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Dopamine and its Relation to Age Related Physical Inactivity

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Abstract:

It's been forever known that dopamine is an important hormone but much attention has been recently put towards its role as a neurotransmitter. Therefore, this present article aims first discuss the role of dopamine as a neurotransmitter and then focus on its relationship with physical inactivity and especially the age-related physical inactivity.

Introduction:

Dopamine is a monoamine neurotransmitter, meaning that it's derived from an amino acid[(1).] It is a catecholamine, meaning it contains a catechol nucleus[(1).] Dopamine is synthesized in areas of the central and peripheral nervous systems, mainly in the hypothalamus, from the amino acid tyrosine, it is converted to L-dopa, then decarboxylated to form dopamine[(1).] There are several areas of the brain where dopamine neurons are concentrated. The largest are the midbrain, the hypothalamus, olfactory bulb, and retina. There are also several major dopamine path-ways that carry dopamine from these areas of concentration to other parts of the brain [(2).]

In terms of action, dopamine acts at G-protein coupled receptors and there are at least 5 subtypes of the dopamine receptor, from D1 to D5 the one we will be focusing on in this report is D2 which highly concentrated in the striatum, The striatum is one of the principal components of the basal ganglia, a group of nuclei that have a variety of functions but are best known for their role in facilitating voluntary movement [(2).] Dopamine is linked to movement due to disorders like Parkinson's disease that involve dopamine deficiencies [(3).] It is also often associated with the processing of re-warding experiences [(3).] However, dopamine also plays a role in many other functions.

Discussion

As recent studies suggest the existence of a relationship between dopamine and age related physical inactivity, evidence provided by some shall be discussed. How this all started was through a study that was conducted on mice to explain the relation between dopamine, physical activity and the weight gain, scientist fed a group of eight mice a normal diet, and they fed another group a high-fat diet for 18 weeks, starting from week 2, the mice on a high-fat diet started gaining significantly more weight than the lean ones [(4).] By week 4, obese mice spent less time moving, had fewer movements, and were slower when they did move, compared with lean mice, Scientists examined whether changes in movement correlated with body weight gain, and they found that it did not [(4).] Interestingly, the mice on a high-fat diet moved less before they gained the majority of the weight, which suggests that the extra weight could not have been responsible for the reduced movement [(4).] They found that the D-2 type receptor (D2R) binding, found in the striatum, was reduced in obese mice. This was consistent with previous research in rodents [(4).] Then, scientists genetically removed D2Rs from the striatum of lean mice to determine if there was a causal link between D2Rs and inactivity [(4).] Researchers then placed the lean mice on a high-fat diet surpris-ingly, they found that these mice did not gain more weight, despite their physical inactivity [(4).] This made room for more concerns regarding the matter, hence, another study that was conducted on 44 individual's age between 23 and 80 showed manly three findings:

The first of which was contestant with the finding study conducting on mic that there was a positive association between the number of DR2 receptors and physical activity so that means when number of DR2 receptors degreases the physical activity degreases [(5).] Secondly it was found that there was a negative association between the age and the number of DR2 receptors means that the number of the receptor degrease as we get older this's at least partially re-flects auto receptor loss with age rather than neuronal loss meaning that the loss is not in the post synaptic nervous but rather than the number of the post synaptic dopamine receptors on the neurons[(5).] Thus, before understanding the third finding we have to know that the striatum is divided into a ventral striatum, and a dorsal striatum, they are part of the basal ganglia [(5).] The striatum is best known for its role in the planning and modulation of movement pathways but is also involved in a variety of other cognitive processes involving executive function [(5).] So DR2 dopamine receptors are mostly abundant in ventral striatum, and a dorsal striatum, so in this research it was found that these straita are differently effected by pathology when comparing the DR2 dopamine receptor decline in normal state and pathological state, For example: in Parkinson's disease, dopamine depletion begins in the dorsal striatum and later progresses to the ventral striatum as the disease progresses. In contrast to this in a normal aging there are lower rates of decline in the dopamine receptor in the ventral striatum relative to the dorsal [(5).] Consequently, this is relevant because as the ventral striatum not only involved in physical activity but also in other physiological functions of human such as reinforcement learning and value base decisions making this study shows great Evidence that the physical inactivity also has impacting on these other functions which greatly explains why older people often have difficulties with such things[(5)]. Therefore as the DRD DOPAMINE receptor present in the brain have also a part in dopamine functioning in general these receptor decline result in physical inactivity there also other impact related to dopamine general function[(5).] Hence as conclusion for this if the physical activity was maintained despite the degrease in the receptor this slows down the receptor degrease resulting in degrease in the compaction of this, thus this really greatly explains why older people who maintain normally activity and exercise frequently often have healthier live and better functioning until older ages and why older people living sedentary life very commonly show accelerated degrease in the normal activities even appearing in young ages such as 50 or so, And sedentary life such as most of the elderly people in our country. Last but not least, a third study has considered the biological basis to the age-related decline in physical activity that occurs in humans. Based on extensive research regarding this question in nonhuman subjects, it should be clear that a gradual and continuous decline in activity occurs in both male and female subjects with advancing age past maturity in a great variety of species [(6).] This degree of age-related decline varies among individuals of the same genotype but also differs among those of different genotypes [(6).] The degree of physical activity also appears related to longevity mechanisms [(6).] The search for neural mechanisms of the age-related decline in physical activity has pointed to a major involvement of the dopamine neurotransmitter system [(6).]

Conclusion

To sum up, when there is receptor decrease there will be a decrease in the physical activity and when the age increase the receptor decreases which again leads to decrease in the physical activity and eventually with a decrease in the normal physiological functions so this highlights the importance of maintaining normal physical activity and exercise frequently to delay the age related complications of the receptor decrease.

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