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## Vestibular Stimulation: A Physiological Intervention for Depression- A Hypothesis.

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### ABSTRACT

Depression is a psychiatric disorder of major public health importance. Depression is more common in women than men. Although most psychoactive drugs that are used therapeutically to treat mental disorders, unfortunately, are abused. Many abused drugs act by enhancing the effectiveness of dopamine in the pleasure pathways and gives intense sensation of pleasure. Optimal vestibular stimulation relieves most of the symptoms of depression through its connections with the structures of brain involved in emotions, behavior and cognition. Current evidence supports the use of vestibular stimulation as an intervention for depression. We recommend translational research in this area to explore the therapeutic validity of vestibular stimulation in the management of depression for the benefit of the population in general.

**Keywords:** Depression, Physiological intervention, Vestibular stimulation.

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## INTRODUCTION

Depression is among the psychiatric disorders associated with defects in limbic system neurotransmitters. Serotonin and norepinephrine are chemical messengers in the limbic system, which are involved in pleasure and motivation. Norepinephrine secreting neurons from locus ceruleus sends fibers to limbic system, thalamus and cerebral cortex and serotonin producing neurons from raphe nucleus sends fibers to many areas of limbic system. The precise cause of depression is unknown, however there is a strong evidence for a role of central monoamines including norepinephrine, serotonin and dopamine. Symptoms of depression includes depressed mood, generalized loss of interests, an inability to experience pleasure (anhedonia), loss of appetite, insomnia or hypersomnia, restlessness, diminished ability to think or concentrate and suicidal tendencies. Although most psychoactive drugs that are used therapeutically to treat mental disorders, unfortunately, are abused. Many abused drugs act by enhancing the effectiveness of dopamine in the pleasure pathways and gives intense sensation of pleasure [1, 2].

Vestibular apparatus, located in the inner ear helps for maintenance of balance and equilibrium. Though there are several methods available to stimulate vestibular system, the simplest method is using a swing, which was inherently incorporated in Indian tradition. It was reported that vestibular stimulation influenced purchase decision making and attenuated the pleasant and rewarding effect of acquisition [3]. Optimal vestibular stimulation relieves most of the symptoms of depression through its connections with the structures of brain involved in emotions, behavior and cognition [4-7]. Conversely patients with vestibular disorders experience symptoms of depression, anxiety at higher rates than the general population.[7, 8] Unlike the psychoactive drugs, vestibular stimulation by swing do not alter dopamine levels and cause minimum or no side effects. Hence it can be incorporated in routine day life style to prevent/ treat depression.

Here we put forward a hypothesis that vestibular stimulation relieves most of the symptoms of depression and review the possible mechanisms to suggest translational research in this area, for the benefit of the society in general.

## MATERIALS AND METHODS

A detailed review of published literature from <http://www.google.com>, <http://www.pubmed.com>, British Medical journals, Medline, ERIC, <http://frontiersin.org> and other online journals was analyzed.

### **Vestibular stimulation relieves most of the symptoms of depression**

#### **Vestibular stimulation modulates serotonin levels**

Serotonin is present throughout the central nervous system and involved in a variety of neural functions such as pain, feeding, sleep, sexual behavior, cardiac regulation and cognition. Age-related alterations in serotonin function may increase the vulnerability to psychiatric and neurodegenerative disorders [9]. Vestibular nuclei has both direct and indirect connections with raphe nuclei. Neurons of raphe nucleus responds to vestibular stimulation and may mediate vestibulo spinal and vestibule-sympathetic reflexes [10].

#### **Vestibular stimulation relieves stress and promotes sleep and improves cognition**

Chronic stress may lead to major depression in susceptible people. Vestibular stimulation relieves stress and controls heart rate and blood pressure within normal limits by inhibiting the stress axes.[11] Sleep and depression are closely related. Depression may cause sleep disturbances and sleep disturbances may cause or contribute to depressive disorders. Evidence suggests that people with insomnia have a ten-fold risk of developing depression compared with those who sleep well [12]. Vestibular stimulation promotes sleep through its extensive connections with the brain areas related to sleep [5]. Vestibular stimulation modulates cognition through HPA axis, through neocortex and limbic system.6 Vestibular system triggers a range of changes in cognition, emotion and personality through controlling autonomic functions [7].

## Vestibular stimulation regulates food intake

Depressive symptoms are associated with food consumption patterns. Depressive symptoms may decrease an individual's motivation to engage in healthy dietary habits and thus may lead to a poor diet [13]. In contrast, it was reported that, nutrition plays a key role in the onset as well as severity and duration of depression. Food patterns that associated with depression are poor appetite, skipping meals, and a dominant desire for sweet foods [14]. It was reported that healthy diet may reduce the risk of severe depression. Vestibular system is having extensive interactions with hypothalamus, dorsal raphe nucleus, nucleus tractus solitarius, locus coeruleus, hippocampal formation and regulates food intake.

## CONCLUSION

Current evidence supports the use of vestibular stimulation as an intervention for depression. We recommend translational research in this area to explore the therapeutic validity of vestibular stimulation in the management of depression for the benefit of the society in general.

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