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Effect on Neurotransmitters in Alcoholic People

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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Review Article

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ABSTRACT

It has become easier to study different neurotransducers and their functions with advancements in technology. We can also study the impact of alcohol on these neurotransducers that disrupt the body's normal functioning. As a result, there seems to be a tendency to have adverse effects on the body due to their malfunctioning. The body has several different pathways for functioning these neurotransducers like glutamate, GABA, serotonin, and dopamine. Some are excitant neurotransducers, and some are interdictory. Both have different reactions when exposed to alcohol for a long or short period. This review paper will briefly introduce what alcoholism is, what it curtails, and the different pathways and how they get blocked by the presence of alcohol in the body. Humans rely on our brain for almost all the activities we carry out daily, whether vital or non-vital. The human body works as an intricate machine. The introduction of a foreign object like alcohol causes the harmony of the machinery to bend out of place and throw everything out of balance. The article explains how our brain acts in the presence of alcohol, not even for a long time but short as well, and is helpful to find a corrective methodic treatment for alcoholism.

Keywords: GABA; serotonin; glutamate; dopamine; pathways.

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1. INTRODUCTION

When mentioning alcohol, we usually mean the alcohol found in beverages that we consume. Alcohol is the component in these beverages that makes you drunk. The alcohol in beverages is known as ethanol.

It is made by fermentation of sugars in grains, fruits, and vegetables.

It is an active ingredient in drinks and stiff drinks. Causing the characteristic effects of intoxication.

It is a compound that slowly makes a person habituated to it. The misuse of alcohol causes social awkwardness in several diagnostic conditions, including physical and mental burdens. Consumption of alcohol also sometimes leads to alcoholism [1].

1.1 Alcohol as a Drug

It slows down bodily functions like speech, gait, balance.

It affects the brain; it is a drug that reduces a person's thinking ability and clouds their judgment [2].

Most people drink for the *hallucinogenic* effect. If a person consumes more than they can tolerate, they experience alcohol's depressant effect. They start to lose coordination and control [3].

Excessive consumption causes several depressants phenomena and even coma and death in worst-case scenarios. These reactions depend on the amount consumed and the time frame [4].

1.2 What are Neurotransducers

Neurotransducers are actinics that neurocytes utilize to correspond among each other and with their terminal action on affected organs in the process of neural transmission. Neural messengers are produced and released from terminal ends into the cleft between two synapses. Then they articulate to receptors in the cell membrane of the target organ. It has an excitant or interdictory or any different kind of change on the affected organ [5].

The most critical neurotransducers are ACH, norepinephrine, dopamine, Gamma-Aminobutyric Acid (GABA), glutamate, serotonin, and histamine.

In the synaptic cleft, voltaic impulses that have traversed down the axon are changed to the actinic kind via the liberation of neurotransducers, causing a particular retaliation in the accepting nerve fibers.

A neurotransducer affects a nerve fiber by either exciting them forbidding them, or modulating their action.

An excitant transducer involves the genesis of a voltaic impulse called an action potential in the receiving neurocyte, while an interdictory transducer prevents it. Whether a neurotransducer is excitant or interdictory depends on the receptor it binds to [6].

Chart 1. Above mentioned neural transducers are carriers of important messages within the body.

Excitant neurotransducers	GABA Acetylcholine Histamine Dopamine Noradrenaline Adrenaline
Interdictory neurotransducers	GABA 5-Hydroxytryptamine Dopamine
Neuromodulators	DA 5-Hydroxytryptamine Acetylcholine Histamine Norepinephrine
Neurohormones	Releasing hormones Oxytocin Antidiuretic hormone (ADH)

Neuromodulators are not bound just to the synaptic cleft between two neurocytes so that they can affect more significant numbers at once.

These actinics and their interminglings perform several neural system functions and control bodily functions.

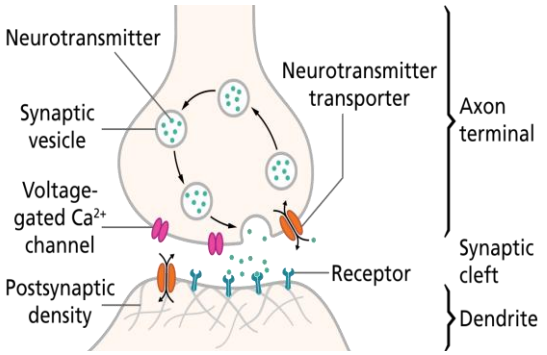

Fig. 1. Neuromodulators

1.3 Neurotransducer Tests

Doctors use Neurotransducer testing to address the function of the neural system. They measure significant neurotransducers, including serotonin, dopamine, norepinephrine, and GABA.

1.4 The Method Used For Neurotransducer Tests

Neurotransducers in the plasma and their constituents are removed by the renal system and are excreted in the urine. The presence of entire structures of neurotransducers in urine is not opposed, as evidenced by studies demonstrating renal transporters capable of filtering neurotransducers from the blood to the urine. A simple urine collection process can obtain the main neurotransducers that regulate mood and behavior.

1.5 Neurotransducers Accessible at the Moment for Examination

- Epinephrine
- Norepinephrine
- Dopamine
- Serotonin
- GABA
- Glutamate
- Histamine

2. REINFORCEMENT AND ADDICTION

Reinforcement is the process that leads to dependency on drugs like alcohol [7]. It provides positive reinforcement that leads to the dependency on alcohol which provides a euphoric effect and hallucinogenic pleasure that makes the person want more of it [7]. The person gets restless and has a longing for alcohol throughout the time spent without it [8]. This feeling of wanting alcohol when avoiding it is called negative reinforcement. Both the positive and the negative reinforcements lead to their role in alcoholism [9].

These reinforcements result from their regulation by coordinating several neurotransducers like dopamine, glutamate, GABA that reinstate the effect of alcohol by acting on the NMDA receptors [10].

2.1 Effect of Alcohol on Neurotransducers

Alcohol is the most common recreational drug that all people flock to have a good time in social gatherings or by themselves. It is not shunned by society like other drugs and is therefore easily accessible and acceptable. It is made readily available to the general masses, and its hallucinogenic effects are very welcome by the user as it detaches them from the outer world, putting them into a euphoric dreamland providing them with temporary emotional highs [11]. Alcohol is consumed in ethanol, which has continually been synthesized from the olden times through fruit juices. The fermented beverage would be stored in a container, and this rudimentary alcoholic beverage remained safe to drink throughout the winter.

It provides a euphoric effect, making the person feel lightheaded and feel like they are floating.

It affects both kinds of neurotransducers:

1. Excitant, and
2. Interdictory

The effects of consumption of alcohol can be felt the instance it is consumed or can even be prolonged.

The effect of alcohol depends upon:

1. The amount of alcohol consumed
2. The frequency with which it is consumed

Depending upon the upper two statements, we can determine whether a person is alcoholic or drinks just for recreation and very seldom.

An alcoholic person has a different response to alcohol in their body than a non-alcoholic person.

2.2 Effect of Alcohol on Serotonin

Serotonin plays a significant part in the uptake of alcohol, leading to alcohol abuse and eventually becoming dependent on alcohol. There are changes in serotonin amounts in the body and products like compounds that help diagnose carcinoid tumors. The use of pharmaceuticals leads to changes in serotonin transmission and results in a lowering of alcohol consumption. An increase in serotonin receptors leads to less alcohol consumption by reducing the drive to ingest alcohol. Thus, it can be seen as something that reduces the tendency of a person to become an alcoholic and leads to them being less anxious and other disorders related to behavior.

2.3 Effect of Alcohol on Dopamine

Dopamine is a neurotransducer used for inspiration and a positive boost to the mental state. It leads to the repetition of things that motivate the person. Consumption of alcohol, even in low amounts lethe, ads to an exaggerated release of dopamine, which provides the person with euphoria and increases consumption. Increased consumption thus is synonymous with alcohol abuse.

2.4 Effect of Alcohol on GABA

The structure of GABA and alcohol are pretty similar, so consumption of excessive alcohol leads to inhibition of neural transmission. The alcohol articulates itself to the GABA receptors or the GABA binding sites. As a result, it delays neuronal transmission. Alcohol is antagonistic to the effects of the neurotransmitter GABA. This neurotransducer produces a sedating and calming effect on the body, and since alcohol binds to its receptors and performs the same function, it also leads to feeling sluggish and euphoric. The immediate effects on the consumption of alcohol make a person feel good, but overconsumption even after getting intoxicated leads to the person becoming unconscious.

2.5 Effect of Alcohol on Epinephrine

The primary metabolic function of epinephrine is generally causing an increase in vascular pressure. Alcohol consumption exaggerates the effect of epinephrine; this further causes increased blood pressure in the consumer, causing hypertension. Other metabolic effects of alcohol include the metabolism of fats into free fatty acids. This leads to the deposition of free fatty acids on the surface of the liver, causing fatty liver, which is an indicator of alcoholism. Alcohol consumption also leads to what laymen call a sugar rush, as epinephrine causes increased gluconeogenesis. There is an increase in glucose levels; hence they get excited very quickly and use up the vast energy reserves that they possess.

2.6 Effect of alcohol on Nor-Epinephrine

When we concentrate on something, the brainstem releases nor-epinephrine, the consumption of excessive alcohol deters the function of norepinephrine, resulting in a loss of focus and can lead to mental illnesses like depression, delusions, hallucinations, disorganized thoughts, speech, and behavior.

3. EFFECT OF SHORT TERM ALCOHOL INTAKE ON NEUROTRANSMISSION

The main interdictory neurotransducer in the brain is GABA(Gamma-aminobutyric acid). Its main functions are relaxation of the person giving them a state of decreased anxiety, almost like a sedative. It acts through its receptors called GABA [12].

Exposure to alcohol, even for the short term, causes an interdictory effect on these receptors. Alcohol exposure also affects other interdictory neurotransducers like glycine and reportedly increases functionality.

Alcohol also increases the interdictory neurotransmission by increasing neuromodulators like adenosine. The adenosine system causes sedation, whereas the forbidding of this system causes stimulation. Short term influence of alcohol causes the increase in adenosine levels that interact with its receptors, thus increasing the sedative-like effects of alcohol.

Such an interaction takes place in the Purkinje cells of the cerebellum. The increased activation of the $GABA_A$ receptors occurs concurrently with the activation of receptors for norepinephrine because alcohol acts on norepinephrine receptors.

Alcohol has sedative-like effects also because it forbids excitant neurotransmission by forbidding several excitant neurotransducers like aspartate and glutamate, which act through the N-methyl D- aspartate receptors (NMDA) as well as non-NMDA receptors. The short-term exposure to alcohol forbids both these receptors' activity that leads to sedation [13].

In a symphony, complex brain activities and cognitive functions like consciousness, staying alert, and memory act together. The brain's memory functions are regulated by a mechanism called long-term potentiation(LTP) that helps form memories. The mechanism works due to the stimulation of excitant neurotransducers in the hippocampus(storage site of memories) [14]. Exposure to alcohol, even for a short amount of time, causes the forbidding of glutamate receptors and activation of $GABA_A$ receptors which is precisely the opposite of what the machine needs to make memories. LTP plays a role in the memory storage mechanism that gets forbidden due to the consumption of alcohol.

4. EFFECT OF LONG TERM ALCOHOL INTAKE ON NEUROTRANSMISSION

The brain tries to restore homeostasis after long-term alcohol ingestion [15]. The short-term effect of alcohol compared to its long-term effects is the opposite. Prolonged drinking alters the $GABA_A$ receptor's functionality due to decreased number of receptors or alterations of the protein site of the receptors [16]. This change in receptor levels decreases sensitivity to neurotransmission.

Similarly, the glutamate receptors increase their excitant activity to adapt to the interdictory effects of alcohol. A decrease in adenosine levels is also observed, which acts as a compensatory mechanism following long-term consumption of alcohol [17].

These compensatory mechanisms lead to several alcohol-induced behavioral changes like the development of alcohol tolerance, leading to increased alcohol intake since a person must drink more to obtain or perform a specific brain function [18]. Continuous drinking makes a person resistant to the short-term effects of alcohol on the $GABA_A$ and glutamate receptors [19]. The resistance is developed due to the regulation between the neurocytes that produce many neurotransducers like vasopressin, which affects the body fluid equilibrium, affecting the tolerance of alcohol in the body [20]. The effect of alcohol depends on vasopressin and vasopressin like neurotransducers like serotonin, norepinephrine, and dopamine, which have several regulatory functions. [21].

5. CONCLUSION

Alcohol, although a recreational drink, should be consumed in a proper amount and not incessantly since too much consumption can cause alcohol dependence that eventually leads to the person becoming an alcoholic. Alcohol has many short-term effects that a person experiences immediately on consumption that brings them back for more. The body acts adversely when exposed to alcohol. Some neurotransducers undergo excitant changes while some undergo interdictory changes. [22].

1. Dopamine release is increased in the body when consuming alcohol and makes the person very happy and motivated [23]. Sustained drinking reduces the number of dopamine receptors in the body, so in alcoholic people, it causes a feeling of hopelessness and depression when they gradually stop drinking.
2. Alcohol acts as an agonist to GABA, i.e., it binds to the GABA receptors and carries out the same activity as GABA [24]. This results in the person feeling lax, less anxious, and tired [25]. Constant consumption of alcohol decreases the number of GABA receptors in the brain as a whole [26].
3. Consumption of alcohol also decreases the levels of glutamate in the body leading to low energy levels and lethargy. [27]. The effects of alcoholism and excess drinking is shown because of its effect on the NMDA receptors concerned with glutamate [28].
4. Alcohol causes changes in the level of serotonin in the neurocytoma synapses and also causes a change in activities of serotonin receptors [29].

Humans rely on our brain for almost all the activities we carry out during a day, be it vital or non-vital. [30]. The human body works like a perfect machine, and the introduction of a foreign object like alcohol causes the harmony of the machinery to bend out of place and throw everything out of balance [31].The article gives as to how our brain acts in the presence of alcohol, not even for a long time but short as well, and is helpful to find a corrective methodic treatment for alcoholism [32-37].

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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