Memories of chocolate

Buffs may have another reason to indulge in their favourite snack, says s ananthanarayan

Lymnaeidae, *from the book* Life of Animals *by AE Brelun, from the Waterevereld website, and Ken Lukowaik (right).*

CHOCOLATE has been credited with numerous health benefits. For one, that it is packed, like red wine and green tea, with anti-oxidants. Then there are claims that chocolate can bring down the blood pressure. As it is usually rich in milk and cream, it is handy nourishment. And as if to balance the good things, chocolate is the despair of those trying to keep their weight down. The *Journal of Experimental Biology* carries an investigative report by Lee Fruson, Sarah Dalesman and Ken Lukowiak of the University of Calgary, Canada, to formally pin down the benefits of one anti-oxidant found in chocolate.

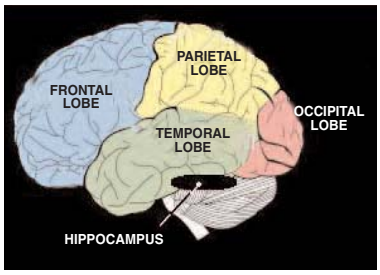
Anti-oxidants are substances that neutralise harmful agents that are created within living cells. The business of living needs substances to get "oxidized" and this results in the release of *free radicals*, which are charged particles that can overcome defences and enter cells, where they cause the cell to break down and die. Anti-oxidants are able to block free radicals and limit the harm they do. Living things generate a number of anti-oxidants to maintain free-radical balance, vitamins C and E being examples.

Anti-oxidant supplements are often prescribed and foods rich in these substances are considered to promote health, delay signs of ageing, alleviate cases of cancer or heart disease and even relieve diseases of degeneration of nerves, like Alzheimer's or Parkinson's. The lower incidence of heart disease among the French, again, is believed to arise from *reservatrol*, the anti-oxidant component of red wine.

An important category of anti-oxidants in human diet is the group of compounds called *flavonoids*. These are responsible for the colours of petals and the leaves of plants and they serve many functions of plant life. Sources rich in flavonoids are fruit, yellow vegetables, tea, the extract of grape skin, which gives red wine its colour, and a very rich source is the *cacao seed*, which is used to make *chocolate*. Chocolate, in fact, is recognised as a mood elevator and there have been suggestions that it may contain substances that improve mental performance, particularly the memory.

But as the areas of health where flavonoids are getting credit are affected by so many factors, it has not been possible to clearly associate the benefits with the flavonoids themselves. The hard evidence, in fact, is that flavonoids may not be as effective in the living organism as they are in the laboratory.

In laboratory conditions, the anti-oxidant effect of flavonoids is found to be more powerful than vitamins C or E, which would make a strong case for their inclusion in diet. But in the living body, it is found that flavonoids are not able to gather in high concentration, as they are poorly absorbed and what is absorbed is rapidly metabolised or excreted.



The Hippocampus is an organ found in humans and vertebrates deep within the brain and is associated with the task of consolidating memory.

Flavonoids & memory

As for the effect of flavonoids on memory, the difficulty in a meaningful study is that there are too many factors that affect memory formation for the effect of one component of chocolate to be isolated. Memory itself is a complex function, existing in different forms for immediate use, for a short time or in the long term. The shortest lived memory, called *Sensory Memory*, is the kind that is formed after exposure to an item for less than half a second. There is a limit to how much can be perceived in such a short glimpse and what is perceived can be retained for barely a second, leaving one with an impression, rather than detail. A slightly better form of memory is the *Short Term Memory*, which can last for several seconds or a minute. This kind of memory arises when the subject has some spatial or acoustic form, for example when one hears a telephone number and remembers it till one completes dialling the number.

Increasing the level of order, for example by repeating the number as two halves, or as an area code followed by the remaining digits as two groups, can prolong or improve retention. In contrast to these kinds of memory is the *Long Term Memory*, which can last a long time, like addresses, names and faces of people we know, or events that we have experienced. Even telephone numbers that we use often can be remembered for a long time, even life-long. The difference is that while short-term memory is encoded acoustically or visually, long-term memory is encoded semantically, or by association with other events or other memories.

At the physical level, short-term memory depends on transient patterns of communication between nerves and is limited to the activity of certain specific parts of the brain. Long-term memory, on the other hand, arises through the formation of more long-lived nerve connections, through repeated experience or the effect of other processes that act to consolidate and permanently fix memories.

The *Hippocampus* is an organ found in humans and vertebrates deep within the brain and is associated with the task of consolidating memory.

Simplify the problem

Given such complexity of memory mechanisms, not to mention individual personal history and associations that would help or hinder remembering, there is scarcely possibility of assessing the effect of a single component of diet, like flavonoids, on how well memories are formed. Ken Lukowiak and colleagues at Calgary decided, nevertheless, to try and they simplified the problem by examining the effect of just one flavonoid, in the case of a simple instance of memory formation where there were minimal factors to complicate the act of remembering — the case of a simple pond snail, trained to remember a particular response to a change in the environment.

The researchers limited the study to the effect of one flavoniod called *epicatechin* (*epi*, for short), which is an important component of chocolate. The memory event that was studied was learning related to a particular behaviour of *Lymnaea stagnalis*, the pond snail, when the oxygen level of the pond water reduces. The snail usually breathes, or takes in oxygen, through the pores of its skin and this works well when the water in the pond has adequate dissolved oxygen. But if the oxygen level falls, the snail extends its breathing tubes above the surface of the water. This behaviour, however, can be discouraged, or stopped, by gently poking the breathing tubes when they are extended, and the snail then keeps the tubes closed, more often than not, despite the lower oxygen level in the water.

This lesson, however, can usually last about three hours, which is the extent of short-term memory of snails. Three hours after the snail has been taught to keep its breathing tubes closed, they forget and revert to the normal behaviour of opening the breathing tubes whenever oxygen levels fall.

The researchers then tried to see if the presence of the flavonoid *epicatechin* affected the duration of memory. A concentration of 15 mg of *epi* per litre of pond water was identified as not affecting the breathing behaviour of the snails. The test was then whether this exposure to *epi* affected the duration of memory. Episodes of lowering of the oxygen level, followed by training to keep the breathing tubes closed, were created with the *epi*-exposed snails, in the same way as the snails in normal water. The results were startling – the *epi*-exposed snails were able to retain the learning for a whole 24 hours, which amounts to long-term memory, with the same training schedule that otherwise resulted in retention for only three hours. Repeating the training session even resulted in the learning persisting for three days!

A further study was whether *epi* resulted in the memories being robust in the presence of *memory extinction training*. This is where a memory is over-written by a contrary memory. In this case, the snails were exposed to falling oxygen levels and *not poked* if they opened their breathing tubes. The lack of adverse stimulus leads to new learning, that breathing tubes *may* be opened and this would extinguish the earlier training. But in the case of *epi*-exposed snails, it was seen that they even resisted such extinction training – the lower frequency of tube opening instances persisted, even if there was no adverse consequence.

The *Journal of Experimental Biology* paper also described other results that indicated that such long-term memory formation in snails did not arise from association with events, like predator activity, but through an effect at the level of nerve cells. And then, there are observations that the *cacao*-derived flavonoids actually improve the blood flows to the Central Nervous System, which helps generation of nerve cells and memory formation. This is not likely to be taking place in the case of the snail, as it has no circulatory system, but the good news for those who love chocolate is unmistakable!

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All about slow viral infections

It is believed that factors responsible for the development of such problems may occur as the result of disturbed immunological reactivity, says tapan kumar maitra

A NUMBER of viral infections that occur to humans and animals are characterised by chronic progressive developments that are often fatal. Viruses that cause subacute sclerosing panencephalitis and progressive multifocal leukoencephalopathy have been isolated and identified. The causative agents of kuru, Creutzfeldt-Jakob Disease and viliuisk encephalomyelitis have not been sufficiently studied.

Subacute sclerosing panencephalitis occurs as a result of chronic measles induced by a defective variant of the measles virus. The disease is characterised by a variety of symptoms associated with the nervous system's involvement through the proliferation of fibrous glia in the white brain matter, demyelination and fatty degeneration of nerve cells. The usual symptoms are headaches, dizziness, irritability and memory and intellect becoming impaired. Young persons die of cachexia within a few months because vital organs get affected. In older patients, the disease follows a chronic course with remissions.

Specific antiimeasles antibodies accumulate in titres of up to 1:16000 in patients' serum. Progressive multifocal leukoencephalopathy is marked by myelin-forming cells of the central nervous system being affected. As a result, motor function is disturbed.

The causative agent is detected in the brain tissue by electron microscopy. The disease develops, as a rule, in persons with immunodeficiency (Hodgkin's disease, miliary tuberculosis, leukaemia, systemic lupus erythematosus and lymphogranulomatosis). It often occurs as the result of immuno-suppression therapy such as transplanting organs. Antibodies to papovavirus are found in the serum of sick persons.

Kuru is a fatal endemic human disease characterised by severe disorders in the central nervous system. It is connected to the cannibalistic rituals of local tribes in the islands of New Guinea. Its infectious nature has been proven by the successful reproduction of the disease in chimpanzees inoculated with a suspension of the brain of persons who died of kuru. Pathohistological examinations of humans and monkeys revealed that spongiose affected grey brain matter which degenerated nerve cells.

The incubation period lasts five to 10 years after which the first symptoms of the disease develops. These are impaired gait, excitation, rapid fatigue after which disorders related to the coordination of movements develop. Death occurs within one or two years.

Creutzfeldt-Jakob disease is characterised by degenerative changes in the central nervous system, leading to convulsions, ataxia and disorders of vision and senses.

Viliuisk encephalomyelitis is marked by the central nervous system becoming affected and commonly occurs among the Aborigines of Yakutia, Siberia. It becomes chronic once the oculomotor nerves get affected and mental disorders kick in. The chronic form lasts anything between a few months to one to four years, sometimes even up to 10 years. Death occurs from severe trophic disorders and ascending urosepsis.

The group of slow infections includes congenital rubella, Lassa fever, rabies, multiple sclerosis, amyotrophic lateral sclerosis and Parkinson's disease.

Slow virus infections occur among animals (scrapie, maedi-visna, Aleutian mink disease, lymphocytic choriomeningitis, transmissible encephalopathy of mink and equine infectious anaemia).

The factors responsible for the development of slow infections have not been clarified. It is believed that these diseases may occur as the result of disturbed immunological reactivity marked by the poor production of antibodies or production of antibodies incapable of neutralising the virus. It is possible that defective viruses persisting for a long period of time in the organism induce proliferative intracellular processes that lead to the development of slow infections among humans and animals.

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Discomfort that swells

prabhjeet singh sethi discovers that apt measures to prevent Deep Vein Thrombosis are as good as ranking prevention higher than cure

Dr Biren Nadkarni

SHARMA travels frequently between Kolkata and Chicago and has a swollen left foot that troubles him time and oft. This is probably because of Deep Vein Thrombosis, says his doctor. Now, what's DVT? The possibility of contracting this complication expands manifold during long journeys or staying immobile after joint replacement surgery.

Generally, it is nothing more than a blood clot blocking the veins in the lower limbs. But taking it lightly might make matters worse. It might as well occur in other parts of the body, like the arms, intestines, liver and even the brain. So make it a point to punctuate your journey with some physical activity because staying glued to your seat for long periods encourages DVT.

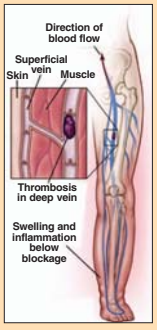
According to Dr Biren Nadkarni, orthopaedic and joint replacement surgeon, New Delhi, not all swellings are potential indications of Deep Vein Thrombosis. "There are certain clinical symptoms that help doctors come to a decision whether it is DVT or not. For all that I know, it is the immobility after joint replacement surgery or a trauma that contributes towards this complication. For those skeptical about it, consult a doctor sooner than later," he says.

To make things easy, here are some symptoms:

- Swelling of a body part;
- Pain or tenderness in the leg while walking or standing;
- Discolouration of the skin; and
- Enlargement of the superficial veins in the affected area.

There are a multiple number of other factors contributing towards it. First, after an orthopaedic surgery, fat streams into the blood, paving the way for coagulation. Second, bed rest for a long period of time after a surgery thickens the blood due to inactivity. Third, smoking is detrimental to health and in some way makes an impact on essential wellbeing. Last but not least, obesity - the silent killer - adds to the weight of the disease.

According to what has been predicted by doctors, people beyond the age of 40 are susceptible to this disease. However, it might as well affect anyone else with qualifying symptoms. The most commonly and effectively used drug for its treatment is Warfarin, which has to be monitored carefully without with routine blood tests. If you have already fallen prey to this complication, don't skip your regular health check-ups and start believing in exercises. The consequences of taking DVT callously are mind-numbing. Apart from a swelling in the muscles of the affected area, clots might enter the lung capacity and cause pulmonary embolism, which is, in fact, one of the biggest threats to life. So if you do find yourself closer to such health problems, take the necessary steps. After all, prevention is better than cure.



FACTFILE

- The World Health Organisation estimates that, on an average, one person is affected for every 20 long-haul flights carrying 300 passengers.
- More than 2.2 billion journeys are made by plane every year across the globe. Of this statistic, the number of travellers contracting DVT is mounting with every passing day.