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Serotonin - A Happy Chemical for Brain and Body

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Abstract: ***Serotonin, often called the "happy chemical", is a vital neurotransmitter that influences mood, sleep, appetite, and overall well-being. The article explores serotonin's synthesis, its dual roles as a transmitter and hormone, and its impact on physiological health. It also examines conditions such as stress and depression, which are closely linked to serotonin levels, and discusses natural and medical interventions to maintain its balance. By understanding serotonin's multifaceted roles, the article sheds light on its importance for mental, emotional, and physical health.***

Keywords: Serotonin, Depression, Stress, Happy Hormone

1. Introduction

Have you ever experienced a sudden surge of happiness for no reason? Or found yourself unexpectedly down on a bright sunny day? What drives a person to feel joy or sadness? Why do mood swings occur? Why can't we remain happy or sad throughout? Is it a part of one's behaviour or is there any science behind human happiness? Is there any chemical process that influences our mood or well-being?

The answer to all these mysteries lies in one remarkable molecule called Serotonin, a neurotransmitter, also named as "happy chemical" of your brain, which plays a wide variety of roles in human body. This powerful neurotransmitter plays a crucial role in regulating not only mood, but also your sleep patterns, appetite, and other bodily functions.

Scientifically, Serotonin is a chemical named as 5-Hydroxytryptamine or 5-HT which transmits the signals between nerve cells in brain. Normal range of serotonin level in the blood is 101–283 nanograms per millilitre (ng/mL) (Kanova & Kohout, 2021). There is strong correlation between mood and serotonin.

Serotonin production takes place in Central nervous system (Brain) and digestive tract. It works as neurotransmitter in CNS and as hormone in periphery. It plays an important role in day-to-day activities such as sleeping, eating and digestion. It is also found in blood platelets. It has key impact on the mental, physical and emotional well-being of the body. It regulates majorly psychological functions and a wide variety of other common body functions (Jones et al., 2020).

How is serotonin synthesized in human body?
Serotonin is synthesized from tryptophan, an essential amino acid. Tryptophan undergoes reaction with tryptophan hydroxylase resulting in the product serotonin. Serotonin for brain is produced in brain and serotonin for GI tract is produced in that part only. It cannot cross blood brain barrier. When the level of tryptophan falls, there will be less serotonin production in the body.

Functions of serotonin
It plays a key role in Central nervous system and general functioning in other body parts especially in gastrointestinal tract. Serotonin influence many body functions given below:

1) **Bowel:** Serotonin is chiefly (about 95% of the body) found in gastrointestinal tract which regulate the bowel movement. It regulates how fast the food moves through the system, how much fluid or mucus secreted in the intestine to aid the digestion and others.
2) **Mood:** Serotonin in the brain influences the mood, anxiety and happiness. In an investigation to see the effect of serotonin on mood, tryptophan depletion technique was used. They concluded that lowered mood state occurs due to lower serotonin levels in the brain.
3) **Blood clotting:** Serotonin is produced by blood platelets at the time of wound or injury promotes wound healing. It helps in blood clot formation by vasoconstriction (narrowing down) of the blood vessels and reduced blood flow.
4) **Nausea:** Serotonin is the reason why someone feels nauseated. More serotonin is produced in gut to flush out toxic or irritating food out of the body in diarrhoea. The increased serotonin level in blood also stimulates the nausea centre in the brain which induces nausea.
5) **Bone strength:** According to some scientist's higher level of serotonin in the bones lead to the osteoporosis condition due to which bones become weaker. While others still challenge the results.
6) **Sexual activity:** Serotonin appears to reduce the sexual activity. People with depression taking antidepressants found with lower or reduced sexual activity. In a nature study, an experiment conducted on mice lacking serotonin and revealed that serotonin regulates sexual preference in mammals.

Nothing much is known about that. Two most common reasons may be- body is not sufficiently producing optimum level of serotonin or the body is not capable of using it sufficiently.

Understanding the function of serotonin in brain and body
To understand this tiny molecule, first we need to understand the term "STRESS". Stress is body's reaction in response to any adjustment. The body responds to these adjustments or changes by means of physical, mental and emotional responses. On the one side positive stress is good for everyone. It keeps the body motivated, alert, with high performance and pumps energy in the body to get rid of danger zone. When a body feels stress, it shifts into the 'fight or flight' mode. with the release of fight or flight hormones

like cortisol, epinephrine and nor-epinephrine body feels gain of energy and is ready to respond physically. Body feels strength as the blood in the vessels divert towards muscles and keeping all the unnecessary systems shut down for a while.

As per the classification by National Institute of Mental Health, there are two types of stress: Acute and Chronic stress (Figure 1)

1) **Acute stress:** It is short term and common form of stress. For example, a person feels bad over an argument or when a person faces an upcoming deadline of a project. But it disappears once the problem is resolved like when person's argument is over or person meets the deadline. But repetition of acute stress may become chronic in later stages.
2) **Chronic stress:** It is the stress that develops over long periods. When a person can no longer finds himself to resolve the situation or avoid it. In this situation body resists to come back to normal level of stress hormones activity. A person faces problems in following systems of body:

- Respiratory: Like shortness of breath
- Sleep: Disturbance of sleep-awake cycle
- Immune: Immune susceptibility
- Reproductive: PCOD in females
- Cardiovascular: May get a stroke

It may also lead to Type 2 diabetes, hypertension and heart attack. Different people react differently with the same situation. The one situation may be stressful for one person may not be the same for another person. It is the matter of perception. There is no reason identified to answer what makes one person to be stressful why not other.

Depression: It is a common mental disorder. It can be described as feeling of constant sadness, loss or anger that interferes person's day to day life. A person feels helpless, worthless, low self-esteemed, pessimistic. Too much chronic stress in susceptible people may lead to depression or sometimes traumatic injury may also lead to depression (Moncrieff et al. 2023).

Symptoms

- Feeling sad, anxious
- Pessimistic
- Low self-worth
- Helpless
- Not enjoying life any more or losing the pleasure of life
- Trouble with concentration
- Poor memory or decision makings
- Sleep disorders
- Appetite changes
- Weight gain or loss
- Irritability
- Headaches, cramps, digestive problems
- Suicidal thoughts

Treatment: SSRIs and their working

SSRIs: Selective Serotonin Reuptake Inhibitors (SSRIs)
Reduced level of serotonin in brain may leads to anxiety, depression and sleeps trouble. SSRIs, commonly used antidepressants are prescribed by doctors to treat major depressive disorders or anxiety. SSRIs approved by Food and Drug Administration (FDA) include Prozac, Zoloft, Celexa, Lexapro and many more (Healy, D. 2015).

Working: Serotonin's level is increased in brain by blocking or limiting the reuptake of serotonin. So, more the serotonin remains in active form at extracellular site to act as neurotransmitter. SSRIs do not start working instantly on the depression from the onset of start of taking medicine. But it takes couple of weeks for the positive response to come (Cowen et al., 2015).

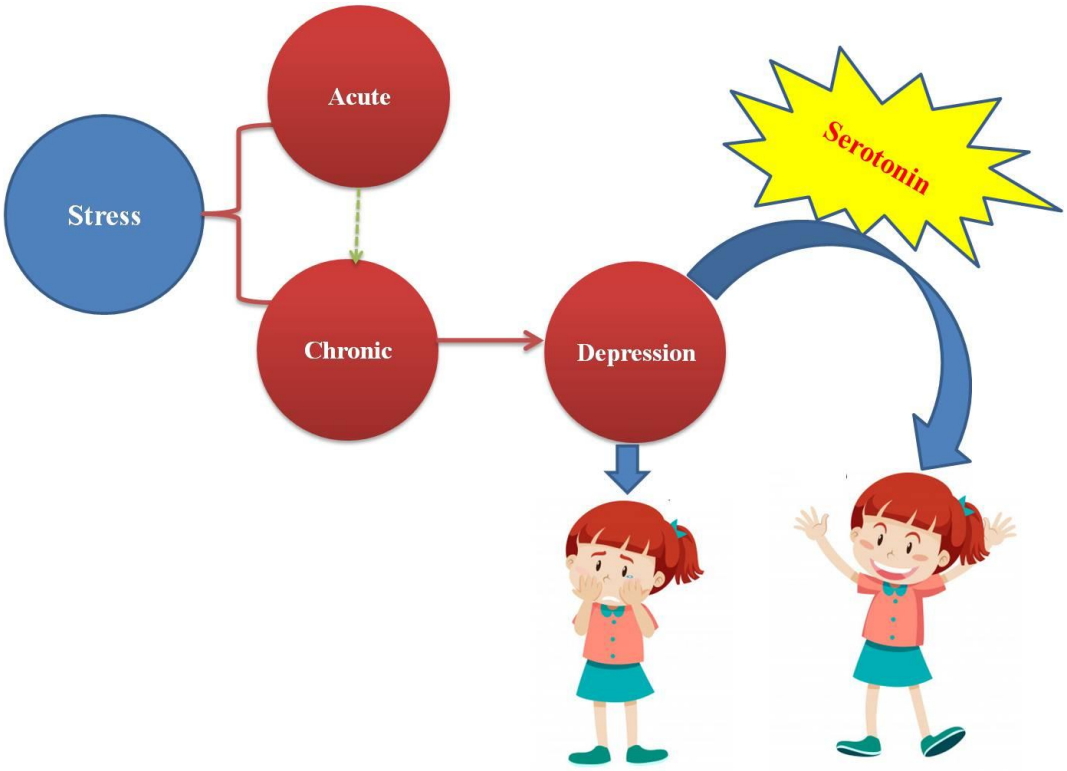

Figure 1: Showing two types of stress: Acute and Chronic. Long time exposure to acute stress may lead to chronic stress. Chronic stress finally resulting into depression. Use of drugs like SSRIs boost up the level of serotonin in brain which causes the relief in this mental disorder.

Serotonin syndrome: If a person is taking two SSRIs at the same time, serotonin toxicity or serotonin syndrome is noticed. Some of the symptoms of serotonin syndrome includes restlessness, confusion, increased blood pressure and heart rate, headaches, sweating, loss of muscle co-ordination and others.

How to combat Depression naturally?

According to an article published in the Journal of Psychiatry and Neuroscience Trusted Source, following factors can help in boosting up of serotonin levels:

1) **Light exposure:** Few studies have revealed that exposure to bright light can used to treat depression. It is also used to treat Seasonal affective disorder (SAD). It is also known as light therapy.
2) **Regular Exercise**: Regular exercise has an antidepressant effect or mood boosting effects because of rise in serotonin level as suggested by some researchers.
3) **Meditation and Yoga**: Meditation and Yoga show significant effects in relieving stress by boosting serotonin levels.
4) **Diet:** Doctors suggest to take foods rich in tryptophan which will increase the level of serotonin in turn leads to mood uplifting. Tryptophan rich foods include: Soya food, Milk, Banana, Walnuts, Fish, Meat, Turkey, Cheese, Sea food and Egg

2. Conclusion

Serotonin is integral to maintain mental, emotional, and physical health. From its role in mood regulation to its involvement in digestion and bone strength, serotonin impacts various aspects of human well-being. While imbalances can lead to conditions like depression, interventions such as SSRIs, exercise, and dietary changes can help restore balance. This article underscores the importance of serotonin and advocates for further research into its multifaceted roles.

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