

IS IT ADVISIBLE TO SLEEP UNDER TREES AT NIGHT?

SUSHIL JOSHI

(Sandarbh issue-89)

Although there are some facts that have been proven by scientists' decades ago, they still continue to confuse the human psyche. Even the text books on science are able to do little to help people move beyond these strange illusions. Ironically, sometimes instead of helping people to understand the truth these text books create even further confusion in the minds of people. This is very sad because books are meant to throw light on aspects that are not known, but a lot of times they can create many more wrong assumptions. One such confusion is related to the process of breathing, or the respiratory mechanism.

We are all aware that both humans as well as all other living beings need to breathe, in order to survive. Thus respiration is one of those fundamental functions which make survival possible both in the animal as well as in the plant kingdom. In the respiratory mechanism of most living organisms' glucose and oxygen have important roles to play. During the entire process of respiration a lot of energy is released which the living being subsequently uses for his/her day to day actions. This process also releases carbon dioxide and water. The body makes sure that the carbon-dioxide is released effectively. In fact this is such an important need that in many organisms including the human beings a special organ is dedicated specially to perform the function of releasing the carbon-dioxide from the body whereas in many organisms this specific organ for the purpose of respiration is missing.

Apart from animals, even plants perform the respiratory function; afterall they too need energy for their survival and growth. Similar to animals, even amongst plants the process of respiration involves the utilization of sugars, while oxygen helps them to continue with their vital functions and carbon dioxide and water are produced as a result of the entire process.

SOME FAITH, SOME FACT

Because of the fact that the respiratory mechanism involves the emission of carbon-dioxide and the consumption of oxygen, most of our textbooks would tell us that in this process we inhale oxygen and release carbon-dioxide. This constitutes the first major myth. While propagating this idea, our textbooks do not tell us that inhalation and exhalation are only one part of the entire process of respiration and not the entire process. The respiratory mechanism involves several processes such as- the inhalation of air, the extraction of oxygen from the air and then the major task of supplying it to the various channels in the body, during this process the released carbon-dioxide has to be transported back to the lungs so that it can be exhaled out of the body- thus respiration is not a single step process but rather a multi-staged one. Respiration thus involves much more than merely inhalation and exhalation; it is composed of various steps.

Have you ever wondered that if man inhales oxygen and exhales carbon-dioxide during the process of respiration, then how is it possible that a man is able to give another man mouth-to-mouth oxygen during a crisis?

Factually, if you study the air that you inhale through your lungs and the one that you exhale and try to compare between them, you would discover that there is not a stark difference between the two. In fact upon observation it can be found that there is much similarity between the two. The air that you inhale through your lungs contains about 79% nitrogen, 20% oxygen and 1% other gasses. Amongst the other gasses about 0.03% is carbon-dioxide. Let us now bring our attention to the air that we exhale. This contains 79% nitrogen, 16% oxygen, 3% carbon-dioxide. You can see it for yourself, that there is no major difference between the compositions of the air that one inhales and the air that one exhales.

Now let us carry forward the discussion and talk about the respiratory system in plants. Plants do not possess any special organs for this purpose. The task of respiration in plants is primarily carried out by the pores that are present within the leaves of the plant. These tiny pores are called stomata. Apart from this the branches too have some pores and besides that the roots spread themselves into the soil, and take oxygen from it. Like animals, plants utilize oxygen and release carbon dioxide during the process of respiration.

It is worth our attention, to see how both animals and plants need respiration to survive and grow. It is through respiration that they find energy for the vital functions and movements that are necessary for their survival. It is for this reason that the process of respiration goes on for 24 hours in a day without any breaks whatsoever.

THE PROCESS OF PHOTOSYNTHESIS AND THE MECHANISM OF RESPIRATION

We have been told by our books that plants also release oxygen. It is from here that the second riddle begins. In the 18th century through the researches of some scientists it was shown that with the help of air, plants also perform another important function. This is called the process of photosynthesis. During this process, by the utilization of carbon dioxide and water the plants produce oxygen and glucose. It took great research and perseverance to be able to understand this complex phenomenon well. What is important to note here is that, for the process of photosynthesis it is crucial that "sunlight" is present. And secondly, this process can only be carried out in the parts of the plant which have chlorophyll in them.

Based upon this, two things could be said clearly- in most of the plants the process of photosynthesis takes place only in the leaves and that this process can only be carried on in the day time. Along with this, the process of respiration is carried out throughout the day without any gaps in between.

It is at this juncture that it would be useful for us if we also remember that the process of photosynthesis is carried out very quickly. What is meant by this is that the speed at which this is undertaken is tremendous. With the onset of the morning, the leaves begin their work like industries or factories, the leaves work laboriously all day without any breaks in their work of photosynthesis, they utilize the carbon dioxide and water and begin to produce glucose. What is interesting to observe here is

that the glucose produced from this process, is then converted into a variety of forms. It is the speed at which the process of photosynthesis is carried out which ensures that what is produced in this entire mechanism is useful not only for the plants themselves but for the entire earth. This is the reason why plants are such an integral part of existence and so important for our survival. It's also worth understanding that, the respiratory mechanism is quite slow among plants as they do not have to move from place to place, perform physical labor etc. That, then also goes on to explain the reason why their need for energy is less as well as the level at which this is produced is much slower than in mobile animals. During the process of respiration, the carbon-dioxide that is released is sent to the vacuum spaces within the leaves itself. It is in these leaves itself that the process of photosynthesis is also going on. For this photosynthesis, the carbon dioxide already present in the air is utilized. Apart from this, the carbon dioxide produced during the respiration is also utilized by the plants. Thus it is because of this that the common belief is that during the day plants take in carbon dioxide and release oxygen. Please note that the air that goes in through the stomata is also composed of 20% oxygen, 79% nitrogen and in a small quantity carbon dioxide and other gasses are present. The air that comes out of the stomata does not however have a content of carbon dioxide while the amount of oxygen is multiplied and the quantity of nitrogen remains the same.

During the day time also, the respiration process goes on and carbon-dioxide is released in the process. But what happens is that the amount of carbon-dioxide released during respiration is utilized in the process of photosynthesis. Thus during the day time, plants release net oxygen.

Now comes the night, what happens now is that the photosynthesis process has stopped but the respiration process is still going on. This means that during the night, the plants are not producing oxygen. Because of respiration oxygen is being consumed but only carbon-dioxide is being released. Had this been the day time, the carbon-dioxide would have been utilized by the plant itself but this cannot happen during the night. This would then mean, that plants release carbon-dioxide during the night- but let us ask one fundamental question at this juncture, wasn't this what humans as well as other animals have been doing during the day as well as in the night? Thus it could be said that if one sleeps under a tree at night, one's lungs could be filled with carbon-dioxide and one would choke to death.

One of my friends, Manohar Jhala used to narrate this phenomenon in a very interesting manner. He used to say that during the night, both the trees as well as you inhale oxygen. Now since the tree is so large it will naturally be able to snatch away all the oxygen from the surroundings. When the oxygen in the surrounding air has been completely exhausted, it would take away the oxygen present in your lungs, and along with the oxygen it would even bring out your lungs. And unable to resist this strong pull of the tree, you would go and get stuck to its branches!

THE TREE VERSUS THE ROOM

The reality is really far more interesting than this! Although trees are generally very big, there is one fundamental difference between trees and humans that even children are well aware about. This is that plants do not walk or engage in movement from one place to another. It is because of this reason that

their demand for energy is also much less when compared to animals. On an average a human being exhales about 500gms of carbon dioxide. If we observe minutely, we would discover that a lesser amount of carbon-dioxide is released during the night because this is the time when most people sleep and thus the rate of respiration is also slowed down upon. Approximately, during the night a person exhales 100-150 gms of carbon dioxide. It's difficult to find estimates for trees but broadly speaking a tree of 10 tons would release about 10 Gms of carbon dioxide during the night.

Now the difference between sleeping under a tree at night and sleeping besides another human being in a room can be understood. It is obvious then that sleeping next to another individual is far more dangerous than sleeping under a tree. There is another reason why the idea that sleeping under a tree is dangerous is absurd. This is because the air that surrounds us is not stagnant; it keeps circulating all the time and more so when one is sleeping in the open. After all so many birds and animals sleep under the open sky, had the trees been so dangerous then wouldn't all of them die within a night itself? Likewise, during the winter in a crowded train compartment we shall not expect any survivors as all windows are also closed?

The assumption that it's dangerous to sleep under a tree at night is a result of half explained scientific truths. What can actually be seen as a danger of sleeping under a tree can be the sudden breakage of a branch which could fall on the one sleeping under the tree or a bird excreting on one's head! And these factors are not even related to oxygen!

Sushil Joshi- He is associated with Eklavya's Srote features. He is a science research and writing enthusiast. This piece was selected for Srote feature June, 2013 issue

TRANSLATED FROM HINDI BY ANANYA PATHAK

TRANSLATION OF ILLUSTRATION CAPTIONS

PAGE 7 (labels-air, oxygen, water vapor)

RESPIRATION DURING THE DAY – In the plant kingdom during the day time carbon dioxide is formed. This carbon-dioxide is utilized during the process of photosynthesis.

PAGE 8(labels-sunlight, oxygen, carbon-dioxide, water, glucose)

THE PROCESS OF PHOTOSYNTHESIS- In the presence of sunlight, plants utilizes their own carbon-dioxide and water and begin the process of photosynthesis. As a result of this glucose is produces and oxygen is released from the leaves.