during and prior to flights
- Avoid overeating and the “free” in-flight meal, especially when that meal does not coincide with normal eating times; commonplace on “red eye” flights
- Eat only in-flight meals you are comfortable with or accustomed to, especially when departing from a foreign land. Sitting in a cramped seat may make matters worse. Going hungry for a few hours may be the better scenario.
- Schedule flights during sleep hours – i.e.-“red eyes”
- Utilize sleeping aids, such as blindfolds, ear plugs, or neck rests (often complimentary on flights) when flying in daylight and sleep is required
- Remove shoes in-flight to reduce foot discomfort should swelling occur
- In flights or on itinerary layovers; exercise, stretch, walk or shower, in order to increase circulation and reduce post-flight stiffness
- Attempt to schedule direct flights or itineraries with the least amount of connecting flights
- Schedule events in advance and allow for ample time to adjust to new surroundings, this may be several days
- Attempt to stay on your local time with sleep and meals, if possible, especially on short trips crossing several time zones when extended stays are not feasible
- Allow time for periods of day sleep when adjusting to new time zones. Even small amounts can be a great help
- Speak with your team physician prior to use of any prescription, over-the-counter or homeopathic medication
- Have updated knowledge of banned substances by the National Collegiate Athletic Association, International Olympic Committee or applicable governing body
- Educate athletes and coaches on these matters well in advance, especially when unaccustomed to this type of travel

--Andy Smith,MS,ATC

Take the Quiz Below.

CEU Quiz for NATA Certified Athletic Trainers
Press Ctrl+p to Print This Quiz

Jet Lag: A Modern Athletic Problem

Certification Number _____

Name _____

Address _____

City _____ **State** _____ **Zip Code** _____

Do you currently receive a MEDCO Catalog? Yes / No

Please rate each item on the scale of 1 to 5. (5 is the highest)

1. Content pertinent to Athletic Training? 1 2 3 4 5

2. Content presented at appropriate level? 1 2 3 4 5

3. Organization of materials? 1 2 3 4 5

4. Quiz emphasis on pertinent material? 1 2 3 4 5

Record answers here. Clearly circle ONE answer.

- | | |
|--------------|---------------|
| 1. A B C D E | 8. A B C D E |
| 2. A B C D E | 9. A B C D E |
| 3. A B C D E | 10. A B C D E |
| 4. A B C D E | 11. A B C D E |
| 5. A B C D E | 12. A B C D E |
| 6. A B C D E | 13. A B C D E |
| 7. A B C D E | 14. A B C D E |

Mark Answers Above.

Jet Lag: A Modern Athletic Problem

1. Melanin secretion is highest:

- A During hours of light
- B During hours of darkness
- C When circadian rhythms are disrupted
- D In normal circadian rhythm

2. The following Zeitgebers effect circadian rhythms:

- A Natural light
- B Artificial light
- C Melatonin
- D ALL
- E A & C

3. Trans-meridian flights require high cruising altitudes. Which statement is false regarding this fact?

- A The higher the frequency of take-off, the greater the chance of jet lag
- B Alcohol will have heightened effects at this altitude
- C Excluding alcohol consumption, swelling is the only problem reported
- D Individuals who are accustomed to higher elevations will have fewer problems

4. Which of the following is not a definitive cause of jet lag?

- A Flight duration
- B Number of take-offs
- C Alcohol consumption
- D Poor air quality

5. According to certain theories, jet lag will be worse when:

- A Traveling east to west
- B Traveling west to east
- C Passengers consuming large meals pre-flight
- D A & C
- E B & C

6. The percentage of all passengers who suffer from some sort of circadian dyschronism:

- A 25%
- B 45%
- C 80%
- D 90%
- E 100%

7. Initially, a disruption of circadian rhythm, may effect:

- A VO2 Max
- B Blood Pressure
- C Muscle strength
- D ALL
- E A & B

8. Choose the passenger who will most likely have the mildest jet lag?

- A Male drinking coffee
- B Elderly
- C Frequent fliers
- D A juvenile
- E All would be equal, dependent on flight experience

9. Melatonin is synthesized by:

- A The retina
- B The hypothalamus
- C Zeitgebers
- D Pineal gland
- E A & D

10. Sleep loss:

- A Has little compelling evidence as to it's initial effect on athletic performance
- B May cause variations of the body's melatonin levels
- C Does not consistently effect muscle strength in the first 72 hours
- D A & C
- E ALL

11. Athletes may be less susceptible to jet lag compared to non-athletes because they:

- A Are less likely to consume alcohol
- B Are considered more physically fit
- C Hydrate better
- D Have a set schedule
- E ALL

12. In order to advance the body's "clock", melatonin could be administered at what time of day?

- A Upon awakening
- B QID
- C In the afternoon
- D Prior to sleeping

13. At 30,000 feet, a jet's cabin is a pressurized to:

- A Sea level
- B 4,000 feet
- C 8,000 feet
- D 30,000 feet

14. Which factor is the primary cause of jet lag?

- A Dry and stale air
- B Trans-meridian flights
- C Alcohol
- D Pre-flight condition

References

1. Copinschi G, Spiegel K, Leproult R, Van Cauter E: Pathophysiology of human circadian rhythms. *Novartis Found Symp.* 2000; 227: 143-157.
2. Leproult R, Copinschi G, Buxton O, Van Cauter: Sleep loss results in an elevation of cortisol levels the next evening. *Sleep.* 1997; 20: 865-870.
3. Martin BJ: Sleep loss and subsequent exercise performance. *Acta Physiol Scand.* 1988; 574: 28-32.
4. Mougou F, Bourdin H, Simon-Rigaud ML: Effects of a selective sleep deprivation on subsequent anaerobic performance. *Int J Sports Med.* 1996; 17: 115-119.
5. Reilly T, Atkinson G, Waterhouse J: Travel fatigue and jet-lag. *J Sports Sci.* 1997; 15(3): 365-369.
6. Skene DJ, Lockley SW, Arendt J: Use of melatonin in the treatment of phase shift and sleep disorders. *Adv Exp Med Biol.* 1999;467: 79-84.
7. Waterhouse J, Reilly T, Atkinson G: Jet-lag. *Lancet.* 1997; 29: 1611-1616.
8. Youngstedt SD, O'Connor PJ: The influence of air travel on athletic performance. *Sports Med.* 1999; 28(3): 197-207.