

## HAPPINESS HORMONES

Shaista Saiyad\*, Usha Patel\*\*,

\*Assistant Professor, Department of Physiology, Smt. NHL Municipal Medical College, Ahmedabad

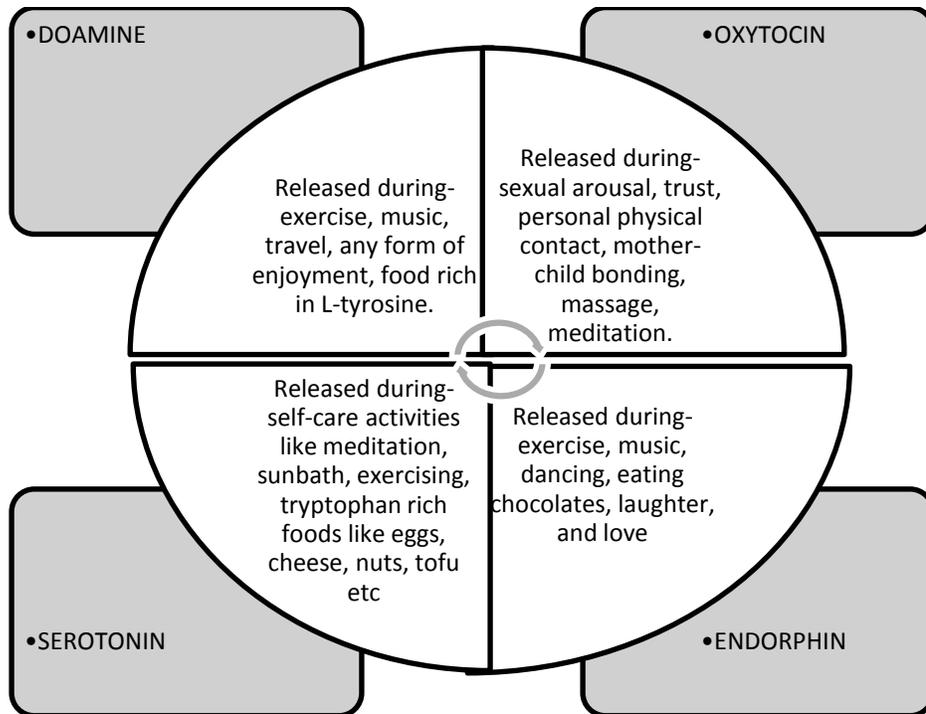
\*\*Assistant Professor, Department of Biochemistry, Narendra Modi Medical College, Ahmedabad.

**Author for correspondence: Dr Shaista Saiyad**, Assistant Professor, Department of Physiology, Smt. NHL Municipal Medical College, Ahmedabad Email: shaistasaiyad77@gmail.com

Happiness is a positive emotion. Factors for happiness can be of two types: endogenous- biological, chemicals (neurotransmitters), cognitive, personality, ethical etc and exogenous- behavioral, socio-cultural, economical, events in life etc (Dfarhud D, 2014). Areas of brain like limbic system, amygdale, hypothalamus play a crucial role in creation of happiness. Genetic factors count for 30-40% of happiness.

Happiness hormones are endogenous chemicals in brain which can produce positive emotions. Main happiness chemicals are Dopamine, Oxytocin, Serotonin, Endorphins.

Figure 1- Happiness hormones and their release.



Dopamine is considered to be reward chemical of brain.

Synthesis:

**Dopamine**

Dopamine is derived from one of most important aromatic tyrosine amino acid (a.a) residue which is non essential amino acid. However tyrosine synthesized from essential phenyl alanine aromatic a.a which is mainly present in egg ,milk, soya and nuts etc. In synthesis of dopamine first step phenylalanine converted to tyrosine in presence of tetrahydrobiopterin reducing agent , molecular oxygen, and phenylalanine hydroxylase enzyme.

In next step tyrosine converted to Dopa in presence of tetrahydrobiopterin reducing agent , molecular oxygen, ferric ions and tyrosine hydroxylase enzyme. Then Dopa decarboxylated in presence of decarboxylase & pyridoxine phosphate vitamin in dopaminergic neurons of nigrostriatal system of brain cells to form Dopamine neurotransmitter (Puri D, 2018).

Functions:

Dopamine is involved in movement, memory, behavior and cognition, attention, sleep and arousal, mood, learning, lactation etc. It has role in 'flight or fight' reaction also. It is released while doing any activity which one likes, like exercise, music, travel, any form of enjoyment, food rich in L-tyrosine

Its release gives a sense of well-being, huge energy levels and euphoria. Positive mood is associated with elevated levels of dopamine in the brain and vice versa (Ashby FG, 1999). Low levels of dopamine are associated with tiredness, lack of motivation, unhappiness, memory loss, sleep and concentration problems, sexual problems.

Imbalance in dopamine secretion can lead to Parkinson's disease, restless legs syndrome and attention deficit hyperactivity disorder. Abnormal high levels of dopamine can lead to addiction, mania and obesity.

### **Oxytocin**

Oxytocin is also called as 'love hormone' or 'cuddle hormone'.

Synthesis:

It is produced by hypothalamus and stored in posterior pituitary gland. It is made up of nine amino acids residue known as nonapeptide.

Functions:

Its main functions are to stimulate uterine contractions during labor and lactation after birth of the child. It is also released in response to loving social interactions and human behavior. It is released during sexual arousal, trust, personal physical contact, mother-child bonding, massage, meditation etc According to a study by Zak PJ, 2022; changes in oxytocin levels are positively associated with happiness indices like satisfaction with life, empathetic concern, dispositional gratitude and religious commitment.

Low levels of oxytocin are related to depressive symptoms.

### **Serotonin**

Synthesis:

Serotonin synthesized from essential aromatic tryptophan amino acid which is first to be identified as essential amino acid. In intestinal enterochromaffin cells & brain of mammals Tryptophan first hydroxylated in presence of tetrahydrobiopterin reducing agent , molecular oxygen, and tryptophan hydroxylase enzyme to form 5- Hydroxy tryptophan. In next step decarboxylated in presence of decarboxylase and pyridoxal phosphate vitamin to form serotonin (Puri D, 2018). Platelets take up preformed serotonin from plasma. Two genes- *5-HTTLPR* and *MAO-A*, affect happiness. This gene codes serotonin distribution in brain cells and helps in mood regulation (Deneve JE, 2012).

Functions:

Serotonin is released during self-care activities like meditation, sunbath, exercising, tryptophan rich foods like eggs, cheese, nuts, tofu etc. It stabilizes mood and gives sense of belonging, well-being and reduces stress.

Increased serotonin is related to satisfaction, happiness and optimism. It has various functions in the body related to learning, memory, regulation of body temperature, sleep, appetite, hunger, aggression, bone health, digestion etc.

Low levels of serotonin can lead to depression, sleep disturbances, anxiety, stress, panic, suicidal tendencies.

Lack of serotonin can lead to mania, depression and mood swings.

### **Endorphins**

Synthesis:

Endorphins function as neurotransmitters and are endogenous opioid peptides. They are produced in pituitary gland and hypothalamus.

There are three endogenous opioid peptides: alpha-endorphin, Beta-endorphin and gamma-endorphin. All are synthesized from the precursor protein, proopiomelanocortin.

Functions:

They form an integral part of endogenous pain inhibiting system of the body.

They reduce anxiety, stress, help in improvement of self-image, help in alleviating pain. They are released during exercise, music, dancing, eating chocolates, laughter, and love. Endorphins provide sense of well-being, confidence and elevated mood.

Low levels of endorphins are associated with anxiety, stress, depression, addiction, body aches, sleep disorders.

In addition to the above chemicals, there are others too which are related to affective domain and happiness-

### **Nor epinephrine**

Also called as nor-adrenalin is a neurotransmitter as well as hormone.

Synthesis:

Dopamine hydroxylated in presence of molecular oxygen, Dopamine hydroxylase enzyme & ascorbic acid vitamin to form Nor epinephrine. It is released from adrenal gland.

Functions:

It is primary neurotransmitter involved in 'fight or flight' reaction in response to acute stress. It also helps in relief of stress, enhancement of mood and memory.

Norepinephrine levels increase by exercise, sleep, healthy foods, music.

### **Melatonin**

Melatonin is produced by pineal gland of the brain. Its synthesis is sensitive to light and darkness.

Synthesis:

In pineal gland serotonin derived from Tryptophan is converted to acetyl serotonin by Acetyl CoA in presence of acetylase enzyme & then acetyl serotonin undergo process of methylation in presence of S-adenosyl methionine with help of methyl transferase to form Melatonin (Puri D, 2018).

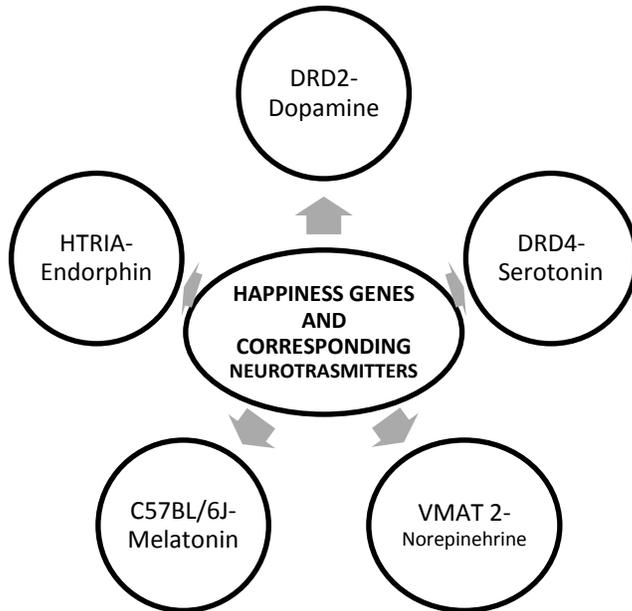
Functions:

It is responsible for sleep wakefulness cycle and is also related to happiness and positive emotions.

### **Genetic factors affecting happiness:**

A special gene encodes each neurotransmitters. Hence, there are genetic factors affecting happiness too (Figure 2) (Farhudd, 2013)

Figure 2: Happiness genes and neurotransmitters.



### References-

1. Ashby FG, Isen AM, Turken AU (1999). A neuropsychological theory of positive affect and its influence on cognition. *Psychol Rev*, 106: 529–550.
2. Deneve JE, Christakis NA, Fowler JH, Frey BS (2012). Genes, Economics, and Happiness. *J Neurosci Psychol Econ*, 5(4): 193–211.
3. Dfarhud D, Malmir M, Khanahmadi M. Happiness & Health: The Biological Factors- Systematic Review Article. *Iran J Public Health*. 2014 Nov;43(11):1468-77.
4. Puri D. Textbook of medical biochemistry. 4th ed. New Delhi, India: Elsevier 2018.
5. Farhud DD, Tahavorgar A. (2013). Melatonin hormone, metabolism and its clinical effects: a review. *Iran J Endocrinol Metabol*, 15(2): 211–223
6. Zak PJ, Curry B, Owen T, Barraza JA. Oxytocin Release Increases With Age and Is Associated With Life Satisfaction and Prosocial Behaviors. *Front Behav Neurosci*. 2022 Apr 21;16:846234.