2020

The physiological effects of stress in populations that exhibit signs of chronic diseases compared to athletes

BOSTON UNIVERSITY

SCHOOL OF MEDICINE

Thesis

THE PHYSIOLOGICAL EFFECTS OF STRESS IN POPULATIONS THAT EXHIBIT SIGNS OF CHRONIC DISEASES COMPARED TO ATHLETES

by

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B.S., Indiana University, 2017

Submitted in partial fulfillment of the

requirements for the degree of

Master of Science

2020

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DEDICATION

I would like to dedicate this work to my family, for you never ending support. Thank you for all that you do and continue to do for me and my growth.

ACKNOWLEDGMENTS

Thank you to Dr. Davies for your encouragement, guide, and overwhelming help in helping me to accomplish this.

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ABSTRACT

Current research has demonstrated that stress is a contributing factor to many chronic disease states in our world today. Diabetes, hypertension, and high cholesterol are just a few health conditions in which stress can worsen these disease states in individuals. Stress is apparent in individuals with chronic disease but can also appear in those dealing with high-performance anxiety such as student-athletes. Stress does not discriminate in how it can affect people physically, mentally, and emotionally. Even though stress can affect a diverse range of people, there may be similarities among different groups affected by stress such that lessons can learn from each other.

For example, research has shown the overwhelming benefits of exercise on physical health and mental health. Yet, even though athletes train consistently, they can still feel the adverse effects of stress on their mental well-being and emotional health. This feeling may be due to the pressure incited to perform at a high level during athletic events. Another adverse area of stress for athletes is the reality that their career will at some point end. This reality may be in their early 30s or 40s. The feelings of loss of purpose are common for many prior athletes and instills additional fear in navigating life direction after sports. In contrast, chronically ill patients go through different events because their stress is directly

due to their illness. However, many studies reveal similarities between athletes and those who have a chronic disease regarding mental and emotional coping mechanisms for stress. This thesis addresses these similarities and discusses how both groups even though they have vital differences can learn from one another when dealing with stress.

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LIST OF ABBREVIATIONS

ACh ..... Acetylcholine

ATP ..... Adenosine Triphosphate

ACTH ..... Adrenocorticotropic hormone

BCE ..... Before Common Area

CO2 ..... Carbon Dioxide

CNS ..... Central Nervous System

CSF ..... Cerebral Spinal Fluid

CRH ..... Corticotropin-releasing hormone

EPSP ..... Excitatory postsynaptic potentials

GnRH ..... Gonadotropin-releasing hormone

GH ..... Growth Hormone

IPSP ..... Inhibitory postsynaptic potentials

ISMA ..... International Stress Management Association

PNS ..... Peripheral Nervous System

PTSD ..... Post-Traumatic Stress Disorder

TSH ..... Thyroid Stimulating Hormone

INTRODUCTION

The Brain and Neurosignaling

The meninges are the overall tissue that covers the brain. Dura matter is the thick portion next to the brain, the arachnoid matter is right underneath, and pia mater is the deepest layer next to the nervous tissue. The subarachnoid space is between the arachnoid mater and pia mater and fills the brain with cerebrospinal fluid or CSF (McCorry, 2007).

Neurosignaling in the brain is possible by the function of a neuron (Figure 1). The structure of a neuron starts with the dendrites which receive neural input and relay that to the cell body. The information in the cell body will send that information down the axon of the neuron. The data communicates that message to the end of the axon into what are called axon terminals. Next, that information will transfer its data into the next neuron. This process is essentially how the brain and the body communicate and interconnect together (Yellen, 2018).

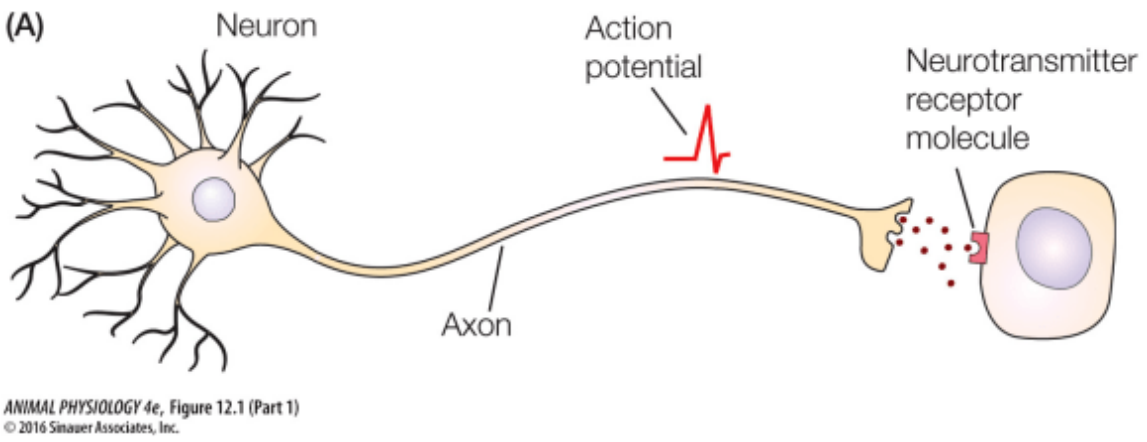

Figure 1: The Neuron: Image show the structure of a neuron from left to right including the dendrite, cell body and axon. Figure taken from Animal Physiology (2016).

Neurons that are sending information to the brain or central nervous system (CNS) are called afferent neurons. Neurons that transmit information from the brain to the muscles and organs are called efferent neurons and are part of the peripheral nervous system (PNS) (Vander, 2019). Interneurons are neurons that are only found in the brain and are responsible for the thoughts, emotions, and processing of information in the cerebral system (Figure 2)(Brooks, 2016).

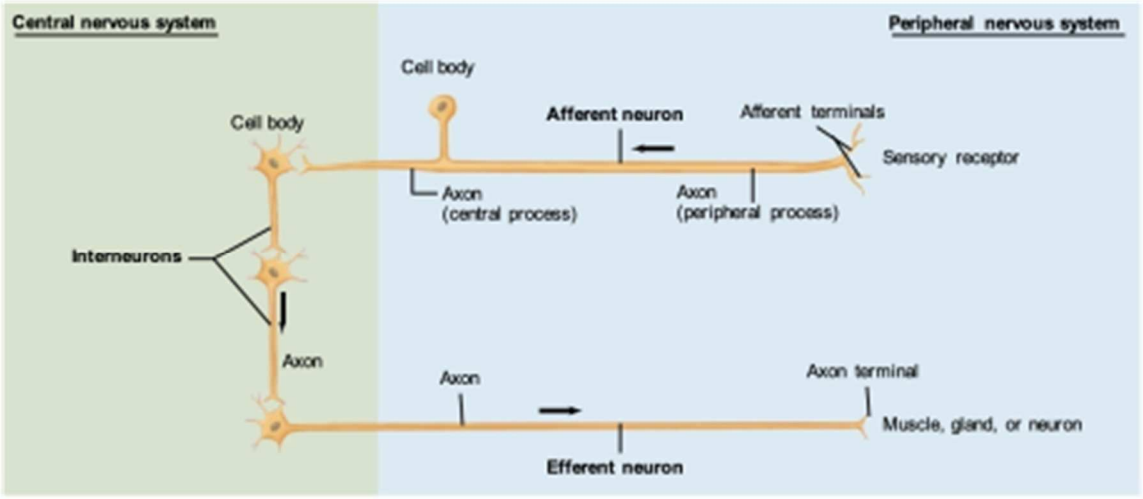

Figure 2: Central Nervous and Peripheral Nervous System: Image show the structure of the Central Nervous System and Peripheral Nervous System, including cell body and interneurons. Figure taken from Animal Physiology (2016).

There is an estimate of over 200,000 interneurons in the brain. Many neurons have a covering sheath called myelin. Myelin is essentially a coating plasma membrane layer that helps neurons trigger faster signals. The CNS has a type of myelin sheath called oligodendrocytes (Brooks, 2016).

When looking at the shape of a neuron, we find that the axon terminals conducting their signals are called synapses. If neuron 1 has a message in which it is conveying information to neuron 2, the neuron would have what labels as the presynaptic synapse because it is the one that is sending the signal. Neuron 2 will be the postsynaptic neuron because it will take that signal and send it to the next neuron (Brooks, 2016).

The CNS also has another glial cell called the astrocyte. Astrocytes help the formation of tight junctions. A tight junction acts as a barrier for only the right materials to go through to the brain like oxygen and carbon dioxide. This barrier is known as the blood-brain barrier (Yellen, 2018). Microglia are also found in the CNS and perform immune functions when foreign substances happen to cross the blood-brain barrier. Ependymal cells line the CNS with fluid (cerebrospinal fluid), which helps regulate and preserve the brain's functions. The PNS has its particular set of glial cells called Schwann cells (Yellen, 2018).

Neuroplasticity is essentially the neural signals in the brain changing their messages and their transmission to function in a particular way. For example, someone that is "wired" to love sugar could unwire themselves by changing their habits over time, therefore changing certain types of neural pathways to make them stronger or weaker. Once they have changed their habits over time, their neurological signal pattern will also change. Neuroplasticity, in essence, is the process of learning something or "unlearning" something (Brooks, 2016).

The best way to change a bad habit is by not doing it, which is easier said than done. However, if a person can replace a bad habit with good habits, the brain will strengthen those neural signal pathways to that good habit, and over time, the bad habit will become less and less prevalent (Brooks, 2016) Another way to describe neuron to neuron communication is by the terminology of action potentials. An action potential is a series of impulses that originate in the cell that help information to carry across the body of a neuron to other neurons. Neurons specifically get their energy from ions such

as sodium and potassium. Sodium and potassium work together as ion pumps in neurons (Brooks, 2016). For example, when a certain amount of sodium level goes into a cell, it changes its membrane potential. The membrane potential is the difference in voltage between the inside and outside of a cell. The sodium-potassium pump is a pump that consists of the movement of sodium and potassium ions. 3 Na+ ions go out of the cell, and 2 K+ ions come inside of the cell (Brooks, 2016).

Since there are more positive ions going out of the cell, the inside of the cell is less positive relative to the outside of the cell. Scientists use the term voltage to describe the state of the cell at rest. At rest, cells usually are at –70mV, which simply means that more sodium is escaping the cell, and the inside of the cell is less positive or (more negative) than the outside (Yellen, 2018). An action potential occurs when there is a rush of sodium ions *into* the cell. The rush of Na+ ions into the cell will cause the inside of the cell to become sharply positive. If the cell becomes positive enough, it will trigger an action potential (Vander, 2019). The action potential is the result of Na+ ions rushing into the cell and exceeding its membrane potential. The impulse triggers the action potential to initiate the current (depolarize) throughout the cell. The pulse slows down when more K+ ions rush *out* of the cell then Na into the cell (Yellen, 2018). If more K+ ions rush out of the cell, it will start to drop the potential (repolarization) until it comes down to the initial resting membrane of -70 mv. Graded potentials are similar to action potentials, but their restriction is local. This restriction means that they cannot initiate an impulse that will transport its way down a neuron, but it can help to break the threshold that will ultimately start the action potential. In other words, multiple

graded potentials can lead to an action potential (summation), which will be the impulse that ultimately carries information down a neuron to the next neuron (Vander, 2019).

Graded potentials take the form of inhibitory postsynaptic potentials (IPSP) and excitatory postsynaptic potentials (EPSP). Therefore, graded potentials can be inhibitory or excitatory for a neuron's action potential (Yellen, 2018). This potential allows different types of neurotransmitters to cause a specific action. For example, acetylcholine (ACh) is a neurotransmitter in the PNS that goes in contact with skeletal muscle cells and initiates a response (Yellen, 2018).

Catecholamines consist of dopamine (DA), norepinephrine (NE), and epinephrine. These all play a role in consciousness, mood, motivation, attention, movement, blood pressure, hormone release, and reward (Vander, 2019).

Understanding the anatomy and physiology of neurons is essential to discuss how that affects stress in human beings. Neurons are an integral part of the human body, necessary for communicating complex signals from the brain to the body. The better we can understand the function of neurons and how they interplay with hormones and emotions, the better we can provide physical and emotional interventions with those suffering from stress.

Neurological Damage and Stress

Neurological damage can result from disease, stress, mental health issues as well as hormonal imbalances. Studies explain that neurons in the central nervous system are relatively resistant to cell death. Cellular homeostasis is vital in allowing neurons the

capability to handle stresses. When an individual experiences stress, this can cause mental health issues due to the nature in which stress can cause dysfunction in neurons. Cell death results from a neuron experiencing multiple pressures, so much so that the cell is unable to recover.

Those who are immunocompromised, or experience a traumatic event, such as a stroke or seizure, commonly see a decline of energy in neuron function. Amyloid-beta proteins are proteins that coat the surface of neurons when stress is persistent. Amyloid-beta proteins commonly coexist with inflammation in cells. These proteins damage neurons by affecting pre- and post-synaptic transmission signaling. These damages incite excitotoxicity and neuronal death when the synaptic defects are unable to repair themselves. Medical professionals often see these discrepancies in a neurogenerative disease such as Alzheimer's disease (Danucalov et al. 2015).

Alzheimer’s disease is a neurodegenerative disease causing complications in cerebral function and intellectual decline. Neuronal degeneration results from deposition on amyloid beta protein on neurons in the brain as well as inflammation. Together, these responses lead to cognitive decline (Danucalov et al., 2015). Serotonin is another neurotransmitter that has an excitatory effect on pathways and inhibits pathways that involve sensation. They also regulate emotional states like mood and anxiety. Scientists have found that people prone to depression have a low dosage of these neurotransmitters, causing a higher chance of depressed mood (Friedel et al. 2010).

Another physiological link of stress ties into hormonal regulation and includes cortisol. Our brain consists of the forebrain, midbrain, and the hindbrain. The forebrain

contains areas like the frontal cortex, which includes the diencephalon and the cerebrum. Within the diencephalon are two main areas, which are called the thalamus and hypothalamus. The thalamus is responsible for coding sensory input, while the hypothalamus is a significant region of the brain in which hormones facilitate themselves through different sites of the body (Castillo-Quan et al. 2007). The hypothalamus has two areas: the anterior pituitary as well as the posterior pituitary. The anterior pituitary releases hormones adrenocorticotropic hormone (ACTH), thyroid-stimulating hormone (TSH), growth hormone (GH), prolactin, and Gonadotropin-releasing hormone or GnRH. These hormones release signals into the blood that circulate to distant areas of the bodies and cause some response (Castillo-Quan et al. 2007).

For example, corticotropin-releasing hormone or CRH is an amino acid peptide that is released by the hypothalamus as a response to stressful stimuli. This peptide secretes ACTH from the anterior pituitary. The ACTH that secretes from the anterior pituitary releases into capillary beds within the pituitary that eventually get taken up into the blood and released throughout the body. These hormones find their way into the adrenal cortex (Castillo-Quan et al. 2007) where cortisol is released from cell bodies known as the zona fasciculate. Cortisol is essential during times of stress, since the body needs to regulate blood glucose. Cortisol assists in increasing levels of glucose metabolism during stress through a method called catabolism (Castillo-Quan et al. 2007).

Catabolism is a method used by the body to break down essential fatty acids and glucose for fuel. This increase in regulation and breakdown gives us the energy that we need to carry out a task. The body finds itself in a very aroused state during catabolism

due to other physiological factors that are taking place, such as increased heart rate from the sympathetic nervous system that can lead to higher cardiac output by the heart beating faster. The increase in cardiac output means that more oxygen and nutrients utilize in the tissues of the body, such as skeletal muscle. This form of physiology prepares an individual for the classic "flight or fight" response from epinephrine or norepinephrine that allows humans to react quickly to any particular stimulus (Castillo-Quan et al. 2007).

Cortisol release is short-term, and can have very beneficial effects, although in the long-term immune function can suffer severely. This fact is especially concerning for individuals who are already immuno-compromised or have some chronic diseases such as asthma, diabetes, or cardiovascular disease (Castillo-Quan et al. 2007).

STUDY PROPOSAL

Stress can affect individuals in several different ways. In the current study, a qualitative, longitudinal, research analysis will be proposed with the rational and potential results discussed. The study aims to analyze stress coping means between a group of individuals with chronic disease versus a group of athletes without chronic disease. Both groups will complete a questionnaire with questions related to the history and length of their disease, how they have managed it, and how it has affected them mentally or physically. Questions regarding overall health, other medications and conditions, and exercise and daily activity levels will be collected.

The characteristics of this experiment will include a longitudinal research design. After baseline observations, follow up with subjects will occur in three-month increments to see how their treatment and/or therapy impacts their level of stress.

Rationale: Comparing Stress State of Diabetics versus Athletes

This research study will include studies that have measured athletes as well as diabetic patients using a range of questionnaires and surveys to assess stress. Ethical considerations will be implored based on anonymity, confidentiality, and informed consent for both patients and athletes. Once data has been collected for both groups, categorization can begin to pinpoint the validity and reliability of the questions answered. There will be one chronic disease group (diabetics) and one group of athletes in a specific sport (collegiate track athletes) to mitigate the variety of responses due to different sports or chronic illnesses. Recruitment will prove to be essential. The sample size will be 100 subjects.

The subjects' age, gender, and demographic data will prove useful background information. Next, subjects from both groups will fill out a stress questionnaire (Table 1). The aim will be to get 50 subjects, both men and women who have type two diabetes who are college age and 50 subjects, both men and women who are collegiate track and field athletes. The questionnaire will have the same questions for both groups. This test is to be an overview before investigating deeper emotional and mental stress.

For the chronic disease group, blood pressure will be assessed to analyze physical displays of stress and the athlete group's blood pressure can serve as control. The mental state of both groups will be analyzed extensively to measure anxiety, depression, or burnout. There may be bias in terms of how the questions reveal results. For validity, it will be necessary to have multiple evaluators to understand the realm of biases and critically evaluate each question and answer based on the response of the individual.

The purpose of assessing both groups is that their stress levels could implicate measures in which chronic individuals deal with stress relative to how athletes deal with stress. Even though both groups are on the opposite spectrums related to physical fitness, stress and cortisol release can drastically impact both groups in their mental and physical performance. Understanding how stress affects both groups can give solutions in which mental health counselors can approach these groups and help them with their stress to prevent depression, anxiety, or burnout. These findings could implicate important prevention methods in protecting people that deal with stressful situations and how to best cope through them.

Table 1 Sample Stress Questionnaire

(Amended from the International Stress Management Association, n.d.).
Answer all the questions by ticking either yes or no. Answer yes, even if only part of a question applies to you. Take your time, but please be completely honest with your answers:

	Yes	No
1. Not enough hours in the day to do all the things that I must do		
2. I deny or ignore problems in the hope that they will go away		
3. I only trust myself to do a job correctly, I do not have faith in people		
4. I struggle with balancing my life effectively		
5. My self-confidence/ self-esteem is lower than I would like it to be		
6. I frequently have a guilty feeling if I relax and do nothing		
7. I find myself thinking about problems even when I am supposed to be relaxing.		
8. I feel fatigued or tired even when I wake after an adequate sleep		
9. I find myself being impatient over small things		
10. I tend to always be in a hurry		
11. My appetite has changed, I either binge or skip meals		
12. I tend to bottle up my feelings when something goes wrong		
13. I experience mood swings, difficulty making decisions, concentration, and memory		
14. I find fault and criticize others harshly even when it is undeserved		
15. I have trouble listening because I am preoccupied with my own thoughts		
16. My sex drive is lower		
17. I have an increase in muscular aches and pains, especially in the neck, head, shoulders		
18. I am unable to perform tasks as well as I used to, my judgment is clouded		
19. I have a greater dependency for alcohol, caffeine, nicotine or drugs		
20. I find that I don't have time for many interests/hobbies outside of work		
21. I feel like I lack control in certain areas of my life		
22. I feel anxious, jittery, and nervous about the future		

Some of the questions in this questionnaire were used from the International Stress Management Association (ISMA), founded in 1974, and known for promoting prevention and reduction of human stress through awareness and sound knowledge (ISMA, n.d.). The present questionnaire attempts to gather physical, emotional, and mental information that can attribute to some level of stress. Subjects that check "yes" get one point, and "no," is zero points (Lovallo, 2016). ISMA analyzes its results based on three categories. If a subject gets less than 4 points, they are less likely to suffer from stress-related illnesses. If a subject gets 5-13 points, they are more likely to experience stress-related illness, whether physical or mental. Lastly, 14 points or more could be a sign of chronic stress relating to chronic disease or mental illness. Counseling or stress management prove useful recommendations in this category, as well as the 5-13 point category (Lovallo, 2016).

Overall, several standardized tests delve deeper into diagnosing and analyzing, specifically if patients struggle with depression or anxiety. One study used the Zung self-rating depression scale for their investigation of anxiety and depression in individuals with chronic disease. This test has a high sensitivity, specificity, and repeatability. It includes items that cover emotional, psychological, and physical symptoms (Gerontoukou et al. 2015).

POSSIBLE SCENARIOS

It will be imperative to utilize the right types of tests in this study to evaluate the realm and depth of stress from diabetic patients as well as collegiate athletes. Comparison of the two cohorts could give valuable results.

Table 2: Scenario Results for Stress in Diabetic and Athletic Populations

Scenario 1	Scenario 2	Scenario 3
Chronic diabetic individuals found to have higher levels of stress and anxiety than athletes.	Athletes found to have higher levels of stress and anxiety than chronic diabetic individuals.	No significant difference in stress and anxiety between groups, whether both groups are high or both groups are low.

Scenario 1 may be the most common due to the full range of difficulties that patients with chronic disease face. The authors that used the Zung self-rating test identified several factors that may have influenced their data. The participants in this study included 118 females (57.8%), compared to 86 males (42.2%). The majority of the participants were high school graduates (67%), married (71%), and living in urban areas (53%) (Gerontoukou et al. 2015). They found that there was a significant correlation between anxiety and education level. Primary education level participants had an 86% likelihood of having an anxiety disorder compared to higher education graduates. Intermediate education levels found to be at 68% experiencing stress and anxiety.

Unmarried individuals seemed to have an increased likelihood of depression when the study showed 94% of them with marginal symptoms of depression, while participants who were married had a rate of 67% showing marginal depression (Gerontoukou et al. 2015). When evaluating genders, it was found that females developed more anxiety and depression symptoms, 47.5% compared to 31.7% of males (Gerontoukou et al. 2015). Age was an essential factor in that participants who were 57 years and older had higher rates of depression compared to younger than 57 years (48% vs. 33%). Lastly, there was a difference between smokers and non-smokers. Forty-nine percent of non-smokers had no signs of acute mental illness compared to 31% of smokers who experienced emotional anxiety and stress (Gerontoukou et al. 2015).

Important to note is that this study included hypertensive patients who had a neurological disease, hypercholesterolemia, coronary artery disease, diabetes mellitus, chronic obstructive pulmonary disease, and ischemic stroke (Gerontoukou et al. 2015). Due to the vast number of factors that influence chronic disease, this could lead to more chronic disease patients having a higher number of stress factors. It is also reasonably probable that an individual could have multiple cases of chronic disease. For example, many patients have a coupling of COPD and CAD or other chronic disease combinations since the heart, lung, and renal systems function together to control varying systems in the body.

Scenario 2 indicating that athletes experience higher stress levels than chronic diabetic subjects would likely be of lower probability, seeing as many athletes do not struggle with physical health complications (Bernard et al. 2018). However, other stress

tests may be useful to test the range of anxiety. For example, using a scale of 1 to 5 for subjects that struggle with anxiety and stress. Better analyzations could, therefore, reveal better comparisons of the two groups, athletes and chronic disease patients. The limited exposure for chronic disease would most likely present a lower number of athletes that have stress-related illnesses (Gerontoukou et al. 2015).

Scenario 3 of high numbers of stress from both categories may be a possibility. Most athletes that are performing at the collegiate level are notable competitors. Seeing as how they are performing at the collegiate level they most likely have been dealing with significant stressors for most of their lives when performing different sporting events (Abdallah et al. 2017). However, inadequate coping mechanisms for athletes can be built in earlier stages of their competition; these can lead to eating disorders, alcohol, tobacco, or drug use with the intention of stress relief. If this behavior is the case, then performing at the collegiate level while balancing coursework and work responsibilities may expose athletes to a realm of mental and emotional complications due to the "high stakes," moment of competing in college (Applin, 1986).

The study done in the future would assess both groups and their varying factors. There will be comparisons of both athletes and chronic state individuals who are battling stress and anxiety. Athletes that are not struggling with stress will receive the sample stress questionnaire from the International Stress Management Association as to how they are coping with stress. The same applied to chronic state patients who are not struggling with stress and anxiety or at least handling their stress in a manageable way.

These tests can be measured as useful tools when providing possibilities of therapy for athletes and chronic state patients that are having difficulty with stress and anxiety.

CONSIDERATIONS AND PRACTICAL APPROACHES

Effects of Stress on Diabetes

Type 2 diabetes is a chronic disease that results from an increase in the lack of sensitivity in insulin receptors. Usually, when an individual eats a meal, there is an increase in insulin secretion. This insulin secretion signals to the body that it is in the "fed state." This result means that the body can utilize the energy from the food and store it into glycogen and other energy stores. This function also means a reduction in glucagon in the blood. The body does not need to increase glucagon or glucose catabolism when in the fed state, since energy stores also obtain from food (Gerontoukou et al. 2015).

However, for people with diabetes, eating food does not signal a decrease in glucagon. Instead, glucose levels remain high after eating, causing the body to be in a state of hyperglycemia. Hyperglycemia is dangerous because it can lead to even more insulin insensitivity as well as damage to blood vessels that supply blood to organs. This consistent increase of glucose can result in a risk of heart disease, stroke, kidney disease, vision problems, or even nerve issues (Gerontoukou et al. 2015).

Notably, it is prevalent to see how diabetes can cause an immense amount of physical stress on the body if not managed properly. Studies have discovered that the more complications that arise with diabetes, the more cortisol will increase from the adrenal cortex. As noted earlier, cortisol is a hormone that can stimulate health benefits if

secreted short-term. However, due to complications from diabetes, the long-term effects of cortisol release will not only affect the physical organs of the body but will also lead to mental and emotional stress for the patient (Uchendu, 2017).

Metformin is a common drug taken by people with diabetes that helps to control blood sugar levels as well as increase insulin sensitivity in the body. Controlling glucose is the primary factor in which people with diabetes can control their health and bodily organ function (Uchendu, 2017).

Effects of Stress on Athletes

The second group of individuals analyzed in this study are athletes. Athletes' body chemistry is undoubtedly different from chronic diabetic patients. In fact, with all the benefits of exercise, it could be assumed that athletes do not struggle with stress compared to chronic state individuals. However, studies show that athletes go through their own array of stresses (Clark, 2016).

These stresses regard to the type of training they have to endure to be in their peak physical state as well as performing to high standards. Many top collegiate athletes are restricted financially by a fully funded sports scholarship and perhaps are training to one day perform professionally. For some athletes that come from high poverty areas, it may be crucial for them to perform at a professional level so that they can take care of their low-income families. There is an incredible amount of stress surrounding collegiate athletes, many of whom are just under the age of twenty-one. This stress can look different, seeing as they may not struggle with chronic diseases such as diabetes or

hypertension, but there may be some mental correlations between both groups in how they cope with their stresses (Applin, 1986).

Perhaps chronic state individuals like diabetic patients have higher physiological adverse effects of stress versus athletes who may have more emotional or mental stress due to their requirement for peak performance in their area of sport. Regardless of the physiological differences, there may be some core similarities related to mental and emotional stress. Perhaps both groups see stress from the same perspective due to the varying degrees in which stress can affect individuals (Applin, 1986).

Effects of Exercise on Stress:

Exercise is an integral part of many people's lives that serves multiple health functions when it comes to stabilizing chronic disease. The effects of exercise have shown several beneficial health outcomes on different populations (Garinger et al. 2018). Physical training can be measured anaerobically or aerobically as a test of fitness. Exercise, whether aerobic or anaerobic, trains the muscles to a higher level of fitness. Therefore, individuals' athletic performance depends on muscles that withstand fatigue for the most extended period and the mental ability to initiate central commands to tissues to continue to work and perform even during distressful sensations.

Studies show that when athletes are stressed, their mental capacity is hindered (Clark et al. 2016). The reason that their mental capacity is hindered is due to the central commands that humans use to perform muscle contractions. When these central commands are compromised due to lack of sleep, diet, and stress, the results are,

therefore, a poor sports performance by the athlete. This area of science includes sports psychology.

Psychologists help athletes become more aware of their body and mind by performing visualization exercises involving athletes performing a particular activity during a sporting event. That activity trains the athlete's mental state to transition to their athletic state when performing. The visualization technique is meant to put the athlete in a "winning" state so that when the time comes to perform, they are intuitively performing to their best capabilities. A simple way to trick the brain into exercising longer, involves subjects rinsing their mouths with solutions of carbohydrates (Garinger et al. 2018). The carbohydrates perform a feed-forward mechanism in which the mind is activated to believe that energy is on the way; this will, therefore, inhibit fatigue.

With resistant training, there is the goal of hypertrophy of muscle fibers causing a more significant expansion of muscle fibers when lifting heavyweights. The expansion in muscle fibers increases the load potential in which individuals can, therefore, lift heavier weights. Aerobic exercise, on the other hand, can serve to raise VO_2 max levels in subjects by allowing more ventilation and oxygen to diffuse when exercising. This effect creates a higher cardiac output, which means more blood can be pumped from the heart in an appropriate matter to the level of exercise performance (Paulsen et al. 2012).

Each of these measures may require a specific type of density in muscle fiber or VO_2 max for success related to a particular sport. For example, endurance runners may have a higher VO_2 max than most people due to the frequency and duration of running. A higher VO_2 max causes a lower than average blood pressure of professional runners due

to the consistent vasodilation of the arteries that is allowing more oxygen to diffuse into tissues. Runners also have more type 1 slow-oxidative fibers, which are known for their high mitochondria capacity and vast stores of ATP that can be used for long distances when running. Sprinters, on the other hand, are known for having more type 2 fast-glycolytic fibers which have a higher amount of phosphagen stores and are excellent for a shorter duration, high-intensity exercises (Horowitz et al. 1994).

It has been shown that aerobic exercise rather than anaerobic exercise is more effective for diabetics (Garinger et al. 2018). However, a combination of both is usually recommended. In fact, many diabetics report using less medication after a consistent time of exercising (Garinger et al. 2018). Exercise initiates a unique response to glucose. During exercise, the body is utilizing glucose for ATP. This means that there is an increase in glucose uptake within the cells. Less glucose within the blood means improved conditions for hyperglycemia. More utilization of type 1 slow-oxidative fibers means a higher carrying capacity for oxygen, which can utilize glucose for ATP and increase insulin sensitivity (Son et al. 2018).

Exercise Physiology

Slow oxidative fibers are type 1. They combine with low myosin-ATPase activity; these fibers have a high oxidative capacity. This capacity means that these fibers produce a lot of ATP and contain large amounts of myoglobin. This oxygen-binding protein allows the rate of oxygen diffusion to increase rapidly and store oxygen. Large storages

of oxygen will lead to red muscle fibers, which represent an excellent function in hemoglobin (Melo et al. 2015). Slow oxidative fibers can be related to runners that run long distances. These fibers help them to preserve large amounts of ATP that they can use for extended periods.

Fast-oxidative-glycolytic fibers (type 2A) are high myosin-ATPase activity. These fibers have a high oxidative capacity and intermediate glycolytic capacity. Glycolytic fibers have few mitochondria, but large stores of glycogen. That means that there is limited use of oxygen, but the energy is explosive. Sprinters usually have vast type 2A fibers due to the glycolytic ability and myoglobin function relating to white muscle fibers instead of red muscle fibers like the type 1 fibers (Melo et al. 2015).

Last is the fast-glycolytic fibers or type 2x. These fibers also have high myosin-ATPase activity and an even higher glycolytic capacity. That means that the explosiveness of energy is even more powerful with these fibers, but they will fatigue more quickly than any other fiber (Melo et al. 2015).

Low-intensity exercise is known as aerobic exercise; and uses type 1 fibers. Type 1 fibers have more oxygen in their cells. Therefore they have the ability to maintain longer duration exercises (Paulsen et al. 2012). Hypertrophy is a term used for muscle fibers that are increasing in diameter. These fibers shift fast and use more powerful type 2A fibers. Hypertrophy is not the only way to build muscles; for example, when a person regularly exercises, they make increased synchronization in the motor unit recruitment of neurons and allow enhancement of fast glycolytic motor neurons. This method can create proportions of strength. Exercise will not change the proportion of fast and slow fibers.

However, with endurance training, there will be a decrease in fast-glycolytic fibers and an increase in fast-oxidative-glycolytic fibers. Strength training will have the opposite (Son et al. 2018).

These signals that act on changes in muscle are just beginning to be understood by scientists. These are related to calcium, action potentials, muscle fibers, and tension. Anabolic steroids can influence muscle strength and growth in perverted ways by targeting specific proteins in the body (Melo et al. 2015).

Myostatin is a regulatory protein produced by skeletal muscle cells and bind to receptors on those cells. Myostatin has a function of preventing excessive muscle hypertrophy and forms as a negative feedback process when lifting weights. Deficiency in myostatin shows excessive muscle growth. Tests are being done to block myostatin to help cases of muscle atrophy (Vander, 2019).

Force of a muscle decreases by 40% during the ages of 30 and 80. The decrease is due to fiber diameter. Diminished physical activity could also be a cause. Noteworthy is that the same intensity and duration of exercise in an older individual will not have the same changes in a younger person; thus, the ability to adapt to exercise and build muscle, speed or agility decreases with age (Melo et al. 2015).

Soreness usually comes from damage to muscle cells due to inflammation. Histamine releases because of the immune system and activates pain neurons in the muscle. Lengthening of muscle fibers usually causes more significant damage when exercising (McCorry, 2007).

A phenomenon explains this very well. When running downstairs, the use of eccentric contractions causes more soreness than running up flights of stairs, which uses shortening contractions. Most weightlifting strength gain is due to the eccentric portion of the movement of muscles (Melo et al. 2015).

When exercise becomes a lifestyle, there are remarkable changes not only physically but emotionally and mentally for the body and mind. The unique ability for exercise to put the body in stimulation mode then immediately into relaxation mode gives cells a chance to dissipate long-term cortisol and adrenaline levels. This change leads to counteracting the effects of depression and anxiety for patients.

The production of endorphins, which are chemicals in the brain that act as the body's natural painkiller, is responsible for feelings of relaxation and comfort after training. These mental effects ultimately can also lead to emotional effects as patients or athletes become more self-aware of their body, their stamina, and their strength. Self-image improves, confidence, and renewed energy are positive emotional effects of exercise (McCorry, 2007).

Effects of Therapy on Diabetics and Athletes

White et al. discuss studies using tests that specifically analyze anxiety and depression and has the primary role of testing for stress. There are many similarities between stress and anxiety. Stress is usually the preliminary symptom that can lead to anxiety as well as depression. This research provided questionnaires not to diagnose anxiety or depression necessarily but to serve more as a preventative function to identify subjects that are at high risk for anxiety and depression (White**,** 2001).

These findings show the complexity of chronic disease patients and the varying factors that influence stress. Studies show a common theme related to athletes as well as chronic disease states. Talk therapy, cognitive behavior therapy (CBT), or any type of counseling psychology has shown that significant mental health relief can grow from these types of therapy. A study done by White (2001) shows that cognitive therapy can manage the psychological aspects of patients that are living with a chronic mental illness. CBT can also manage emotional and psychological disorders in athletes that struggle with stress anxiety related to their sport (White**,** 2001).

Practical Measures and Recommendations: Stress Management for Athletes and Older Adults

Physical

Aerobic Exercise

Physical activity has proven to reduce the amount of cortisol (brought on by stress) in the body. The more oxygen in the lungs, the more it diffuses into those muscular tissues and releases endorphins and other neurotransmitters that are known for activating the brain's reward system. Aerobic exercise is a form of exercise that utilizes the nature of oxygen and diffusion into cells. Overall, aerobic exercise helps to release stress, escape, and physically feel amazing, which leads to feeling emotionally secure and having more self-confidence (Abdallah et al. 2017).

Eat well

Nutrition has been shown in many studies and populations that it is critically important to health and well-being (Clark et al. 2016). It's the fuel for the body and specifically for the function of cells. If cells are functioning correctly, then body functions correctly as well. This fact helps to regulate emotions and those hormones when feeling the weight of stress.

Rest and sleep.

Studies show that when our body lacks sleep, enzymes start breaking down in our bodies (Clark et al. 2016). We become short focused, our brain lacks concentration, and physically we lack energy. It is advisable to get 7-8 hours of sleep.

Practical

Break apart the to-do list

Have a schedule, and start on the things that take the most energy and the most time. Especially in the morning, most people have the most energy from morning to midday. It's vital to utilize that time where a person can get stuff done.

Take note of the stressors

If a person doesn't know what is specifically causing stress, it's hard to know what to do. Whether it's school, work, or relationships, a person can take note of what is causing the most stress to cause the least stress. Then approach the problem with a plan to

make the most of those situations. It's important to direct energy on what a person can control versus what they can't control.

Ask for help

It is essential to acknowledge when enough is too much and not over exert yourself. If someone can get help from someone, whether their spouse, a friend, a family member, or a co-worker, then get help. Don't be afraid to ask for help. A person may be surprised how many people are willing to lend a hand or give support.

Emotional

Make life more enjoyable

It's important for people to do things that they love. Whether that's spending time with family and friends, traveling, watching movies, taking naps, eating, sports, cooking, or doing something that makes a person feel good. Setting up a reward for oneself after a stressful moment to relax can be important in feeling recharged.

Practice introspection

Journaling thoughts, talking to someone like a mentor, therapist, or friend that a person trusts is crucial. It is important to let those dark thoughts out because those negative thoughts drive the cycle to make a person more stressed.

Focus on being in the moment

It's easy to get carried away with life and exaggerate when bad things happen. Put things into perspective, practice thankfulness. A person can write 5 things that they're grateful for and put them in a place where they can see it every day. Even taking moments of the day to say what they're thankful for will help to stay present at the moment and remember their blessings.

Give grace

Finally, it is important to remember that we are human; we are not perfect. People are going to make mistakes. It's never going to be ideal, but a person can only control what they can control. Forgiveness is vital to being able to let go of things that aren't truly important. Practicing self-love, grace, and smiling through life is important for mental and emotional health.

PSYCHOLOGICAL APPROACHES TO STRESS

Meditation

The art of meditation is a practice that has risen in Western culture in the last century but been fluent and influential in the Eastern world since 1500 BCE. The use of mindfulness techniques has popularized itself throughout social media and the public. Some people doubt its usefulness and relevance, yet, the recent scientific data behind meditation has confirmed incredible physical, emotional, and spiritual benefits from meditation practice.

Meditation is a practice where a person uses some sort of technique to go deeper into their subconscious (Tang et al. 2105). Whether it may be through mindfulness, thinking intentionally about a subject, perhaps a thought, a written word, or focusing on training the mind to be attentive and aware of the emotion and feelings that a person is experiencing at that moment. The heart of the practice is to gauge deeper into oneself and connect them to their mind, whether emotionally or spiritually. The idea is to be in a positive and conscious state. So many times, in our lives, it feels like we're riding passengers in our minds and not driving the vehicle. And often, the decisions we make impulsively can frustrate us, cause us anxiety, or just an overwhelming amount of negative emotion (Danucalov et al., 2015).

There are historical contexts to which explain the origins of meditation and its influence on culture today. More recently, there have been widespread scientific research data on the impact of meditation on the mind, even related to medical practice.

Studies show that meditation practice can have a significant positive impact on individuals with attention deficit hyperactivity disorder (ADHD) and protect people that are inclined to experience some sort of dementia in their lives (Evans et al. 2018). Another way to describe meditation is a wakeful form of intentional consciousness. Most people feel incredibly relaxed during meditation, yet experience heightened senses of alertness, awareness, and focus (Danucalov et al. 2015).

The mental state of mindfulness can physiologically be compared to exercise. When a person thinks of exercise, there are many components in the body working towards homeostasis. A physical body's goal is always to bring the body back to a state of balance. So, when the internal body temperature rises, as an example, due to running, the body cools itself by releasing moisture from the surface of the skin as sweat to bring the body back to homeostasis and lower the internal temperature of the body. When running, the heart is more active in pumping a significant amount of blood that can give oxygen to the tissues of the muscles. Simultaneously, smooth muscle arterioles are dilating (relaxing) to make more room for the blood to flow sufficiently to those muscles. In other words, there is both sympathetic (constricting) and parasympathetic (dilation) features of the body taking place at the same time during an exercise. Also, blood pressure acts in a way where it resets itself to the new physical activity that a person is performing. Therefore, it's higher relative to if the person were not performing any physical activity, but reasonable when they are exercising.

Scientists are beginning to see this similar give and take even mentally during meditation. Where stilling the body and the mind in a relaxed but intentional state, can lead to a higher mode of cognition, alertness, and attentiveness (Figure 2) (Tang and Leve, 2016).

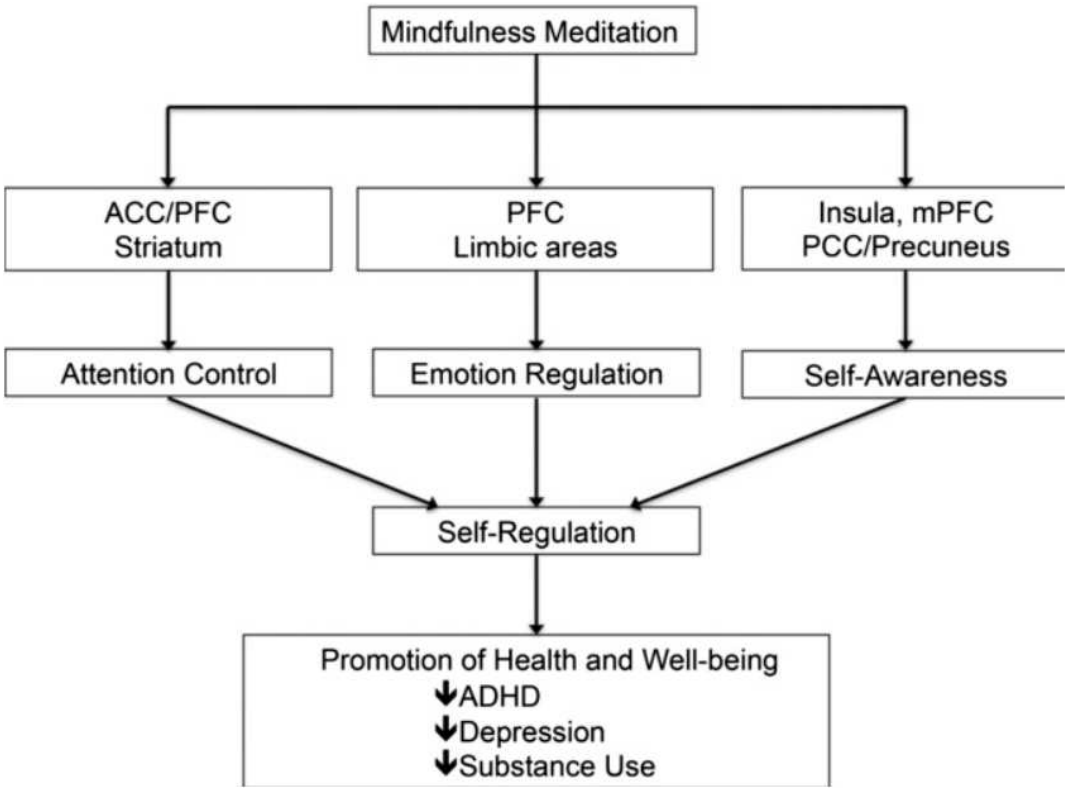

Figure 2: Mindfulness Meditation. Meditations leads to attention control, better emotional regulation and self- awareness. Figure taken from Tang and Leve, 2016.

There are numerous ways to meditate, but most methods share common characteristics including focusing on cognition with the regulation of breathing. Physiologically when a person concentrates on breathing, it is automatically a beneficial process for the body. Meditation can also be viewed from a mental perspective to control the physical

state. The process starts with the contraction of the diaphragm, then the chest cavity creates volume in the thoracic space, the pressure decreases in the alveolus, air, inspiration is initiated and finally expiration follows as a passive process (Danucalov et al. 2015).

Mental cognition of focusing on breathing, physiologically allows the body to take in more oxygen. Some forms of meditation even use diaphragmatic breathing (Cleveland Clinic, 2018). The diagram is the use of abdominal muscles responsible for initiating inspiration. These muscles work much harder during exercise to take in additional air for the activity. These muscles are much more passive when at rest, but a person intentionally using more abdominal muscles to breath at rest can be highly beneficial (Cleveland Clinic, 2018).

Again, it goes back to homeostasis for the body. A physical body does not need deep breathing diaphragmatic muscles firing when at rest. It is required only for exercise. But the feelings of homeostasis that that type of breathing would typically give to an individual exercising can provide positive physical emotions at rest.

Benefits of Diaphragmatic Breathing

Diaphragmatic breathing lowers the body's heart rate and blood pressure, which causes the body to relax overall. It also lowers cortisol (known as the stress hormone). Cortisol is active during high levels of stress. Unfortunately, for many individuals, this hormone doesn't turn off at rest—a reason why many people feel stressed even when relaxing. Lowering cortisol could be beneficial for people that have post-traumatic stress disorder (Ma et al. 2017).

Overall, diaphragmatic breathing improves core function. Developing the core will lead to better breathing in general, especially during exercise. The feelings of discomfort when running, escape when abdominals are strong and stable—allowing the efficiency of oxygen exchange when working to open up the lungs. All these benefits lead to stored physical energy. This energy is what many people initiate to focus on their mindfulness as they meditate (Ma et al. 2017).

The body already has numerous things to control and regulate. If a person has high blood pressure, stress, and anxiety, then there is less energy flowing in the body that a person can effectively utilize for their personal use. It's like a sleep-deprived person; the body *will* shut down if not given enough time to recover that energy. When a person has more stored energy due to reduced stress levels, anxiety, lower blood pressure, then they have more power they can utilize for other beneficial needs (Abdallah et al. 2017).

Meditation is a form of mental recovery that is utilizing physiological components of energy. The attention-based process of meditation is a possible explanation as to why people that struggle with ADHD (attention deficit hyperactive disorder) or dementia can have beneficial effects due to the focus on cognition and concentration (Evans, 2018). The science of meditation is simply that. People are changing their physical state to a state that they prefer by using mental consciousness to drive that energy and produce a feeling of calm and alertness. One can begin to see how the practice can be beneficial. Although it is certainly not easy, just like with many things, it takes practice to master the art of mindfulness.

Focused meditation is another technique that focuses on a single object or thought for a certain amount of time. It is impossible for the mind to not drift away at a certain point, but even recognizing this drifting can cause one to come back to a state of consciousness. Like driving a car, a person can sense when the vehicle starts to drift off the side of the road and can place their hand on the steering wheel to move it back in the right direction. Mindfulness meditation is different as the focus is on an experience, feeling, or sense of any particular concept or theory. This practice is more abstract, more flexible in thoughts and cognition, but still intentional of how those thoughts interact with a person's reality and perception (Lippelt et al., 2014).

The Neuroscience of Meditation

Neurologically, meditation is building more reliable neural signals in several areas of the brain. These neural signals assist higher cognitive processes that control areas such as the prefrontal cortex, the temporal and parietal lobe regions, by increasing cortical thickness (Tang et al, 2015), The prefrontal cortex is a brain region known for attention, alertness, and self-control. Utilizing meditation improves these neural circuits, explaining why there are beneficial effects for those who have ADHD or are at risk for dementia (Evans et al., 2018).

Evidence of scientific meditation presented research trials where there was an 8-week meditation course (Evans et al., 2018). The control group had no meditation training, while the other group was trained based on measuring cognition, attention, and awareness. At the end of the experiment, the meditation group performed better than the

control group during cognitive analysis. This finding used electrophysiological modulations such as EEG to investigate the neural synchrony of the neurons. The outcome seemed to analyze that working relationships with neurons were building higher levels of synchrony over frontal-parietal regions, which increased *during* meditation (Danucalov et al., 2015).

The brain measures specific types of signals that are called event-related potentials. An ERP is a measured brain response directly tied to a kind of stimulus relating to sensory, cognitive, or motor. It is essentially an electrophysiological response to a stimulus (Vander, 2019). Interestingly enough, the group that had practiced meditation for a duration of time had a reduction in ERP. This effect means that the environmental stimulus that usually distracts people from thought or concentration was not affecting them in the same way as the control group. They were not receiving as much neurological activity; instead, the neurological signals attributed to increased attentional resources. At the same time, there was greater activation of frontal-parietal, cerebellar, and temporal regions of the brain (Danucalov et al., 2015).

In other words, less neurological activity, meaning concentrated and more robust neurological signaling, causing higher brain functioning regions to be activated. It's like when someone uses their collective brain energy to focus on one task; there are specific sequences of neurons that are helping them complete that task. This same form of neural activity happens when people meditate. Although, because they have built a pattern of concentration, it is easier for them to also concentrate for more extended periods (Danucalov et al., 2015).

Swami Rama, a Yogi from the Himalayan International Institute of Yoga Science, accomplished some incredible tasks with the power of meditation. An American psychologist by the name of Gardner Murphy investigated Swami's abilities by taking him through a series of tests. Remarkably, Swami was able to accomplish some complex tasks that most people usually would not have voluntary control. For example, he could produce different types of brain waves when commanded, like alpha, delta, theta, and gamma waves. These waves can attribute to the depths of meditation. In other words, he could control the level of deep meditation patterns that he wanted in a short amount of time (McCorry, 2007). This control allowed him to alter his heartbeat to as fast as 300 beats per minute for 16 seconds and ultimately stop it from beating for a few seconds. He could also maintain consciousness of his surrounding environment while his brain was in a deep sleep cycle. Lastly, he could also control his internal body temperature to make himself feel cold or warm at room temperature.

These are functions of the body generally under *involuntary* control. When a person exercises, they don't have to *think* about raising their heart rate; their body does it for them. Swami was able to use meditation in a way where he could control what usually would be involuntary controls of the body (Danucalov et al., 2015).

This evidence is pretty remarkable stuff. Swami has been using meditation for a long time and has mastered certain principles that allow him to do these things.

It may be ambitious for someone that has never meditated to have hopes of having this much control and precision of the mind, but it's never too late to start. If someone is looking to start meditation, here are few ways to focus their consciousness today.

The first thing that person can do is to focus on breathing for one minute. Next, they can start with a thought, a word, visualization, object, or a phrase then meditate on that concept for 5-10 minutes (Danucalov et al., 2015).

Some forms of meditation include transcendental meditation, which involves repeating a phrase or a sound for 5-15 minutes. Vipassana meditation is the meditation awareness of surroundings and the environment (Danucalov et al., 2015).

The body scan is another form of meditation where a person can focus on parts of their body, starting from their head to toes. Noting meditation is a great way to focus on the distractions that pull a person's mind away from concentration. Overrall, people can meditate based on people, colors, themes, emotions, ideas, reflections, or just awareness (Danucalov et al., 2015).

These are just a few ways to meditate to get someone started. The idea is to start small, get consistent, and build upon other complex forms of meditation. Some may work; some may not. The duration and consistency are different for everyone, but the idea is to commit and give it a try. A person may find there is additional peace, pleasure, comfort, serenity, and power that comes from this practice, and it all starts in the mind. Whatever begins in the mind can also lead to positive progressions in life.

DISCUSSION

Studies show that both athletes and chronic disease patients can fall into high stress-related health patterns. From the literature, there are patterns shown of chronic disease state patients attributing their stress to mental illness such as depression and anxiety. In comparison, athletes that are under stress-related illness experience several problems such as sexual dysfunction (Bernard et al 2018)., food disorder behavior (Clark et al 2016), reduced immune system function (Yellen, 2018) and obsessive-compulsive disorder (Lovallo, 2016). There is evidence that cortisol levels are high in both groups during these stress-related patterns and contribute to the intensity of mental illness as well as behavior issues (Garinger et al 2018). However, in a preventative approach, it is essential to ask neutral and not leading questions of subjects to best evaluate and ultimately assist. Research questionnaires and interpretation should be conducted by multiple evaluators to reduce the risk of bias in the interpretation of results.

Interestingly to note about both groups, one potential bias assumption is that chronic disease patients tend to relate to severe forms of mental illness while athletes tend to relate to more behavioral issues. Data from research studies mention that there may be a pattern of negative behavior from athletes suffering from stress, such as drug or alcohol (Bernard et al 2018), while chronic state patients internalize stress as much more mental and emotional situations like anxiety and depression (Bernard et al 2018). Both groups show to suffer from both behavioral and mental illness; however, there may be underlying reasons as to why there are different patterns for both groups. Further research

will need to study patterns to gauge whether or not there is prevalent information found between how athletes and chronic state individuals respond and react to stress.

It is essential to mention that athletes are usually much younger than patients with chronic disease. As well, both groups deal with different types of stressors. Future studies should be evaluated and compare athletes that are much older to chronic state individuals in the same age group. Another possibility is to compare chronic disease individuals who are younger and in college and compare them with collegiate athletes. The chronic state group in the studies discussed in this thesis deal with a life-threatening physiological disease that could lead to severe mental and emotional pain. On the other hand, the athlete dealing with the emotional and mental stresses of sports performance that, when failing, could lead to physical as well as mental pain. This thesis also did not discuss the realms of which medication could also be a benefit to specific individuals suffering from mental health or chronic disease. Studies show that mental illness isn't just an environmental factor but has a legitimate genetic component as well and was not discussed here but could be significant Future studies may attempt to find correlations between medication and exercise or medication and talk therapy between athletes and chronic disease patients.

In terms of other beneficial therapies, the literature shows that exercise is an immense tool for helping with mental stability as well as emotional happiness (Lippelt et al., 2014). Even though most athletes are consistently exercising due to the sport they play, they may benefit from other areas of relief such as talk therapy, counseling, and sports psychology.

Most patients that have chronic disease utilize some form of therapy, whether talk therapy or clinical psychology. However, due to their physical condition, it may be even more advantageous to couple that therapy with exercise (Bernard et al., 2018).

In summary, both groups deal with different types of stressors, but the results are often the same. Feelings of stress, anxiety, post-traumatic stress disorder (PTSD), sexual dysfunction, low immune system, and depression are found in both groups. Even though athletes benefit from exercise, research shows that combining exercise with therapy may be the best combination of mental health that people can utilize (Bernard et al 2018). In a different light, exercise could prove vitally necessary for chronic disease patients who are already utilizing counseling or talk therapy as forms of controlling their mental health.

More research needs to study the varying ranges of chronic diseases such as hypertension, high cholesterol, renal dysfunction, and other chronic diseases where patients may measure their stress in different ways. Also, the number of sports that athletes participate in is endless, and each sport contributes to their array of stressors and challenges. The diverse array of sports, as well as chronic illnesses, can prove to be challenging to compare. Especially with each person managing their stress in different ways according to the illness or the sport.

The findings of the proposed study will continue to contribute to the longitudinal research design. After observations from the first experiment and once subjects receive the help they need, 3 and 6-month follow-ups will be needed. In the future, the same questionnaire will show if stress has reduced or increased due to the treatment given. The goal is to overtime provide stress relief to these subjects and gather data to measure

improvement in either the chronic state illness or sports performance. However, after time the approach can be expanded with additional measures such as additional athletic groups or patients that have hypertension or are recovering from stroke. Using the same experiment with different sample groups or perhaps slightly different questionnaires can provide validity to the research overtime in proving its results are significant to the public, and the test is repeatable to a larger sample.

Overall, it is remarkable how stress can affect different groups of people in similar but different ways. Stress nowadays is a standard broad issue in any area of life. Thankfully as awareness to the broad range of mental health issues has risen, more people are utilizing not just one method of therapy, such as exercise, yoga, or fitness training, but other methods of therapy like counseling, CBT, talk-therapy, hypnosis, and meditation as ways to combat the complexities that stressors can present. The biggest takeaway from this study is that it may be beneficial to not only utilize one form of therapy like exercise or talk-therapy but intentionally utilize both methods in combination as a form of mental illness prevention and positive behavior.

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