

A Review on the Effects of Yoga on Epigenetics

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Abstract

Yoga is an art form, popularly known for its psychological benefits, which mainly includes reducing stress in the fast paced modern world. Recent studies have started to show that Yoga might have additional effects on the body, such as an effect on epigenetics. Epigenetics is the study of phenotypic changes in genes due to external environment and body activities which does not alter the DNA sequence. Yoga has been found to target the same genes that are also the targets for stress, hence reversing and mitigating its effects. Regular practice has been found to reduce cytokines and other transcription factors that are responsible for inflammation. Thus, Yoga can be used to treat the incorrect reading of genes by the body and can be a form of treatment to many ailments, either genetic or lifestyle.

Keywords: Yoga; Epigenetics; Stress reduction

Introduction

The ancient Indian art, Yoga, which has improved the quality of life for millions around the world, has only recently come into the limelight as a form of cleansing for the body and mind. The art form is found to have several effects on the body, like relaxing of the mind, de-stressing, mental awareness, and even physical flexibility to name a few. The fast-growing needs and larger financial burdens require work harder and longer, more than usual, which is leading to the issue of stress and mental health becoming another major obstacle to overall well-being. Yoga is seen to be a method used by many to combat this obstacle, thereby rejuvenating the mind.

Recent studies are showing that, apart from the above aspects, Yoga can also be linked to epigenetic changes. Until now, yoga was known to only relieve psychological stress, but with these new studies, it now broadens into the relief of the physiological effects that stress causes on the body. Epigenetics is the study of change that occurs in the body due to one's daily habits and exposed environment [1-2]. This new relationship between Yoga and Epigenetics could be a potential breakthrough in the field of health and genetics. For example, genetically predisposed mice born with diabetes or cardiac disorders are found to have offspring who are normal if they are fed the proper diet. This means that epigenetic factors can take

precedence over genetic factors. If understood properly, it could be a cure to genetic disorders that have been untreatable since the beginning of modern healthcare. The effects of Yoga on epigenetics and its causes are discussed further in this review.

Literature Review

Epigenetics

Day-to-day behaviour and environment directly affect the way the body reads genes. It is similar to cause and effect. The cause is one's daily activities and environmental factors and the effect is the reading of genes to suit the daily activities and the environment. The study of how to improve the expression of genes without altering the DNA is what Epigenetics is all about [3]. Since the DNA is not changed, epigenetic changes are reversible and therefore this can be used to express genes in a desired manner. The field of epigenetics is still relatively new to science, and is slowly becoming popular as it is a new method to improve physical wellbeing. There are different types of epigenetic processes [4-8].

DNA methylation

A methyl group is added to certain parts of the DNA, mostly sites with consecutive cytosine bases, which inhibits the binding of the protein, transcription factors, which are responsible for reading the DNA, thus turning 'OFF' the gene. A chemical process called demethylation can occur to remove the methyl group and turn 'ON' the gene once again.

Histone/Chromatin modification

Chromatin is a complex of proteins called histones. DNA fibres wrap tightly around the histones. These complexes can be modified so as to make the structure more open or tight, thus altering gene expression. A tighter or closed complex has lesser expression, while a more open or loose complex has a greater gene expression.

Non-coding RNA

DNA is used as instruction to make coding and non-coding RNA. Coding RNA is involved in making proteins while the non-coding RNA is used to control gene expression by binding to the coding RNA, along with other proteins, to break down the coding RNA, thereby not allowing protein creation [4,6,8].

Epigenetics is linked to physical health, and not all of its changes are good for the body. For example, germs that enter the body can cause epigenetic changes and weaken the immune system. Mycobacterium tuberculosis causes tuberculosis. The infection can result in changes to histones in some of the body's immune cells that result in turning 'OFF' the *IL-12B* gene. Turning 'OFF' the *IL-12B* gene weakens the immune system thus aiding in the survival of Mycobacterium tuberculosis [5].

Further studies need to be performed to classify the good and bad epigenetic changes that arise due to various factors so it can be used to improve quality of life.

Yoga

Yoga is an art form, first found in Indian philosophy, as an exercise to bring peace to the soul. It began as a spiritual practice but has become popular as a way to promote physical and mental well-being. Yoga consists mainly of physical postures (asanas), meditation (dyana) and breathing techniques (pranayama). The positive effects have made the activity popular among western countries as well and are now performed by several people around the world.

The American Academy of Pediatrics (AAP) has officially stated that Yoga is safe and is an effective therapy for children and adolescents coping with physical, mental, emotional, and behavioral health conditions. It can help cope with tension, relax muscles and even improve balance[9,10]. Sana Jarraya et al. performed a 12 week study on the effect of yoga on 45 5-year old children where they were divided into 3 groups. Group-1 performed Yoga for 30 min twice a week, Group 2 had physical activities twice a week and Group 3 performed no activity and served as a control. After the 12-week study period, it was then concluded that the children of Group 1 showed significantly less inattention and hyperactivity compared to the other two groups [11-13].

Research has suggested that Yoga has the following benefits:

1. Help improve general wellness by supporting good health habits, and improving emotional health, sleep, relieving stress and balance.
2. Helps reduce lower back and neck pain, and possibly headaches and knee osteoarthritis.
3. Boosts metabolism and thus people who are overweight or obese could lose weight.
4. Aids people to quit smoking.
5. Helps to manage anxiety or depression that arises due to life events.
6. Relieves menopause symptoms and can reduce period cramps.
7. People diagnosed with chronic diseases can manage their symptoms and improve their quality of life [2,9,10].
8. Yoga is still relatively new in research, and thus further research is necessary to determine its full benefits.

The effects of yoga on epigenetics

Yoga is based on the postulate that a healthy body requires a healthy mind. Studies demonstrate that epigenetic factors are involved in the outcome of several common conditions. Many problems are considered lifestyle problems that occur due to bad food habits, lack of physical and mental activity and so on and can be reversed by changing one's lifestyle. It has been stated that 95% of conditions are not inherited and hence can be tackled by modifying one's lifestyle.

The type of input that comes into every cell is determined by the cell membrane. The cell membrane consists of two types of proteins, the sensor protein and the effector protein. The sensor protein responds to many extracellular signals that may be vibratory, electromagnetic or biochemical. In view of this, cellular response, as well as the entire body response, may be determined by non-physical inputs, such as mechanical movements, and even with thoughts, in this case Yoga, which helps in both of the above inputs. Thus, genes do not control their own activity. The membrane proteins decide how the genes should read the signal. The environment and behaviour of the individual affects how the proteins on the membrane control the gene expression [11].

Studies indicate that practicing yoga can reverse changes brought about by inflammatory responses triggered by stress. A regular yoga practice lowers NF-kb levels and cytokine levels. The expression patterns of genes involved in inflammation are thereby reversed. There is a lower risk of diseases and conditions associated with inflammation the inflammation is under control [2].

A study performed by Dada et al. in 2015, states that the redox state of the body is greatly improved when one performs Yoga, due to the reduced amount of reactive oxygen species (ROS) which is associated with accelerated ageing and inflammation [14,15]. Moreover, Yoga can counteract stress by lowering serum cortisol levels through the HPA (Hypothalamic-pituitary-adrenal) axis in the body [16]. Researchers observed that both healthy and depressed subjects' levels of BDNF (Brain-derived neurotropic factor), which plays an important role in neuroplasticity, increased following practice [16-18]. Since BDNF crosses the blood-brain barrier suggests that peripheral BDNF levels are indicative of those in the brain [19]. It is possible that Yoga can slow down neurodegenerative processes triggered by a variety of types of stress since it reduces cellular aging and preserves neuroplasticity in the brain. Furthermore, reduced plasma cortisol levels and increased BDNF were associated with improved cardiovascular function [12,20].

Conclusion

When done correctly, under the guidance of a qualified instructor, yoga is generally thought to be a safe form of exercise. As with any physical activity, yoga can also cause injuries. A sprain or a strain is the most common injury associated with yoga. It is rare to sustain a serious injury. Injuries associated with yoga are less likely than those associated with higher impact sports.

People with health conditions, such as those who are older adults or pregnant, should talk with their health care providers about yoga. There may be yoga poses and practices they must modify or avoid. Yoga appears to have a significant effect on the mind-body and the genetic system. In the course of evolution, mind-body interventions like yoga will certainly play a role in influencing our genetic makeup.

Yoga and meditation practices seem to act on the same stress-related gene targets and promote neuronal, endocrine and behavioral functions. This suggests that through the practice of Yoga, one can prevent or reverse the detrimental effects of a stressful environment. However, because of the relative novelty of the field, the exact relationship between Yoga and meditation and the effects of stress is unclear. The immune system, metabolism, stress-response pathways and neuroplasticity to which yoga and meditation might contribute, make it plausible for them to have beneficial effects on psychology.

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