

Science News | Health Perspectives | Nutrition Trends | Body & Emotional Fitness

WellnessOptions

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No.37

Sports Environment / Lymphatics

Is lightning a threat to outdoor sports?

How heat and smog affect sports performance

New discoveries on lymphatics and cancer

A knowledge institute for health

Are all sugars equally sweet?



Special Edition



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Cover Feature

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Sports and regular outdoor activities are important to both physical fitness and our sense of well-being. However, our body's ability to function and perform efficiently is influenced directly and constantly by the external environment.

In sports, the environment is, therefore, a concern in terms of comfort, safety and performance.

Specific weather conditions such as lightning can, at times, be a threat to sports. The effects of environmental factors such as heat and air quality are well-documented and should be taken into account. Other seemingly harmless features in the environment, such as a small killer caterpillar, may also pose great danger. Being aware of unique environmental risks is very important when travelling or engaging in outdoors activities in unfamiliar territories.

The best prevention is knowledge and precaution. In many cases, unnecessary sport injuries and deaths can be avoided by being prepared and taking the correct precautions steps.

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How often does lightning cause injuries or death?

Lightning deaths and injuries in sports and outdoor activities

When does lightning occur?

Who are the victims?

Typical activity and age of victims when struck

Protection and precaution

The 30-30 rule

Golfing, camping and lightning

Lightning facts

Killer and stinging caterpillars

Heat stress and sports performance

Drop out rate of past Olympic marathon events

Heat stress symptoms and prevention

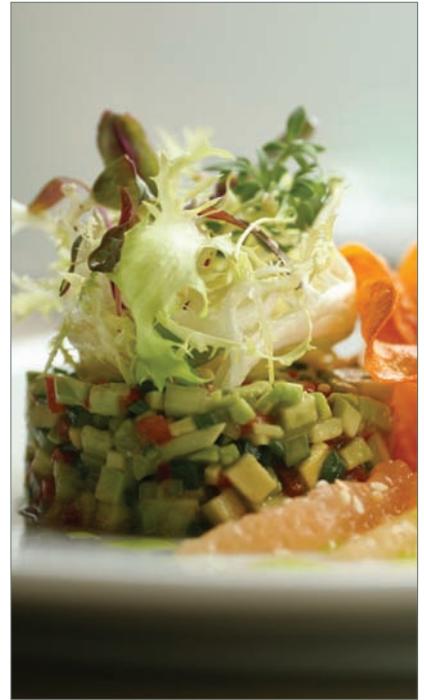
Heat stress and strain on body temperature regulation in sports

When breathing heavily

Air quality monitoring and health index

Exercise for people with asthma

Health impact of various air pollutants



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What will happen to this golf ball?

It is expected that the golf ball shown on this issue's magazine cover will be hit by a golfer.

But a review of 60 golfing events that involve 37 deaths and 117 injuries caused by lightning reports that 29 golfers never made the expected swing. Instead, they were struck by lightning flashes while playing and were either killed or injured.

The study finds that golfers often ignore thunder storm warnings or indications, and do not leave the course when they should. A raised golf club in a thunder storm is especially dangerous. Not only does it conduct electricity, it also contributes to making the golfer a taller target for being struck in the open field.

But data in the report also suggest that there are as many deaths while playing as when the golfers seek safety in the wrong places - under a tree or an umbrella, or in an unsafe structure such as a shed.

Sometimes it is surprising how a single piece of information or a simple realization can significantly change the course of events. Knowing what to do within a very short time – you may only have 30 seconds to safety – may mean the difference between life and death or injuries.

In this issue

Sports and regular outdoor activities are important to both physical fitness and our sense of well-being. However, our body's ability to function and perform efficiently is influenced directly and constantly by the external environment.

In sports and outdoor activities, the environment is, therefore, a concern in terms of comfort, safety and performance.

In this issue of WellnessOptions, we have included a review on lightning and sports safety, and a study on how heat and air quality affect health and sports wellness. A recent report in the Canadian Medical Association Journal documenting the tragic death of a woman killed by caterpillar stings also demonstrates how important it is to learn about potential environmental risks while adventuring in exotic places.

The best prevention is knowledge and precaution. In many cases, unnecessary injuries and deaths caused by environmental factors can be avoided by being prepared and taking the correct precautions.

In the Body section, we present a review of new discoveries on the lymphatic system and cancer. Even though lymphatic circulation was discovered centuries ago, it was thought that its function was limited to returning tissue fluid to the blood circulation system. It was only in the last decade that the essential role of the lymphatic system in immune defense, wound healing, and tissue regeneration was recognized.

With the novel discoveries of lymphatic cell markers, an explosion of new research followed. Better understanding of the lymphatic circulation has significant medical implications for the prevention and treatment of various inflammatory diseases and cancer.

Our Canadian Health Research series continues with a discussion with Dr. Mike Evans on the purpose and the launching of the Health Media and Innovation Lab and the new Li Ka Shing Knowledge Institute at the St. Michael's Hospital in Toronto. It is an innovative, patient-centered research program focusing on translation of medical knowledge into effective health care and patient self-care.

Please enjoy the issue and safe, energizing sports and outdoor activities.

Lillian Chan

Contributors



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Brandie Adams received a Master in Library Information Science from Dalhousie University, working at the Sexton Design & Technology Library. She is the Reference

Librarian at SIRC Sport Research and is involved with indexing, information literacy and research. She contributes regularly to the SportDiscus database in the areas of sports medicine, physical therapy, rehabilitation, sport business and outdoor recreation. She has held tutorials for local high school and college students, members of Sport Canada and visiting African delegates. Recently, she has become involved in SIRC's collaboration with the International Culture, Education, Sports and Ethics Program to promote sportsmanship and fair play in youth sport around the world.

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Lillian Chan has over 30 years of experience in journalism and editing. She has established editorial direction for several publications. She has also served as a Governor and Deputy Chairperson of the Board of Governors at Simon Fraser University.



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He is currently launching The Health Media & Innovation Lab at the new Li Ka Shing Knowledge Institute of St. Michael's Hospital. This will be the first centre of its kind in Canada and will bring together leaders in innovation, design, media, technology and marketing with clinicians and researchers to improve patient education and self-care.

Evans's activities to inform Canadians about health range from being a health columnist for the Life section of the Globe & Mail, to regular commentary on national CBC Newsworld, to being the Chief Editor of the Province of Ontario's health website for the public, HealthyOntario.com. This site has won the "Webby" – hailed as 'the online Oscars' by TIME magazine – for "best government website in the world". He is also the Chief Editor of the 2006 Mosby Family Practice Sourcebook, the fastest selling textbook for front-line clinicians in Canada, and editor of the Complete Canadian Health Guide, which has sold over 100,000 copies to the public.

He launched the renowned Mini-Med School at the University of Toronto in 2004. The Mini-Med School graduates 1,000 laypeople annually after they have attended five interactive weekly sessions with the university's best speakers on medicine. This program is made into a series for TVO, featured weekly in the Toronto Star, Maclean's, the Globe & Mail, and CBC radio. Evans won the 2007 "Healthy U of T" award for the impact of the program on the Toronto community.

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Global eradication of polio and its dilemma

Infection with poliovirus produces symptoms including fatigue, diarrhea, fever and nausea that eventually pass. But, 1 in 100 of infected individuals are paralysed.

Buoyed by its success in eradicating smallpox by vaccination, the World Health Organization (WHO) committed itself to the worldwide eradication of poliovirus, setting the year 2000 as the deadline for accomplishing this daunting task. This deadline was later changed to 2002, then again to 2005, and now, in 2008, the goal has yet to be achieved.

The WHO program has been highly successful in greatly reducing the incidence and extent of polio from 350,000 cases of paralysis in 125 countries in 1988 to 1,083 cases in 2007.

Current status

Of the polio cases in 2007, 984 (91%) were found predominantly in certain regions of only 4 countries where wild poliovirus is still endemic: India, Nigeria, Pakistan and Afghanistan.

The other 99 cases were found in 8 other countries, and are apparently due to poliovirus that had entered the country via persons who had been infected in one of the 4 countries where the virus is endemic.

The zones designated as free of the wild (naturally occurring) poliovirus by the WHO are the Americas, Europe and the Western Pacific.

Vaccines

Two types of vaccine have been used for vaccination against poliovirus. One is based on inactivated (“killed”) poliovirus (IPV) and is injected into the recipient. The other employs active (“live”) poliovirus and is given orally (OPV).

The WHO has been using OPV for eradication, and the strategy was to vaccinate millions of people, especially children, around the globe so that the wild virus would no longer be able to proliferate and infect a population.

OPV is relatively cheap compared to IPV. It is conveniently administered to thousands of people at a time, thus eliminating the cost of syringes and the need for trained medical personnel. It also increases the probability that recipients will accept vaccination if they don’t have to be stabbed with a needle.

OPV is a preparation of live poliovirus that has been attenuated. The virus is genetically changed so that it does not cause paralysis in infected individuals, but is still able to stimulate the individual’s immune system to make antibodies that will protect the body if and when it is infected by the wild, virulent poliovirus.

The poliovirus in OPV actually infects the cells lining the digestive tract, grows in these cells and stimulates the formation of antibodies in the blood and also produces immune activity in the cells lining the intestine. Since the wild, pathogenic, poliovirus enters the body through the mouth, it should be put out of commission by the immunity induced in the intestinal cells by OPV. The poliovirus in the OPV can happily grow in the intestinal cells of vaccinated individuals for years without causing harm.

These viruses are continuously eliminated with the feces from vaccinated individuals, and when sanitation conditions are poor, the eliminated viruses can be ingested with contaminated water by an unvaccinated individual and stimulate immunity in that individual.

Mutation problem

One problem with OPV is that the attenuated poliovirus used in the vaccine is only slightly different genetically from the wild virus and can undergo mutation to change back to wild, pathogenic poliovirus.

This can occur in the gut of an individual vaccinated with OPV, and when the mutated viruses are eliminated in feces, they can potentially infect non-vaccinated individuals. This occurs at a low frequency according to the WHO, which claims that more than 10 billion doses of OPV have been given to more than 2 billion children in the past 10 years with fewer than 200 cases of paralysis being attributed to pathogenic poliovirus derived by mutation from the OPV.

During this period, 33,000 children were paralyzed by wild poliovirus, while more than 3.5 million cases of polio were prevented by the vaccine. It is presumed that children who get the disease from the vaccine-derived poliovirus are children who were not vaccinated with the OPV and so were not protected. When such an outbreak occurs, the WHO will vaccinate all children in the vicinity with 2 to 3 rounds of OPV.

Instances of paralysis caused by virus mutated from OPV have occurred in Haiti, Indonesia and in Minnesota. In the latter case, 5 Amish children who were not vaccinated for religious reasons were affected.

Since 2006, 70 children in northern Nigeria have become paralyzed by virus mutated from OPV. WHO was accused of withholding this information but denies this.

The concern of WHO in the case of Nigeria is that people in the region will balk at vaccination at a time when more vaccinations need to be carried out to eradicate the virus there. But a backlash against the vaccination program did not occur.

Regional differences

The drive to eradicate polio in India started in 1995 using OPV, but despite repeated use of the vaccine, polio is still a problem there. The country has had more than 600 cases of polio each year for 2006 and 2007. More than 70% of cases occurred in the two northern states of Bihar and Uttar Pradesh, which contribute about 32% of the national child population under 5 years of age.

Most of the polio cases that are found in the rest of India have been shown to be due to the wild virus carried throughout the country by migrants from the two states. In addition, the poliovirus strain found in Uttar Pradesh has been carried to Nepal, Bangladesh, Namibia, Angola and the Democratic Republic of Congo.

Reasons for failure

Why is there more polio in these Indian states? It is known that not all children have been vaccinated with OPV and thus are susceptible to polio. However, the fact is that 64% of the polio cases in Uttar Pradesh had received more than 5 rounds of OPV, suggesting that the vaccine failed to induce immunity in a large number of cases.

This failure may be due to genetic factors in this population, or perhaps the nutritional status of recipients affects their response to the OPV, or perhaps the quality of the OPV is involved.

Adding to the problem in India is the existence of polio caused by pathogenic poliovirus derived from the OPV. According to a recent report, the Indian Medical Association has evidence that in 2006, there were 1,600 cases of polio that resulted from the OPV, and it believes that this number may be an underestimate.

This figure is completely at odds with the WHO, which as mentioned above, reported there were only 200 such cases worldwide for the past 10 years. The disparity may be a matter of classifying diseased individuals as genuine cases of vaccine-derived paralysis.

Searching for the right strategy

Eradicating polio in India is crucial for worldwide eradication. Some are questioning the strategy of continuing to use the OPV to accomplish the goal. Since OPV, for whatever reason, seems not to be entirely effective, using IPV have been suggested.

There should be no poliovirus derived from this vaccine since the virus in IPV is “dead”. But IPV is more expensive, requires personnel who know how to inject it, and may even scare off people loathe to be stabbed with a needle.

The WHO sticks by its OPV approach. With funds to continue the program running low, the WHO has issued the following statement:

“Polio eradication will only succeed if the necessary funds are made available and with strong political commitment in polio-affected countries. More than 10 million children will be paralysed in the next 40 years if the world fails to capitalize on its US\$5 billion global investment in eradication.”

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Polio information websites:

- www.polioeradication.org/content/fixed/VDPV_background.asp
- www.thehindu.com/thehindu/mag/2006/11/19/stories/2006111900100400.htm
- www.polioeradication.org/content/general/current_monthly_sitrep.asp



Cycle to walk

Ramesh Ferris is an Indian-born Canadian with a message: the end of polio is within reach. The 28-year-old polio survivor is hand cycling across Canada this year as part of the Cycle to Walk campaign – a fundraising and public education initiative geared to bring polio back to the forefront of people’s minds. To date, the Cycle to Walk campaign has raised over a quarter of its goal of Canadian \$1 million. Cycle to Walk launched from Victoria, British Columbia on April 12, 2008, and will arrive at Cape Spear, Newfoundland and Labrador on October 1. Visit www.cycletowalk.com for more information.

www.cycletowalk.com

Is lightning a threat to outdoor sports?

Dark clouds blanketed the sky and threatened to open up at any moment. All of a sudden, the rain began to pour with torrential fury. The winds were howling, and the thunder and lightning filled the air with an awesome and frightening intensity.



iStockphoto.com/Andrew Penner

Luckily, we were protected and safe in our car. But a team of teenage players in the nearby field sought shelter huddling under the canopy of a large tree.

Oh no, do they not know how dangerous it is to be near a tree in a lightning storm?

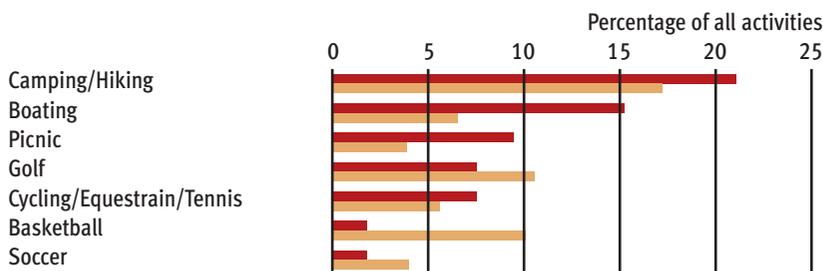
How often does lightning cause injury or death?

In the US, the odds of becoming a lightning victim is 1 in 700,000 in any one year. The chance of being struck in a life time is 1 in 3,000. On an average, 73 people die from lightning strikes each year, and hundreds suffer serious injuries.

While the odds of being struck by

LIGHTNING DEATHS AND INJURIES IN SPORTS AND OUTDOOR ACTIVITIES

Lightning-related deaths (■) and injuries (■) by sport/outdoor activity as a percentage of all activities (indoor & outdoor) studied, 1986-2005
Activities at work, home, other and unknown are not accounted for in this graph



lightning are fewer than one in a million, on an average, 10 Canadians are killed by lightning each year. About 150 are seriously injured, and many suffer permanent neurological disabilities. In fact, lightning kills more Canadians than hail, wind, rain and tornadoes combined, making it a prime safety consideration.

In Canada, more than 94% of deaths and 74% of injuries related to lightning occur during the summer season from June to August. Thursday to Saturday is the period of the week that accounts for almost 55% of all fatalities and over 70% of injuries. This is particularly relevant information to note since many summer outdoor sports and fitness/recreation activities take place during the evenings and weekends.

Outdoor recreation activities account for over 70% of victims killed and over 62% of injuries(see graph).

Who are the victims?

Examples of recent injuries and deaths in Canada:

Toronto, Ontario July 2008: 28 year old man killed by lightning while taking shelter under a tree near a baseball diamond.

Dawson Creek, B.C. July 2007: 15 year old girl struck by lightning after a baseball practice while walking to a car. She felt her feet burning after a fork of lightning surrounded her.

Carp, Ontario July 2007: Five people injured when lightning struck a nearby tree while they played golf at local golf and country club.

Fort Frances, Ontario, 2007: a group of teens were playing soccer on an outdoor field at the time of the storm. Tragically, a thirteen year-old boy was struck and killed by lightning.

When does lightning occur?

Thunderstorms frequently occur on a warm, humid summer afternoon, but may develop at any time of the day or

night. They usually form quickly, travel rapidly and always produce lightning.

Protection

Protection from lightning begins before the storm. Paying attention to weather conditions and forecasts allows time to plan and to react appropriately.

Knowing how lightning behaves can help you determine the safest place to be during a storm. Higher ground, open areas and prominent objects are most vulnerable to lightning strikes.

Since light travels faster than sound, you will see lightning before you hear thunder. Thunder can be a good indicator of lightning proximity – loud crackling means it is close, whereas rumbling means it is further away.

Each second between the flash and the thunderclap represents about 300 metres. As a rule, if you can count less than 30 seconds between the lightning strike and the thunder, the storm is less than 10 km (about 6 miles) away. There is an 80% chance that the next strike will happen within that 10 km, and if you can hear thunder, you are within striking distance.

Go immediately to the nearest well-constructed building or a metal-topped vehicle...there is no safe place to be outside in a thunderstorm.

When thunderstorms threaten, coaches and sports officials must not let the desire to start or complete an athletic activity hinder their judgment when the safety of participants and spectators is in jeopardy.

Precautions to take

Listen for thunder and use the 30-30 rule (see box) at your event as a reference guide for when to seek shelter and resume play.

Postpone activities if thunderstorms are imminent. Prior to an event, check the latest forecast and, when necessary, postpone activities early to avoid being caught in a dangerous situation. Stormy

weather can endanger the lives of participants, staff, and spectators.

A safe building is one that is fully enclosed with a roof, walls and floor with electrical wiring, plumbing, a telephone line, or antennas to ground the lightning should the building be hit directly.

When inside, keep away from the windows, wirings, electrical devices, and telephone – anything that can conduct electrical current. Keep as many walls as

REMEMBER THE 30-30 RULE

When you can count 30 seconds or less between lightning and thunder, head for safe shelter.

Remain sheltered for 30 minutes after the last clap of thunder.

This safety rule is included in the lightning safety policy statements by the American Meteorological Society and the US National Weather Association (www.nwas.org/links/lightning.html).

Environment Canada and SIRC are providing sport themed wallet-sized business cards with the 30-30 rule on them along with some lightning safety tips. (www.sirc.ca and www.weatheroffice.gc.ca).



If you feel your hair stands on end, lightning is about to strike.

This could be a bad sign that positive charges are rising through you reaching towards the negative charged parts of the storm cloud.

If you cannot get inside a safe building or car immediately, crouch down on the balls of your feet. With feet together, put your hands over your ears, and bend down. Make yourself as small a target as possible and minimize your contact with the ground. Do not lie flat on the ground.

TYPICAL ACTIVITY AND AGE OF VICTIMS WHEN STRUCK BY LIGHTNING

Baseball and softball	11-20 years old	During game, coaching, near tree
Soccer	11-20	During game, under tree
Golf	31-40	Under tree, shed or umbrella
Camping	11-20	Inside tent, near tree or tent poles

GOLFING, CAMPING AND LIGHTNING

A review analyzed lightning death and injury data from cases cited in other studies or reported around the world. Some of the findings in relation to lightning casualties and injuries while golfing and camping are as follows.

In 60 cases of golfing events involving 37 deaths and 117 injuries, there are as many deaths while playing as when players sought safety under trees/unsafe structures such as a shed or an umbrella. Golf players often either do not leave the course despite thunder storm indications/warnings, or they may be too far away from a safe shelter.

The report suggests that players should pay more attention to weather condition before golfing, or safe structures at points along the golf course should be installed.

In 50 cases of lightning events with 23 deaths and 228 injuries while camping

and/or in activities involving tents, it seems that staying inside a tent in a camp ground with a tree nearby is especially unsafe (see table). Many situations can be avoided by seeking safety in a nearby bathhouse or inside a metal-topped car.

Main activities of people killed or injured by lightning in 60 golf events

Playing golf	29
Sought safety in unsafe structures	22
Under/next to tree	15
Inside shed	6
Under umbrella	4
Running/heading for shelter	4
Working at course/driving range	3
In parking lot	2
Looking for golf ball	1

Some events have more than 1 entry in the list.

Main activities of people killed or injured by lightning in 50 camping/ staying in tents events

Inside tent	19
Lightning struck tent pole/ nearby tree	19
Sitting outside tent	3
Setting up tent	3
Under tarp or damaged tent	3
Walking in campsite	2
Dismantling camp	1
On swing set in camp ground	1
Resting on rubber mattress inside tent	1
Riding bicycle in campground	1
Running to shelter	1
Sitting in metal chair under tree	1

Some events have more than 1 entry in the list.

LIGHTNING FACTS

It is estimated that the Earth is struck by an average of more than a hundred lightning bolts every second. In the US, an average of 22 million strokes of lightning flashes strike the ground during about 100,000 thunder storms every year. In Canada, lightning strikes once every 3 seconds during the summer months.

An average flash of lightning is packed with enough energy to keep a 100-watt light bulb lit for 3 months. It contains 100 million electric volts, and heats the air around it to almost 27,760°C (50,000°F), which is hotter than the surface of the sun.

About 10% of lightning victims are killed, and 70% suffer long term serious health effects. Injuries include cardiac arrest, severe burns, permanent brain damage, memory loss, sleep disorders, numbness, dizziness and attention deficits.

Everyone who is involved in outdoor activities: soccer, baseball, golfing, tennis, football, swimming, boating, camping, hiking, jogging, walking, picnicking, or working outdoors all need to take appropriate precautions in a timely manner

when a thunder storm approaches.

People on or in or near water are among those most at risk as water is a good conductor of electricity. Swimming is particularly dangerous. A swimmer who protrudes from the water is presenting a potential channel for electrical discharge.

The enormous electrical discharge generated in lightning is caused by an imbalance between positive and negative charges. When colliding particles of rain, ice or snow collide as they swirl around in a storm, they separate the electrical charges. Positively charged ice crystals rise to the top of storm cloud, and negatively charged ones drop to the lower parts of the storm.

The moving storm also gathers positively charged particles along the ground, which travel with the storm. As the differences in positive and negative charges increase, positively charged particles rise up tall objects such as trees, an umbrella, telephone poles or a person.

When the negative charges at the lower parts of the storm are attracted by the positively charged objects on the ground, a

channel is developed. The resulting electric transfer accompanied by a flash of light and a loud crack of thunder is lightning.

A flash of lightning can travel over 8 Km (5 miles). While some victims are struck directly by the main lightning stroke, many are struck as the electric current travels in or along the ground.

For a shelter to provide protection, it must have a mechanism to conduct the electrical current to the ground. On the outside, lightning can travel along the outer shell of the building, or along metal gutters and downpours to the ground. Inside a structure, electric current can travel along wiring, plumbing, and phone lines to the ground.

A structure such as a shed or a rain shelter that has no wiring or plumbing, or no mechanism to conduct electricity from the roof to the ground, offers little protection.

It is also important to avoid touching anything that conducts electricity while being protected inside a building or car.

In the US, phone use is the leading cause of indoor injuries from lightning!

Killer & stinging caterpillars

possible between you and the outside.

An enclosed metal car, truck or van (but NOT a tractor, golf cart, topless or soft top vehicle) is considered a safe shelter. Make sure the vehicle is not parked near trees or other tall objects that could fall over during a storm.

Inside the car, avoid touching any metal or wired device including the steering wheel or plugged-in cell phone. A direct strike to your car will flow through the frame of the vehicle.

Avoid open areas. Stay away from things that are tall (trees, hilltops, flag or telephone poles or posts), water, and other objects that conduct electricity (metal fences, lawnmowers, golf clubs, fishing rods).

If you are in a group in the open, spread out several metres apart from one another.

Stay away from metal bleachers, backstops, bicycles, and fences. Lightning can travel long distances through metal.

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SIRC website: www.sirc.ca

US National Oceanic & Atmospheric Administration, National Weather Service/Lightning Safety website: www.lightningsafety.noaa.gov/

Fatal bleeding syndrome from killer caterpillar sting

A recent report in the Canadian Medical Association Journal documented the case history of a young Canadian woman who died after she accidentally stepped barefoot on 5 caterpillars while traveling in Northeast Peru.

She immediately experienced burning pain shooting up from the affected foot to her thigh after the incidence. A headache also developed. But both symptoms subsided within 12 hours, so she did not seek medical attention.

She returned to Canada a few days later and soon noticed severe bruising. She was admitted to hospital and a blood coagulation abnormality was diagnosed and managed accordingly.

Since caterpillar venom was the suspected cause, antidote was requested from Brazil. Unfortunately during the 48 hours before antidote arrived, an irreversible multi-organ failure developed, and she died.

The *Lonomia* caterpillars that caused the fatal bleeding syndrome are native to South America and not found in North America. In a 5 year period, 688 cases of *Lonomia* envenomations (stings) were reported in the State of Rio Grande do Sul in Brazil.

Adventure travelers to South America should be aware of the dangers of *Lonomia* stings. If antivenin (antidote to the venom) is given within 12-24 hours after the sting, disastrous consequences can be prevented.

Stinging caterpillars in North America

In North America, there are more than 11,000 species of caterpillars. The number of caterpillar species with stinging capabilities is small, and most are harmless. Venomous or stinging caterpillars have hollow quill-like spines connected to poison sacs.

These caterpillars do not attack, but inadvertent contact may break off the

spines (hairs), releasing toxins contained inside the sacs. The spines may penetrate the skin, or the toxin may spill onto the skin.

This causes burning, itching and hives. For most people, the sting produced by most species is generally minor, mild, and short-lived even though it is painful. The severity of the reaction depends on the type of caterpillar, the amount of venom and the sensitivity of the individual. When the spines become wind-borne, they may cause dermatitis and conjunctivitis.

In North America, the Puss Caterpillar sting causes the most severe reaction including: intense burning and nettling of the skin, severe pain, reddening and inflammation, development of pustules and other lesions, numbness, swelling, and nausea. The pain may persist up to 12 hours.

The greatest risk of coming into contact with caterpillars is in the woods. If one lands on you, do not brush it off with a bare hand. Use a stick to remove it so that the fragile spines will not be broken off.

Remove any spines on your skin with an adhesive tape (that you should always carry with you when hiking). Wash the area with soap and water, and put an ice pack or a paste of baking soda on the affected area. If allergic symptoms develop, seek medical help immediately.

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Puss Caterpillar

<http://edis.ifas.ufl.edu>

Running strong in heat and smog

This summer, the temperature has bounced around like a yoyo. One day it is blazing hot and sunny. The next, we are faced with a haze of smog. Heat and smog are issues athletes need to consider seriously before they tie up their laces and head out for a long run or bike ride.

Whether the mindset is competitive or recreational, endurance sport events including long distance running, cycling, and race walking are the most vulnerable to heat and pollution.

Heat stress and sports performance

Heat stress impacts on three aspects of sports participation: comfort, performance, and health/safety.

The most dramatic examples of the detrimental effects of heat stress on performance can be found in the history of the Olympics. Olympic events such as the marathon have high incompleteness rates, often attributed to heat stress and dehydration (see table).

In what was one of the more dramatic examples of heat stress, Pietri Dorando, the Italian favourite to win the 1908 London Olympic marathon, collapsed in front of 100,000 spectators only 100m from the finish line.

Doctors and officials, who feared for his life, ran to assist him. They carried and half-pulled him over the finish line. Dorando was placed on a stretcher and taken to the hospital to recover. He was later disqualified, and the second place runner from the USA, Johnny Hayes, won the race.

When exercising, the human body can reach temperatures of 41°C (from normal body temperature of 37°C), and it may be difficult for the body to cool itself down in a hot, humid environment.

The body temperature may be cooled by radiation (transfer by electromagnetic waves), convection (wind or air movement), conduction (by contact) or evaporation (by sweating). The most

common method of cooling when the surrounding temperature is hot, is through sweating. One litre sweat evaporation results in 600 kcal heat loss.

During exercise, sweat can be produced at a rate of over two litres per hour. In fact, sweat losses of over 6 litres per hour have been recorded in marathon runners. The evaporation process converts the liquid sweat into vapour, thereby creating a cooling effect.

Humid weather is especially challenging to the body because water vapour in the atmosphere makes it difficult for evaporation to take place. Imagine exercising in a rubber wetsuit (not recommended)!

Athletes are not the only people susceptible to heat stress. Spectators must also be careful since they often sit for hours in the hot sun watching events. During the 1992 Grand Prix and trials for the 1996 Olympic Games in Atlanta, organizers had to make frequent announcements over the public address system for everyone to drink before they noticed they were thirsty.

Heat stress symptoms and prevention

Typical signs of heat stress include:

- nausea
- cramps
- clammy skin
- dizziness
- confusion

It is important to note that thirst is not a good indicator of the true need for

DROP OUT RATE OF PAST OLYMPIC MARATHON EVENTS

Year	Location	Start Time	Weather	Drop out rate (%)
1980	Moscow	17:15	Very warm	30
1956	Melbourne	15:13	Sunny, hot	28
1924	Paris	17:23	Warm	48
1912	Stockholm	13:48	Very hot	50
1908	London	14:30	Warm, humid	51
1904	St. Louis	15:00	Very warm	53
1900	Paris	14:30	Hottest race	56

Source: Excerpt from Climate variability of Olympic Games 1896-2000, Peiser and Reilly



METABOLIC HEAT STRESS AND POTENTIAL FOR STRAIN ON TEMPERATURE REGULATION IN SPORTS

	Tennis	Football	Running
Body mass of athletes (Kg)	70.0	95.0	65.0
VO ₂ max (L of oxygen per minute)	4.2	5.2	4.9
Exercise intensity (% VO ₂ max)	60	75	85
Metabolic heat production (W)	880	1330	1410
Sweat evaporation required for heat balance (L per hour)	1.3	2.0	2.1
Predicted steady state core temperature (°C)	38.4	39.2	39.7
Theoretical rise in core temperature if no heat loss occurred (°C per hour)	9.4	14.5	22.5

Source: Brotherhood J (2008) Heat stress and strain in exercise and sport. *Journal of Science & Medicine in Sport*, 11(1), 6-19.

fluids – by the time you are thirsty, the body is already dehydrated.

Drink water and/or fluid replacement drinks before, during and after training. Wear cooler, porous clothing that allows perspiration to escape and reflect the sun. Exercise during the cooler part of the day, morning or evening.

When breathing heavily

Heat is not the only environmental factor that affects sports participation. Smog and air pollution are also major concerns.

While athletes can often train and acclimatize to heat and humidity, it is very difficult to prepare for pollution. Smog is composed of smoke and fog. Common air pollutants include sulfur dioxide (SO₂), nitrogen dioxide (NO₂), ozone (O₃), carbon monoxide (CO), and “particulate matter” (PM₁₀), which is particularly harmful (see box).

In sports, a greater oxygen supply is necessary for the body in order to cope with the increased demand for energy. The lungs have to work harder, and more air passes through the respiratory system. Individuals who exercise or perform strenuous activities outdoors are, therefore, more susceptible to the negative effects of air pollution.

1. While exercising, an individual inhales an average of 20 times more air than at rest, which means 20 times more pollutants pass through the airways.
2. When breathing harder, many people breathe through the mouth instead of the nose. The pollutants inhaled will bypass the body’s filtering system through the nose and travel to the lungs directly.
3. When breathing heavily, the pollutants are inhaled more deeply into the respiratory system.

Air quality monitoring

Easy access to air quality information that allows for better planning of outdoor exercise and activities is important.

Health Canada and Environment Canada have collaborated with numerous partners across the country to develop a health-based approach to presenting air quality information. The Air Quality Health Index (AQHI) is a communication tool designed to help people take appropriate measures to reduce the risk posed by the mixture of air pollutants in Canada.

The AQHI is currently available in British Columbia, The Greater Toronto Area and Saint John New Brunswick (see air quality index page). Work is underway to initiate a transition from the single pollutant threshold based forecast to the new multi-pollutant prediction requirements of the AQHI. Implementation will

AIR QUALITY HEALTH INDEX

The screenshot shows the Air Quality Health Index (AQHI) website for Toronto, Ontario. The page is titled "Air Quality Health Index" and "Toronto". It features a navigation menu with links for Home, Contact Us, Help, Search, and canada.gc.ca. The main content area displays the current AQHI of 3 (Low Risk) observed at 10:00 AM EDT on Thursday, July 31, 2008. Below this, there are sections for "At-Risk Population" and "General Population". The "Forecast Maximums" section shows a forecast of 3 (Low Risk) for Thursday, Thursday night, and Friday. The page also includes a "Who is at risk?" section, a "Did you know...?" section, and a "Forecast Maximums" section. The footer contains the date modified (2008-07-30) and a link to "Important Notices".

Source: Air Quality Health Index website www.airhealth.ca

EXERCISE FOR PEOPLE WITH ASTHMA

People with asthma need to be cautious about their exercise conditions. Exercise induced asthma is quite common. It is estimated that over 27% of the US Olympic team suffer from asthma.

Cold air exacerbates exercise induced asthma. The higher the ventilation and the colder the air breathed in, the greater the asthmatic response.

For a given task and physical activity, the inhalation of cold air leads to a markedly more severe response, while warm, humid air blunts or abolishes it. Activities such as ice hockey, cross-country skiing, and ice skating are more provocative than swimming in an indoor, heated pool. Under the same air conditions, running produces a more severe attack of asthma than walking.

Poor air quality can be particularly difficult for athletes with asthma. A restriction in the upper airway triggered by breathing hard may occur, and this can be exacerbated by smog (see table for health effects of air pollutants).

(Editor's note: Exercise induced asthma and pollution induced asthma work through different mechanisms. The mechanism by which exercise produces obstruction may be related to a thermally produced hyperemia and engorgement of the microvasculature of the bronchial wall and does not appear to involve smooth-muscle contraction.)

The asthma medication used in bronchodilators is considered a banned substance according to the World Anti-Doping Agency list of banned substances. It is necessary to obtain a medical Therapeutic Use Exemption (TUE) prior to competing in the Olympic Games, or the medal won could be revoked if the substance is found in the athlete's body.

Canadian officials test athletes in the years and months leading up to the Olympics to ensure the asthmatic athletes, such as Brent Hayden, the 100 m freestyle world champion, are allowed to use bronchial dilator puffers.

take place gradually across the country over the next couple of years.

Besides monitoring and considering the air quality of the outdoor environment, it is also important to note the physical surrounding before sports participation and exercising. For example, traffic pollution can be carried over 50m, so exercising or training should take place away from traffic.

Running strong

Regular exercise is important, and the health benefits of exercise most often

out-weigh the risks of inhaling pollutants, especially in clean, open, and natural spaces. But we should also check out the temperature and air quality indices to choose the best location and the best time of day to exercise. In high smog conditions, exercising and training indoors is more appropriate.

The heat and smog should not get in the way of your wellness or achieving your athletic goals.

For more on body temperature regulation and sweating, refer to WellnessOptions issue #31; for more on environmental

HEALTH IMPACT OF VARIOUS AIR POLLUTANTS

	Respiratory tract symptoms and acute illness	Exacerbates Reactive airway disease (RAD)	Broncho-spasm in person without RAD	Increased mortality rates in many studies	Implicated in carcinogenesis
PM ₁₀	+	+	+	+	+
SO ₂	+	+	trace	debated	-
NO ₂	+	trace	-	-	-
CO	see text	-	-	see text	-
O ₃	+	+	+	-	-

PM₁₀ (particulate matter)

Particulate matter refers to any particles suspended in air, such as dust, dirt, and smoke, which are 10 µ or less in diameter. These particles can be deposited deep into the lungs and are particularly harmful to health.

It has been shown that PM₁₀ air pollution increased the incidence of cough by 3.7 times, bronchitis by 2.5 times, and earache by 1.6 times in normal healthy children. Asthma symptoms also increased by 1.5 to 2.1-fold in asthma patients exposed to chronically elevated PM₁₀.

SO₂ (sulfur dioxide)

The primary source is from the burning of sulfur-containing fuel. At rest, most of the SO₂ inhaled is absorbed in the nasopharynx. During exercise, more of it is delivered directly to the lungs.

Studies show that exposure is followed by an increase in inflammatory cells in the bronchoalveolar fluid. In healthy individuals, weak measurable broncho-constriction is shown during vigorous exercise at levels of 1 ppm or higher. But in patients with asthma, levels as low as 0.4 ppm can cause shortness of breath and wheezing during moderate exercise.

NO₂ (nitrogen dioxide)

Major sources are motor-vehicles and jet engines. High exposure has been linked with a 24-29% increased incidence of coughing, wheezing, and bronchitis in children. Broncho-constriction and

exercise-induced symptoms have been noted in asthmatic patients exposed to moderately high levels of 0.3 ppm for short periods of time.

CO (carbon monoxide)

Levels can be high near highway interchanges and when traffic is congested. When inhaled, CO readily diffuses from the lungs into the red blood cells. It forms a tight bond with hemoglobin, preventing it from transporting oxygen.

Toxicity symptoms do not appear until a healthy individual has been breathing in CO at a high level of 100 ppm for 8 hours. But at risk individuals are more susceptible. CO in ambient air may produce ischemic symptoms in patients with cardiovascular diseases.

O₃ (ozone)

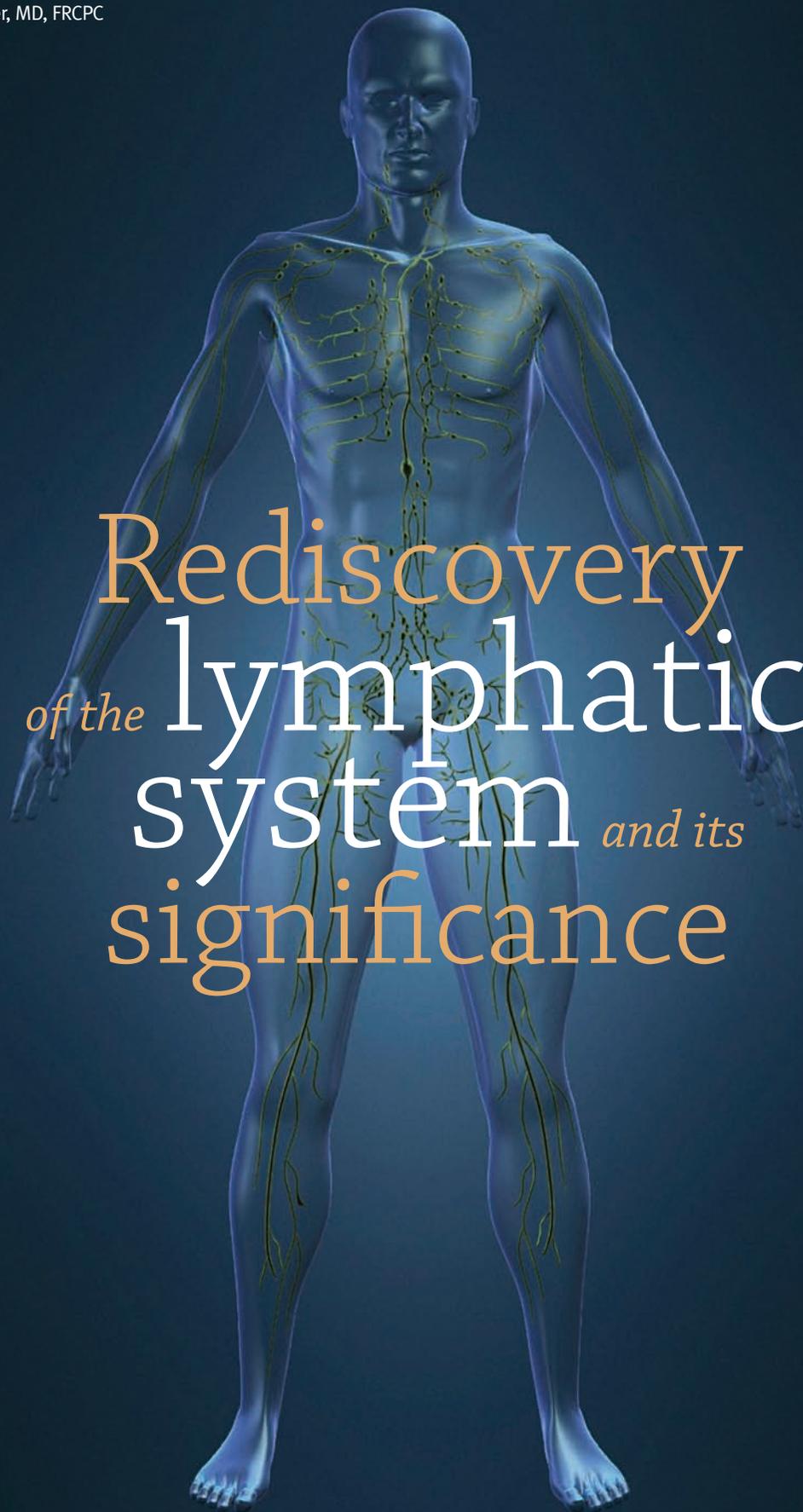
Ozone is created by a series of chemical reactions involving volatile compounds and nitrogen oxides in the presence of ultraviolet radiation. Sources include gasoline and other fuels, paint, and chemical solvents.

Ozone exposure causes eye irritation, chest pain, shortness of breath and cough. Symptoms in healthy individuals have been shown at the low concentration of 0.08 ppm after a day's physical activity of manual labour. In normal adults, an average of 1 mL of FEV₁ (volume of air breathed out during the first second of forced expiration) is lost for every 0.001 ppm increase in ozone.

factors and health, refer to #3, #11, #17, #20, #23, #24; for body energy, refer to issues #9 and #30.

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Rediscovery
of the lymphatic
system *and its*
significance

Lymphatic fluid was discovered centuries ago. But it was thought that our lymphatic circulation only served as a transport system returning tissue fluid to the blood circulation.

It was only in the last few decades that the essential role of the lymphatic system in immune defense, wound healing, and tissue regeneration was recognized.

Novel discoveries of lymphatic cell markers since the last decade, and the explosion of medical research that followed, have unraveled new insights.

Better understanding of our lymphatic circulation has significant medical implications for the prevention and treatment of various inflammatory diseases and cancer.

Lymphatic circulation

Lymphatic circulation is essential for life. When genetic defects prevent the development of lymph vessels in the foetus, it cannot survive.

The lymphatic system consists of lymphatic vessels, lymph nodes and the lymphatic organs – the thymus, the tonsils, Peyer’s patches in the gut, and the spleen. This system has multiple functions.

The lymphatic system complements the blood circulatory system in sustaining the correct amount and composition of tissue fluid in the body. It plays an important role in the body’s immune defense and in inflammation. But it can also propagate malignant cells resulting in metastases of cancer.

Long road to rediscovery

Lymphatic fluid was observed and recorded a long time ago. Hippocrates around 400 BC saw vessels containing “white blood”. Aselli (Italian physician) reported “milky veins” in the dog’s gut in 1627.

What they saw were lymph vessels containing fat absorbed from food and transported after a meal. The lymph in other parts of the body is a clear fluid.

We have learned much about the blood vessels and blood circulation in health and disease states. By comparison, much less attention has been given by medical science to the lymphatic system until recent decades.

Even in the second half of the last

century, while an abundance of new knowledge was gathered about the active role of blood vessels in cardiovascular disease, the centuries old view on the role of the lymphatic vessels still prevailed. It was thought that lymphatic circulation served only as transport pipes returning fluid from the tissues to the blood stream.

(For more on fat metabolism, refer to WellnessOptions #21).

New explosion of findings

The tide of research interest started to change during the last decade of the 20th century, when the vascular endothelial growth factor receptor (VEGFR-3) on the lymphatic endothelial cells was recognized.

Subsequent search for the molecules that bind to this receptor led to the identification of vascular endothelial growth factor-C and D (VEGF-C, VEGF-D) as its ligands.

Another explosion of studies started when UK biochemist DG Jackson discovered in 1999 a unique lymphatic endothelial cell marker, the lymphatic vessel endothelial hyaluronan receptor (LYVE-1).

Hyaluronan (a glycosaminoglycan) is found in the extracellular matrix. It is primarily involved in cell adhesion and cell migration. Jackson described LYVE-1 expressed on the surface of lymphatic endothelium.

This discovery enabled the unequivocal identification of lymphatic endothelial cells and their differentiation from the endothelial cells of blood vessels.

Besides the recognition of lymphatic cells in cell culture, these discoveries also facilitate other studies such as the study of the normal development of lymphatic vessels in the foetus, and genetic abnormalities of lymphatic vessels caused by mutation.

Since then, several lymphatic cell markers have been discovered, and slowly, the sequence of gene activations during lymphatic vessel development and their responses to varied stimuli are elucidated.

Implications & research focus

The use of specific cell markers and the

WHAT IS LYMPH?

All the cells in the body are bathed in a fluid called tissue fluid or interstitial fluid. Water, protein, nutrients and oxygen delivered by the blood to the tissues pass from the blood capillaries to the cells through this fluid. Similarly, carbon dioxide and metabolites from the cells cross through the tissue fluid back to the blood capillaries.

However, this process is neither perfect nor complete. More water and protein leave the blood capillaries than are returned. The lymphatic capillaries pick up and transport the excess through the lymphatic vessels to the large veins and back to the blood circulation.

White blood cells, bacteria, viruses, other large molecules (macromolecules), and fat absorbed in the gut from food are transported by the lymph. The composition of the lymph depends on which organ it drains. Some examples of protein content are given in the table here.

APPROXIMATE PROTEIN CONTENT OF LYMPH IN HUMANS

Lymph source	Protein content (g/L)
Liver	62
Heart	44
Digestive tract	41
Lung	40
Skin	20
Skeletal muscle	20

emerging results from recent studies give us new insight and perspective in the active role of the lymphatic vessel endothelium.

The recent review written by Oliver and Detmar entitled “The rediscovery of the lymphatic system” reflects how our understanding of the lymphatic vessel has fundamentally changed.

Investigation of the lymph vessels and their role in wound healing, in inflammation, in transplant rejection, and in the spread of malignant tumours is expected to yield important knowledge with significant medical implications in the near future.

THE LYMPHATIC CIRCULATION

The lymphatic capillaries merge into pre-collecting and then larger collecting lymph vessels which empty into major central veins. The wall of the lymphatic capillaries is a single layer of endothelial cells. Muscle cells appear in the walls of the pre-collecting and collecting vessels.

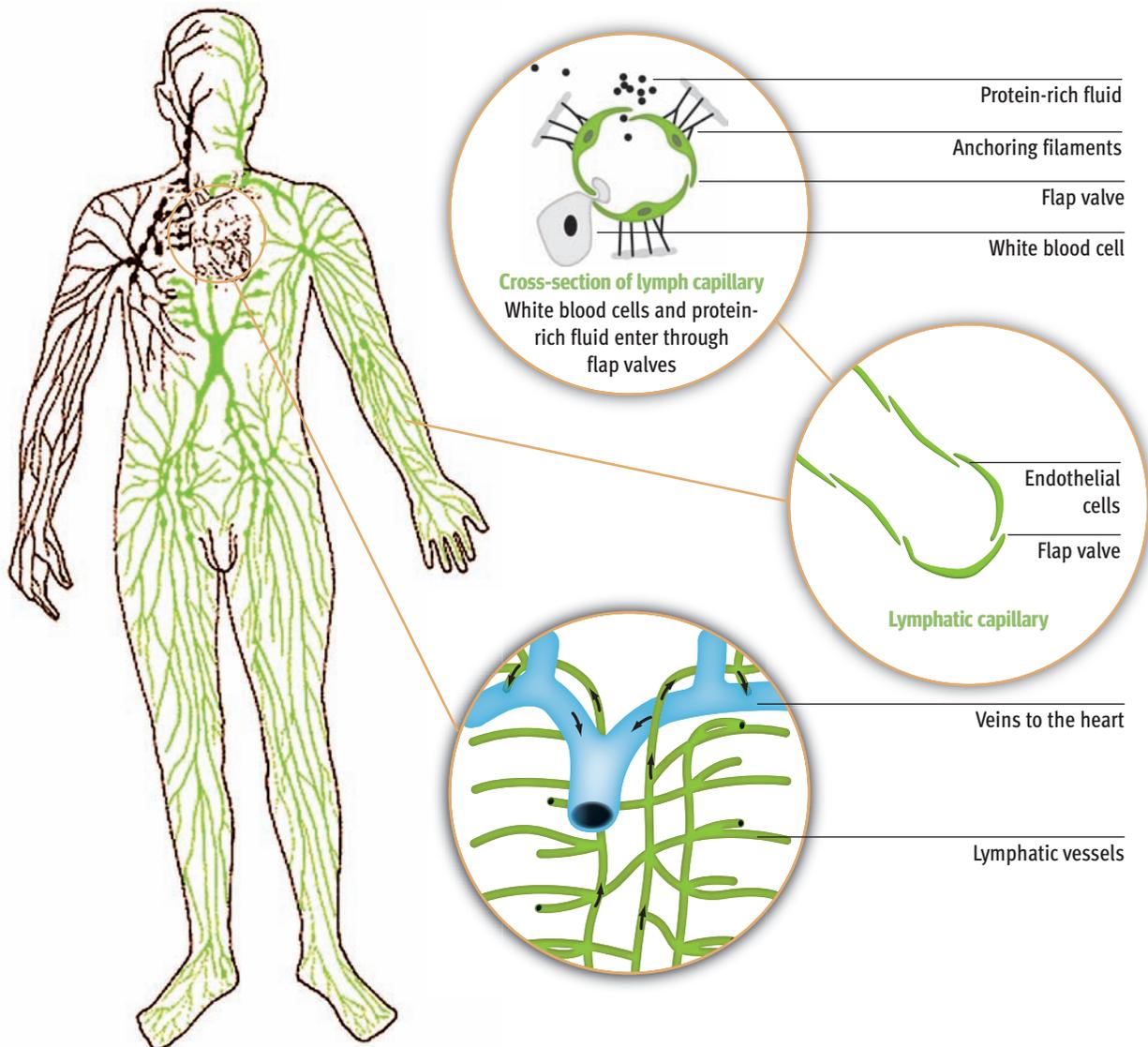
The driving force of lymphatic flow is the pumping effect by surrounding skeletal muscles and the rhythmic contraction of the collecting lymph vessels' own smooth

muscle cells. Funnel valves in the collecting vessels prevent backflow.

Except for the cornea, cartilage, outer layer of the skin (epidermis), the brain, bone marrow and the retina, all tissues have lymph vessels.

On its travel, the lymph passes through lymph nodes. These structures are all along the lymphatic circulation, but there are specific sites where they cluster, such as the groin, neck, armpit, chest and abdomen.

The lymph nodes play an important role in the immune defense of the body. As the lymph flows through the lymph node, foreign materials such as viruses and bacteria are presented. A cascade of immune response follows, which may cause swelling of the lymph node. The critical role of the lymph nodes in tumour metastasis is well recognized.



New lymphatic vessel growth and cancer

In adults, the lymphatic endothelial cells are unperturbed (in a quiescent state). However, wound healing, inflammation and cancer can stimulate new lymphatic vessel formation (lymphangiogenesis).

How lymph vessels start to grow

For a century, two theories have been competing to explain the origin of lymph vessels.

In 1902, FR Sabin suggested that the primary lymphatic sacs bud from the embryonic veins and then from these, the

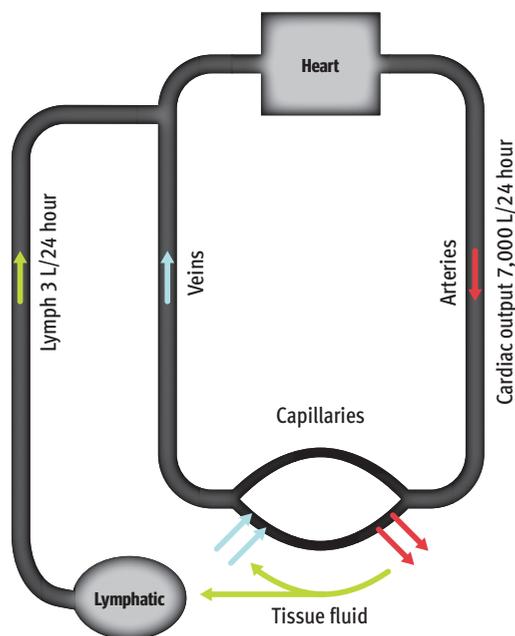
lymphatic vessels sprout. In 1908, GS Huntington suggested that the lymphatic sacs originate from precursor cells, independent of veins. These researchers developed their theories with only the microscope as their tool for observation.

Since there were no known lymphatic markers, the study of the lymphatic vessels was a neglected field for several decades.

By the end of the last century, several sophisticated research methods such as molecular techniques, cell cultures, and mouse models with impairment of

SCHEMATIC REPRESENTATION OF THE TWO CIRCULATORY SYSTEMS

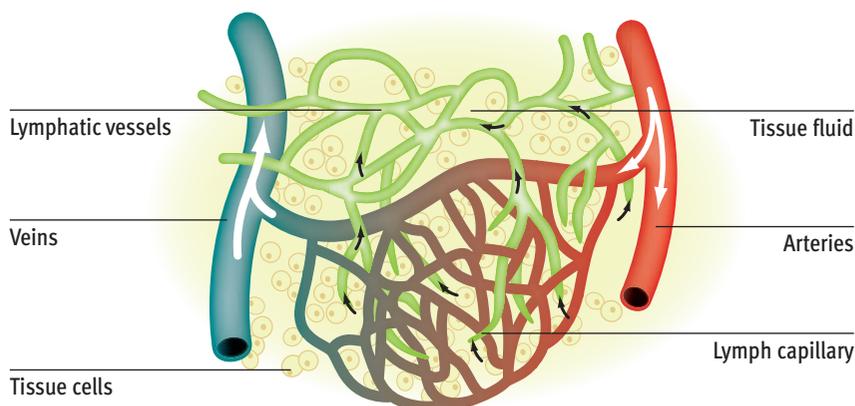
In contrast to the blood circulatory system, the lymphatic circulation flows in one direction, from the periphery to the centre, and it has no pump. The blood and lymphatic circulations work in concert to maintain the ideal amount and composition of tissue fluid. Figure shows the volume contributions of the two systems.



LYMPHATIC CAPILLARIES

The lymph vessels start close to the blood capillaries in the tissue fluid as blind-ended tubes. Their wall is a single layer of endothelial cells kept open by anchoring filaments similar to the ropes of a tent. The endothelial cells are less tightly connected than in the blood capillaries and overlap somewhat, creating a valve-like structure referred to as "flap valves".

These intercellular openings allow for an easier entry of proteins and other macromolecules.



Body Lymphatic System

lymphatic function became available. These technologies make it possible for researchers to identify cell markers and the molecular control that are specific to the lymphatic circulation system.

The appearance of certain markers at different stages helped to unravel the genes that control the maturing of the lymphatic system.

In the foetus, the development of the lymphatics lag behind that of the blood vascular system. The earliest marker called PROX-1 appears in certain groups of venous endothelial cells. Soon after that, another lymphatic marker LYVE-1 emerges.

The endothelial cells expressing both markers are dedicated to the lymphatic fate. They start budding from the capillary veins, then separate to form lymph sacs. From these, the lymphatic vessels sprout.

Receptors and growth factors that bind to them are involved in the normal development of the lymphatic circulation system.

The receptor VEGFR-3 identified as specific to the lymphatic endothelial cells belongs to the group called Vascular Endothelial Growth Factor Receptors (VEGFR). The ligands that bind to it are VEGF-C and VEGF-D, members of the Vascular Endothelial Growth Factor (VEGF) family.

When the ligands bind to the receptor, a pathway is activated, resulting in new lymphatic capillary formation.

These observations support Sabin's theory that the lymphatic system develops from the blood circulatory system. Lymphatic vessels' appearance follow that of the blood vessels during tissue regeneration, wound healing, inflammation, and cancer. (However, special precursor cells may play a role in certain disease states).

New lymphatic vessel formation and cancer

In wound healing, inflammation and cancer, inflammatory and tumour cells

produce growth factors that bind to VEGFR-3 and initiate sprouting of new lymphatic vessels.

Tumours that produce high levels of VEGF-C and VEGF-D are more aggressive.

Our knowledge of the players and our understanding of the mechanisms of metastasis formation is growing. Recent observations indicate that lymphangiogenesis starts in lymph nodes before malignant cells arrive, thus "preparing the soil" before the actual homing of metastatic cancer tumour cells.

In animal experiments, it has been shown that the following strategies could prevent tumour metastasis:

- blocking VEGFR-3 that prevents the binding of growth factors
- neutralizing VEGF-C and VEGF-D with antibodies to inactivate the growth factors

These findings hold hope for human cancer patients that more precisely targeted treatments that are potent and safe will be available in the future.

LYPHHEDEMA, A LYMPHATIC DISORDER

In lymphedema, a lymphatic disorder, lymphatic drainage is insufficient or blocked, resulting in protein-rich fluid accumulation in the tissues. In the early stages, this disorder is asymptomatic. But later on, swelling develops behind the blockage.



Changes in the lymph vessels and in their surroundings occur gradually with time. They become fibrotic and lose permeability. Collagen and fat then accumulates in the affected area, with connective tissue overgrowth. In the most severe form, lymphedema becomes disfiguring (see photo).

Lymphedema is a chronic disease. It is different from venous edema, in which water seeps out from the blood capillaries.

Primary lymphedema is caused by developmental deficiencies of the lymphatic circulation that result in inadequate lymphatic drainage. These can be isolated cases or familial.

Secondary lymphedema is much more common than the primary form. Some known causes include trauma, inflammation, radiation, surgical removal of lymph nodes, or invasion by malignant growth into the lymph vessels.

Swelling of the arm after axillary lymph node removal due to breast cancer may

occur. Breast cancer surgery is the leading cause of secondary lymphedema in industrialized countries.

In the tropics and subtropics, a parasitic infection, filariasis, is the most common cause of lymphedema. According to the World Health Organization, 90 million people are infected with filarial nematodes, in which massive lymphedema deforms the limbs and often the genitals.

This disfiguring form of the disease is also referred to as elephantiasis. The quality of life of such patients is very poor not only because of the physical disability, but also because of the additional psychological burden.

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Integrated medical treatment more prevalent

Complementary and alternative medicine (CAM) has made an increased presence in the US health care system. This is also true in Canada, Australia, Denmark and the United Kingdom, where reports of CAM use vary from 9 to 65%.

A report published in 2007 studied the use of CAM among US military populations. It shows that the use of CAM is significant, even though this group has ready access to conventional medicine.

In this study, CAM was defined as one or more of the following treatments: acupuncture, biofeedback, chiropractic care, energy healing, folk remedies, herbal therapy, high-dose megavitamins, homeopathy, hypnosis, massage, relaxation, or spiritual healing.

Based on a return of 1,305 completed questionnaires, 37% of the respondents reported using at least one CAM therapy during the past year. Herbal therapies were used the most (16%). This is followed by massage (14%), high-dose megavitamins (11%), and relaxation (10%). Most respondent (69.8%) reported their health as excellent.

The study reported that the prevalence of CAM therapy within the US military is consistent with patterns in other US civilian populations. It also recommended that conventional medical professionals should inquire and record the use of CAM therapy among their patients when collecting medical history data.

According to Grace Keenan, MD, director of an American integrative medical facility in North Virginia, integrative medicine is a complete approach to healthcare. "It offers an individual more options than traditional medicine, lessening costs, side effects, and drug interactions."

"This approach places self-care central to healthcare, allowing the patient to work with medical providers to optimize the benefits of diet, exercise, and natural therapies such as herbs, along with using prescription medications and invasive techniques only when needed."

Keenan is internist and founder of the four-site integrative health facility that includes a group of family doctors, medical

specialists, and holistic health practitioners. She treats member of the US military using the integrative approach.

"Similar observations had been made among cancer patients," according to Teresa Clarke, MD, director of clinical services at an integrative cancer care centre in Vancouver. "Most of our patients chose conventional treatment such as surgery, chemotherapy or radiation that target the disease. But in addition, they also engage in the other aspects of treatment that target the self-exercise, diet, vitamins and supplements, and so on."

"By supporting the health of the "self" we can improve our immune system and other inner healing resources to improve the quality of life and achieve a better treatment outcome," she said.

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Whatever happened to bird flu H5N1?

It's still around...

Although the H5N1 influenza (bird flu) virus has not triggered a flu pandemic among humans, it remains a potential threat since the virus could eventually evolve the genetic apparatus that would allow it to spread from human to human.

While alarms of a possible pandemic have virtually disappeared from the popular news media, research efforts to produce an effective vaccine have continued since 1997, when the virus first caused disease in humans in Hong Kong.

Producing a vaccine against H5N1 has proven more difficult than making vaccines against other influenza viruses that have infected humans in the past. One problem is in the difficulty of growing the virus to produce the vaccine.

Up until now, the commercial production of flu vaccine involved growing the flu viruses in chicken eggs containing embryos. (see *WellnessOptions* #14, and #17) However, in the case of H5N1, the virus rapidly kills the embryos so that there is little growth of the virus, making it difficult to obtain sufficient virus for the large quantity of vaccine that would be needed to avert a pandemic.

A recent report shows that it is possible to grow H5N1 flu virus (isolated from an infected human in Vietnam) in monkey kidney cells cultured in large vats, eliminating the need for chicken eggs.

Vaccine prepared from virus grown this way was shown to stimulate antibodies in 275 human volunteers given 2 doses of the vaccine. These antibodies could neutralize

two other strains of H5N1 that have infected humans in addition to the one used to prepare the vaccine. The vaccine had no serious adverse effects.

By using the monkey cells and by modifying other procedures usually used in flu vaccine production, flu vaccine production takes 12 weeks as compared with 22 weeks for previous methods that employ chicken eggs. This 10 week reduction could provide valuable time in gearing up for vaccine production when a pandemic threatens. More trials are underway to further evaluate the vaccine's effectiveness and safety.

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Avocado tartar with pink grapefruit, sesame and sweet potato chips

Serves 4

Ingredients

2	Ripe avocado
½	Red bell pepper
¼	Small English cucumber
1 tsp	Lemon juice, freshly squeezed
1 tsp	Lime juice, freshly squeezed
1 tsp	Orange juice, freshly squeezed
1	Large pink grapefruit
3 dash	Tabasco sauce
3 dash	Worcestershire sauce
1½ tbsp	Olive oil
To taste	Salt
To taste	Finely ground black pepper
1 head	Blonde or spider frisee, picked and cleaned
1 package	Sprouts, radish, or coriander
3 tbsp	Sesame seeds, lightly toasted
2 tbsp	Olive oil
1	Sweet potato
1 litre	Canola oil in a tall 4 litre pot

Special Equipment

- 1 set of round ring molds
- 1 Japanese mandolin
- Oil thermometer

Preparation

Dice peppers and cucumber as small and uniformly as possible, as they add texture, color and crunch to the dish. Dice avocado slightly larger than the peppers and cucumber, and place all three ingredients in a medium stainless steel mixing bowl.

Add lemon, lime and orange juice, Tabasco, Worcestershire and 1½ tbsp olive oils to the above and gently mix. Season to taste with salt and finely ground black pepper. Cover with plastic wrap, and set in fridge until ready to plate (this will keep for up to two hours).

Using a sharp knife and clean cutting surface, cut the top and bottom of the grapefruit off and stand it up straight. Remove peel from top to bottom with knife, keeping the circular shape of the grapefruit.

Once all skin is removed, skim with knife to make sure all white pith has also been removed. Remove each “section” (referring to the cleaned, skin free pulp of the grapefruit). Squeeze any remaining juice from skin onto grapefruit sections and set aside in fridge.

Peel sweet potato. Using a Japanese mandolin, slice the potato to 1/16-inch rounds. Heat canola oil to 275°F and fry chips (5-6 at a time) until light golden brown. Remove and season lightly with salt. Reserve until ready to plate. They will keep for up to 3 days in an airtight container.

Presentation

Visualize three circles all meeting in the centre of the plate. The first circle, the ring mold, is the most important as it will set the design for the rest of the dish. Fill the ring mold up to the top with avocado mix, remove the mold and repeat for each dish. Place two or three sections of grapefruit at the base to form a second circle.

In a small stainless steel mixing bowl, toss sprouts and frisee with reserved grapefruit juice and 1 tbsp of olive oil. Season with salt and fine ground pepper to taste. Place on top of the avocado mix.

Build a stack of chips in the third circle. Garnish with 1 tsp of toasted sesame seeds and remaining olive oil. Serve immediately.

Sugars



What are sugars?

Sugars are carbohydrates in their simplest chemical form. In our food, carbohydrates are divided into two basic forms: simple and complex. Simple carbohydrates are one, two, or at most three units of sugar linked together in single molecules. Simple carbohydrates are commonly referred to as sugars, while complex carbohydrates are called starches or fibre.

Sugars and starches are consumed for energy. One gram of sugar consumption provides 4 calories of energy, and one gram of starch also provides 4 calories. But one gram of fibre provides no calories because the human body cannot digest fibre.

Sugars in food taste sweet, while complex carbohydrates such as starches and fibre are pleasant to the taste buds, but not sweet.

Building blocks of sugars

All carbohydrates are made up of the elements carbon, hydrogen and oxygen

combined in various ways and in different numbers. These three elements form chemical units called saccharides, which are the building blocks of a variety of sugars (mono- and di- saccharides) and complex carbohydrates (poly-saccharides).

Three types of mono-saccharides (single-unit sugars) important in human nutrition are glucose, fructose and galactose.

Glucose is the primary break down product of other carbohydrates in food. Glucose is also found in some fruits and plant juices. Fructose is found in fruit, vegetables and honey. Galactose does not occur in a free state but is one of the two sugar units that form lactose, the sugar found in milk.

Di-saccharides are double-unit sugars. Sucrose, better known as table sugar, is a di-saccharide (double-unit sugars) made up of equal amounts of glucose and fructose. Other di-saccharides include lactose, which is only found in milk, and maltose, which is produced by the breakdown of starch found in grains.

Where does brown sugar come from?

Brown sugars, golden or dark, are pure white sugars combined with a heavier coat of molasses. They are refined white sugar crystals that are covered with a fine coat of syrup (molasses) selected for colour and flavour. The differences in colour and flavour between different kinds of brown sugars depend on the amount of molasses present. The more molasses is added, the stickier the crystals, the darker the colour, and the stronger the flavour.

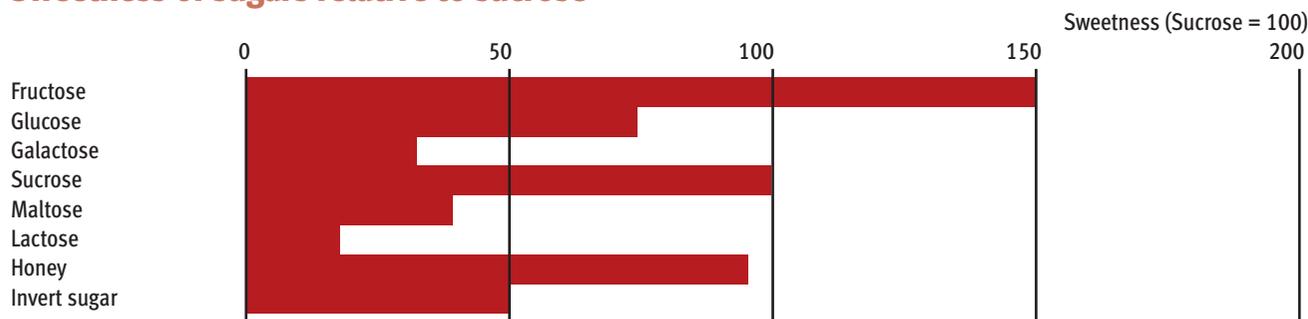


iStockphoto.com/Michael Utech

Carbohydrate classification with sweetness scale and energy significance

Type of carbohydrate		Relative sweetness scale	Energy provided	Food sources
Simple mono-saccharide	Glucose	(70-80)	Fast burning energy most preferred by the body	The main sugar produced when carbohydrates are digested.
	Fructose	(140) Sweetest		Fruit, vegetables, honey, or added to some foods as an ingredient.
	Galactose	(35)		Produced by the breakdown of lactose, a sugar only found in milk.
Simple di-saccharide	Sucrose (Glucose + Fructose)	(100) Sweet	Fast burning energy	Table sugar
	Lactose (Glucose + Galactose)	(20) lightly sweet		Found only in milk
	Maltose (Glucose + Glucose)	(30-50)		Produced by the breakdown of starch, and found in grains and malt.
Complex Poly-saccharide	Starch (Long chains of mostly glucose units)	Not sweet	Longer lasting, slower burning energy	Grains, vegetables and fruit
	Fibre/cellulose (Long chains of mostly glucose units)	Not sweet	Not digested, glucose not accessible for energy, aids digestion and promotes regularity in digestion/bowel movement	Found in grains, vegetables and fruit

Sweetness of sugars relative to sucrose



Source: http://academic.pgcc.edu/~ssinex/blt/carbohydrates/sugars_graph.gif

Role of sugar in food

The main sugars in food are sucrose, glucose, fructose, maltose and lactose. When we talk about sugar, we are generally referring to sucrose, which is mainly produced from two main sources: sugar cane or sugar beet. In addition, simple sugars are commonly

found in fruit, fruit juices, vegetables, honey and milk.

Sugars play many important roles in our food supply. Sugars produce the sensation of sweetness, contribute aroma, texture and colour to food. Sugars are also a source of energy. All sugars provide the same amount of

energy regardless of the source and sensation of sweetness.

But not all sugars are equally sweet. The degree of sweetness of a food is not always the best indication of the amount of sugars present. For example, as shown in the sweetness scale table, fructose is sweeter than sucrose.

Some types of sugar

Name	Description	Measure	Weight g	Energy kcal	Carbo-hydrate g	Total Sugar g
Brown sugar	White granulated sugar blended with small quantities of molasses for extra flavour.	5mL (1 teaspoon)	5	18	5	4
Honey	Made by bees from the nectar of a flower. Honey's sweetness comes from fructose and glucose.	5mL	7	22	6	6
Icing sugar (powdered)	Finely ground granulated sugar, contains approximately 3% starch, an anti-caking agent to prevent clumping.	5mL	3	10	2	2
White table sugar (granulated)	Pure sucrose. The most common form of refined sugar, made by extracting the juice from sugar cane stalks or sugar beet roots, then dried to harvest the sugar crystals. Sold in varying crystal or granule sizes including: Coarse, Medium, Fine, Extra Fine	5mL	4	16	4	4
Maple syrup, maple sugar and flakes	Mostly sucrose. Maple syrup is made from the sap of maple trees by boiling it down to a syrup or sugar consistency.	15mL	20	55	14	12
Molasses	Dark coloured syrup left after the sugar cane and sugar beet refining processes. It has a distinctive colour and flavour.	15mL	21	62	16	12
Pancake (golden) syrup	Table syrup containing sucrose and invert sugar (sucrose broken down into its two component sugars, glucose and fructose). Made from selected blended refinery cane syrups, which are thickened by evaporation. Used in recipes as a syrup topping.	15mL	20	47	12	7

Sugar performs many essential technical functions in food. For example, sugar is a natural preservative. By attracting water, sugar prevents the growth of harmful bacteria and keeps the food from spoiling. Most microorganisms do not grow in honey because of its low water content.

Sugar is also added to food to produce browning characteristics. In baking, sugar provides a source of nourishment for the growth of yeast, which contributes to the leavening process. Sugars or other carbohydrates (with the exception of lactose) can also be used to produce alcohols by fermentation.

The process of extracting and purifying sugars from sugar cane and sugar beet allows for the production of a large variety of sugars. Sugars come in many types with distinctive flavours, crystal size and uses: dry crystals, powders, moist brown sugars or thick syrups.

Nutritional recommendations

Carbohydrates are the preferred source of energy for the body and help provide essential nutrients. Dietary Guidelines recommend obtaining 45% to 60% of energy intake from carbohydrates, including starch and sugars. The US Institute of Medicine (IOM) also suggests a minimum of 130 grams of carbohydrate per day for normal brain function.

However, not all carbohydrates are nutritionally equal. "Added sugars are those incorporated into foods and beverages during production, which usually provide insignificant amounts of vitamins, minerals, or other essential nutrients. Major sources include soft drinks, fruit drinks, pastries, candy, and other sweets. Added sugars should comprise no more than 25% of total calories consumed," according to the IOM.

Starch is the main form of complex carbohydrate in our food. Common sources of starch include flour, potatoes and legumes (beans, peas) as well as cereals, vegetables and fruit. High-fibre whole grains like barley, brown rice and oats are great sources for complex carbohydrates. Foods containing complex carbohydrates are often accompanied by significant amounts of other nutrients including dietary fibre, vitamins and minerals.

When purchasing packaged foods, use the Nutrition Facts table on labels to find out about the nutritional value, and compare products. You can achieve balance and moderation in sugar consumption by choosing more nutrient-dense foods.

Cooking and baking tips

When fruits ripen, the starch is changed into sugars, giving the sweeter taste associated with ripe fruits. Instead of

What is high-fructose corn syrup?

Corn syrup is made from corn and primarily contains the sugar glucose. High fructose corn syrup is a mixture of glucose and fructose produced from corn. The most common form of high fructose corn syrup has 55% fructose and 45% glucose, similar in composition to sucrose (table sugar). Its relative sweetness is rated as 120-160 as compared to 100 for sucrose and 140 for fructose.

using simple sugars, try to substitute ingredients in recipes for sweetening purpose with fruit or fruit juice.

Reduce the sugar in everyday recipes. You can often reduce the sugar by about one-third without changing the taste or the texture. Start by reducing the sugar a bit and see if the flavour and texture is still to your liking.

Oil in a muffin or quick bread recipe may be replaced with a sweet fruit puree like apple sauce.

Use fruit juices and frozen fruit juice concentrates instead of sugar to sweeten baked goods. You may also bring out the flavour of sweet potatoes or carrots with a no-fat topping by adding a dash of brown sugar, maple syrup or apple jelly.

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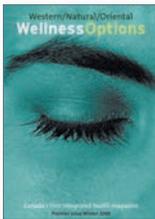
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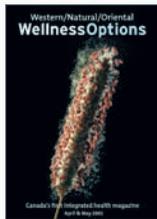
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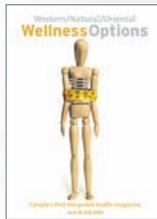
1: Eye/Hypertension



2: Sleep



3: Allergy



4: Body Image/
Diabetes



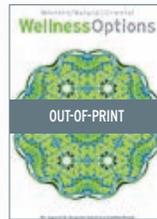
5: Sexuality & Health



6: Pain



7: Aging/Hormone
Imbalance



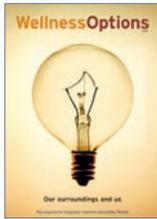
8: Mood and
Addiction/Depression



9: Life Energy



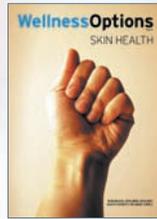
10: Heart Health



11: Our Surroundings
and Us/Stress



12: Emotional Fitness/
Traumatic Stress



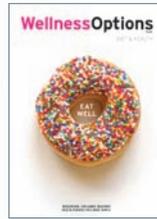
13: Skin Health



14: Infectious Diseases



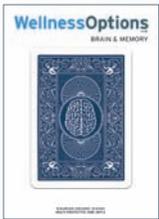
15: Healthy Joints



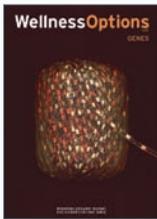
16: Diet & Health



17: Lung Health



18: Brain & Memory



19: Genes



20: Smell/Taste/
Allergy



21: Stroke & Fat Facts



22: Dental Health



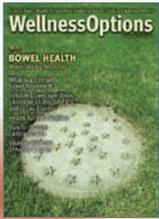
23: Work & Health



24: Early Development



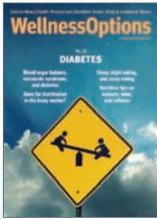
25: Digestion &
Absorption



26: Bowel Health



27: Consciousness



28: Diabetes



29: Bone



30: Exercise



31: Clothing



32: Men's Health



33: Hearing



34: Bread for Health



35: Appetite Control



36: Balance/
Hypertension



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