WINTER HEALTH

Winter seems to challenge our capacity to live a 'circadian-friendly' life. ***Fleur Borrelli*** *examines the impact this may have on our health…*

Winter begins as our cushy arrangement with summer time, or daylight saving time, ends. At the end of autumn, the clocks are cruelly adjusted so that the nights are even longer and the days even shorter. The harsh drops in temperature that accompany the darker days tend to threaten our physiological, mental and emotional well-being. Winter seems to be aligned with greater levels of stress and depression, sensitivity to cold, over-eating, lack of exercise and increased susceptibility to winter bugs. Is there a way out of the poor winter health trap?

DISRUPTION OF BIORHYTHM

One of the determining factors in winter health is the disruption of biorhythm. Typically, we should be going to bed at sunset and rising at sunrise. It was Benjamin Franklin who was said to have coined the proverb; "Early to bed and early to rise makes a man healthy, wealthy and wise." As an industrialised society, we set our working day by the clock rather than by the solar system, which may go against our natural evolutionary rhythm. The suprachiasmatic nucleus is considered to be the biological clock of the human brain; it regulates a large number of neuroendocrinological functions that are affected by changes in the level of sunlight and darkness. Because it communicates with organs such as the pineal gland, to maintain the right biorhythm, any deviation from this may result in stress, depression and cardiovascular conditions[1].

SLEEP DISTURBANCES

Melatonin is a pineal gland secretion implicated in the regulation of the circadian rhythms. Synthesised from L-tryptophan, melatonin is released from the pineal gland and undergoes rhythmic fluctuations over twenty-four hours. Because melatonin peaks at night and decreases during daylight hours, it is considered to be the time regulator of the sleep/wake cycle and reproduction[2]. Abnormal fluctuations in this cycle may therefore affect both sleep quality and menstruation. Even short-term sleep deprivation in healthy individuals may cause adverse changes such as decreased glucose tolerance and increased blood pressure. But both insomnia and hypersomnia, or sleeping too much, have been linked to increased risk of coronary events[3].

In a very recent study, scientists from Tokyo Women's Medical University have produced the first large longitudinal study to indicate that long sleep duration is associated with total mortality, as well

as cardiovascular disease mortality[4]. Melatonin has also received attention because of its unique antioxidant ability to neutralise free radicals and stimulate immune cell proliferation, offering protective effects against inflammation[5,6].

CARDIOVASCULAR LINK

While cardiovascular diseases can be caused by classic factors, one risk may be the disruption of biorhythm. According to a recent report in the *North American Journal of Medical Sciences*, there is a clear seasonal trend of cardiovascular diseases, with the highest incidence occurring during the colder months[7]. Further disruption may also be attributed to the fact that a true sense of night does not exist anymore in Europe and America. A satellite picture would show that the only continent in true darkness at night is Africa. This move away from a solar rhythm may have a detrimental effect on the regulation of blood pressure, heart rate and heart rate variability[8]. Usually, blood pressure drops significantly during the night, heart frequency lowers and heart rate variability is at its peak. People with this brain-heart pattern are called healthy 'dippers'. Non-dippers have an increased chance of damage to the biorhythmic organs which include the heart, blood vessels, kidneys and liver[9].

Some protection may be offered through a healthy diet and nutritional supplementation. Melatonin is a substance formed from serotonin by methylation. Tryptophan, an essential amino acid, is a precursor of serotonin and should therefore be eaten in increased quantities. Food sources include chicken, turkey, banana, salmon, nuts and avocado. Its conversion depends on a number of co-factors, including folic acid, B12, choline, methionine and betaine[10]. Carnitine, and its product acetyl-carnitine, may assist in the energy management of the heart, mitochondrial detoxification and regulation of the immune system[11]. It is formed in the liver and kidneys from L-lysine and methionine with co-factors vitamin C, B6, niacin and iron. Carnitine and acetyl-L-carnitine are precursors of the key neurotransmitters glycine, aspartate, GABA and glutamate. Deficiency of these may be linked to fatigue and depression[11].

WINTER BLUES

Winter blues may be accompanied by anxiety, depression and excessive consumption of carbohydrates. Typically, in our evolutionary history, winter was a time of compulsory fasting due to lack of availability of food[13]. During these periods, fat and protein were used as sources of energy and for the formation of gluconeogenesis. The necessity to eat, or hunger, is considered to be a moderate stress factor which ensures the production of a large number of neuropeptides and proteins of a regenerative nature, such as brain-derived neurotrophic factors and nerve growth factors[14].

Nowadays, winter is a time associated with high meal frequency and overconsumption of refined carbohydrates and sugar, which can result in high insulin production. Frequent intake of refined carbohydrates tends to instigate continuous fluctuation of glucose levels and may contribute to hypoglycaemia. Immunoglobulins may be broken down to off-set the glucose requirement, resulting in a weakening of the immune system and increased susceptibility to colds and infections[15].

Another consequence of high insulin production is the conversion of carbohydrate into fat which may be stored around the viscera. This fat is capable of producing pro-inflammatory cytokines implicated in metabolic syndrome and neurodegenerative disorders[16].

Disorders of glucose homeostasis can induce a change in the blood's amino acid pool. Hyperinsulinaemia may increase the presence of tryptophan and tyrosine, while the quantity of Branched-Chain Amino Acids (BCAAs) can fall. Because these five amino acids have the same transport system at the level of the blood brain barrier, small changes in proportion in the bloodstream can have drastic consequences for the proportions in the brain. The quantity of certain neurotransmitter production can increase dramatically, giving rise to a manic episode in someone with bipolar disorder[17]. Conversely, a shortage of insulin can increase the BCAA pool in the blood, causing less tryptophan and tyrosine to be absorbed by the brain and symptoms of depression taking root[18].

Neurological health depends on a number of substances being made available to the body; of particular importance is vitamin D. Vitamin D in combination with DHA and vitamin A has proven to be important for the modulation of genes and mRNA, responsible for the brain structure, energy metabolism, neurotransmission, signal transduction and regulation of feedback mechanism[19]. Because vitamin D affects the function of almost all parts of the brain, it may be considered as a tool for aiding depression[20].

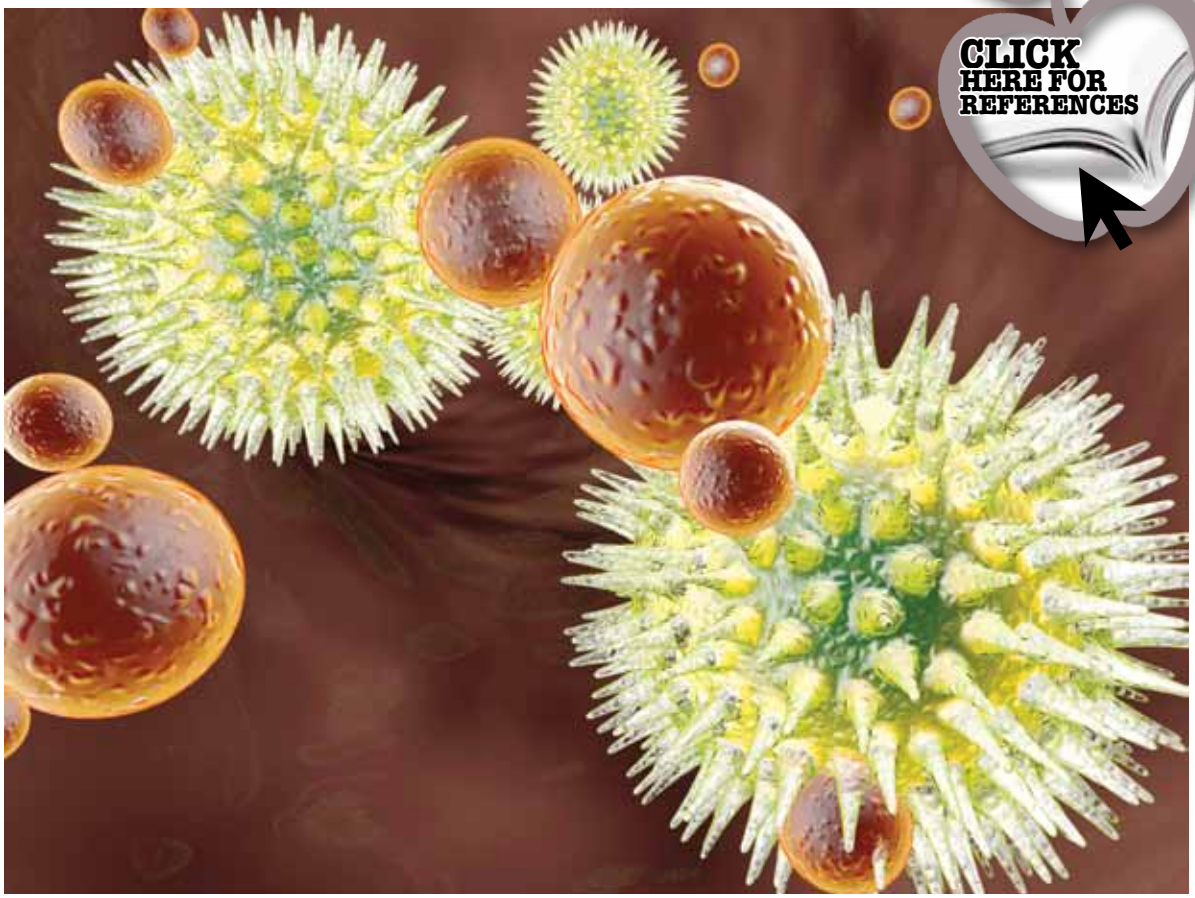
One example of receptor function influenced by vitamin D, is sensitivity to steroid hormones, including cortisol. Cortisol regulates a large number of functions in the body and, in principle, is anti-inflammatory until we lose sensitivity to it; then it can become a pro-depressant. If glands such as the hypothalamus, the pituitary and the immune system are sensitive to negative feedback for cortisol, then the stress response they are involved in may be switched off. Loss of cortisol sensitivity may increase the stress response, activating the immune system, encouraging fat storage and increased sensitivity to pain.

TEMPERATURE CURVE FOR THE MEASUREMENT OF BIORHYTHM

Biorhythmic disorders can be measured by reading the body's temperature through the day. Normally the curve is determined by the outside temperature and the time of day. Disturbances in biorhythm will change this temperature curve and may even show aberrations for weeks before a person develops a heart problem or possibly depression[11].

BODY TEMPERATURE

Maintaining a core body temperature



within certain boundaries, regardless of the surrounding external temperature, is crucial to health. Thermogenesis, or heat production, is regulated by the sympathetic nervous system and as we become more sedentary over the winter period, may account for a large part of our energy output. Heat production from Brown Adipose Tissue (BAT) should be activated whenever we are in need of extra heat, to allow us to be active even in cold surroundings.

However, if BAT is not used for the purpose, it may undergo cell death and affect our ability to produce optimal, diet-induced thermogenesis. Being able to maintain BAT for thermogenesis depends on the level of thermal stress we are exposed to. With the advent of central heating, our exposure to cold has been drastically reduced. Obviously this can be viewed as to our advantage, but without the sympathetic triggering of brown adipose tissue through thermogenesis, the loss of brown adipocytes may follow. The result of all of this may be the inability to thermoregulate effectively and a tendency to gain weight, particularly over winter[21]. Those who are most at risk, however, are the elderly, who may be unable to thermoregulate effectively but also unable to afford soaring energy costs and food bills[22].

Help may be at hand with therapy involving BAT activation through cold and diet. Cold treatment may be considered as a valuable intervention, with whole body immersion being the most effective[23]. Diet-induced thermogenesis may be promoted through nutrients and herbs such as l-tyrosine, capsaicin, green tea, coffee, DHA, arachidonic acid, piperine and curcumin[24].

PHYSICAL INACTIVITY

There is no doubt that the freezing temperatures and shorter days force us to become more sedentary. And yet physical inactivity has been related to almost every type of chronic disease; heart insufficiency, type II diabetes, metabolic syndrome, gallstones, depression and neurodegeneration to name but a few [27]. In response to excessive inactivity, systematic changes may occur very quickly. These include loss of tissue mass and disruption of adequate functioning in many cells and tissues, loss of bone mass, weaker skeletal muscles with reduced mitochondrial concentration, a lowered capacity to oxidise fatty acids and lowered sensitivity to insulin. Inactivity may also decrease neurogenesis in specific parts of the brain responsible for memory and motor learning[28]. It would seem that to be able to effectively 'survive' the winter, we should aim to live as closely to our circadian rhythm as we can. Avoiding large, luminous displays such as computers and flat screen TVs close to bedtime may help to prevent the suppression of melatonin and the body's ability to heal and repair. By remaining physically active, we may help to decrease the prevalence of depression and the detrimental effects it may have on appetite[29].

FLEUR BORRELLI graduated from the University of West London with a BSc in nutritional medicine in 2006. She practices from two locations; a multidisciplinary clinic, Bodies Under Construction, and a sports injury clinic, The Putney Clinic. She is currently studying clinical psychoneuroimmunology to enhance her practice.
www.nutritionandsuperfood.co.uk.