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The physiological and psychological benefits of Rock Steady Boxing and their implications for the management of Parkinson's disease.

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Rock Steady Boxing: The Physiological and Psychological Benefits and Their Implications for the Management of Parkinson's Disease

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Abstract

According to the American Parkinson's Disease Association (ADPA), there are an estimated 1 million people in the U.S. living with Parkinson's disease, and over 10 million people worldwide. Parkinson's disease is a chronic, progressive movement disorder that is characterized by motor symptoms such as tremor and bradykinesia, as well as non-motor symptoms such as sleep problems, fatigue, and depression (ADPA, 2023). Currently, there are no treatments for Parkinson's disease, however, several interventions have been determined to provide symptom relief, slow the rate of disease progression, and improve one's quality of life. These interventions range from medication to exercise participation. Rock Steady Boxing (RSB) is a non-contact boxing group fitness program designed specifically for individuals with Parkinson's disease (Larson *et.al.*, 2022). It has been proposed that RSB can improve the quality of life of its participants by improving physical functioning and fostering socialization and empowerment. The purpose of this study is to investigate both the physiological and psychological benefits of Rock Steady Boxing, and their implications for the management of Parkinson's Disease. This literature review analyzes and draws upon the current research on Parkinson's Disease, Rock Steady Boxing, and the benefits of exercise for Parkinson's disease to draw conclusions about the actual benefits of the program, and to bring awareness to the topic. RSB is a newer program, and research is limited about its benefits and effectiveness, so this study will serve as a cohesive guide to the benefits and reported outcomes of the program's participants. The goal of this study is to draw conclusions about the impact of Rock Steady Boxing on the management of Parkinson's disease, and to educate the public on these findings.

Background

Parkinsons's disease is a progressive central nervous system disorder that affects the entire body. Studying this disorder begins with understanding both the pathophysiology and neuroscience involved. According to the Cleveland Clinic, the basal ganglia are a set of structures in the brain that form important connections, allowing different parts to work together. Most importantly, the basal ganglia help control voluntary bodily movements through their production of dopamine. Neurons are cells in the nervous system that receive information and transmit it where it is needed. In Parkinson's disease, the neurons in the basal ganglia that transmit dopamine become impaired or die, greatly reducing dopamine's concentration in the body (NIA, 2023). Another change to the nervous system with Parkinson's disease is reduced norepinephrine, due to the loss of nerve endings that produce the neurotransmitter. Norepinephrine controls involuntary actions such as heart rate, digestion, and blood pressure. Reductions in norepinephrine explain some of the non-movement features of PD such as fatigue and memory deficits (NIA, 2023). The causes of dopamine and norepinephrine impairment are still unknown to scientists. According to the Parkinson's Foundation (2023), genetics only account for 10-15% of an individual's chance of developing the disorder. Although it is still being studied, the combination of genetic and certain environmental influences contributes to the likeliness of getting Parkinson's disease. These environmental influences may include head injury, exposure to toxins, metals, or certain chemicals, although the way these interact with genes varies depending on the individual. It is important to understand individual differences and their contribution to a diagnosis. Likewise, once a person develops Parkinson's disease, their clinical presentation and symptoms are unique to them, not everyone experiences the same symptoms, and the severity differs as well. The symptoms associated with PD can be divided

into two categories: motor and non-motor impairments. It is important to note that these symptoms begin gradually and may appear subtle at first. Each individual may experience these symptoms differently, and the rate of disease progression is also inconsistent between individuals. Motor impairments usually begin on one side of the body, or in one limb, and later progress to the other parts of the body as the disease worsens. Motor symptoms of PD include, but are not limited to tremors, muscle stiffness, bradykinesia (slowed movement), difficulty chewing and swallowing, impaired balance and coordination, and having a parkinsonian gait. Parkinsonian gait can be identified as a forward leading posture with reduced arm swing and small quick steps. These motor symptoms are a result of reduced dopamine levels lessening one's control of bodily movements. Non-motor symptoms are caused by the impaired production of norepinephrine. These include fatigue, depression and emotional changes, urinary or digestive issues, and dementia. Parkinson's disease is often seen comorbid with Lewy body dementia.

Parkinson's disease is a progressive disorder, and treatment options involve slowing the progression of the disease and managing symptoms. Current therapeutic approaches and treatment options include medication, physical, occupational, and speech therapy, and exercise. Medications aim to increase the levels of dopamine and norepinephrine in the brain, and to control motor symptoms (NIA, 2023). The most common medication is Levodopa. However, medications often fail to address the non-motor impairments of PD, which can be disabling and lead to a decreased quality of life. In addition, most medications have side effects that may lead to decreased quality of life. Medication response can be used as an important tool to help diagnose PD, as there is no specific test that can be used to diagnose the disease, especially since genetics are still being studied. Another treatment is physical therapy which can be used for improving strength, balance, and coordination. A specific type of PT has been proven effective

for the management of PD: LSVT BIG and LOUD. LSVT-BIG therapy puts an "emphasis on exaggerated movements to compensate for PD's movement and speech symptoms" (Mellett, 2017). Whereas LSVT-LOUD therapy focuses on loud speaking, sustaining a vowel sound, and speaking activities that increase in complexity (Mellett, 2017). Both have been proven effective at decreasing bradykinesia, hypokinesia, and kinesthetic awareness, as well as improving speech volume and voice quality. According to Mellet (2017), LSVT BIG and LOUD are most beneficial for patients early in their PD diagnosis with mild to moderate functional deficits because a cognitive effort is required to rewire the brain and gain better control of symptoms. In addition to physical therapy, occupational therapy can be used to help individuals with their activities of daily living and maintain their independence as the disease progresses. Speech therapy can also be utilized to improve speech quality, sound production, facial expression, and aid in chewing and swallowing when compromised. The final type of therapeutic approach for symptom management is exercise. Studies show that there are many benefits of physical activity and exercise spanning from physical to mental health. Exercise can be used as a complementary treatment strategy for Parkinson's disease when used alongside medication. According to the Brian Grant Foundation, exercise can benefit those with PD in three main ways: motor symptom management, non-motor symptom management, and delay mobility decline. Research has shown that exercise improves gait, coordination, and strength, and may positively impact depression, anxiety, cognition, and sleep difficulties (Brian Grant Foundation). General exercise has proven benefits for PD management, but there are some specific types that are more beneficial for both the motor and nonmotor impairments characteristic of this disorder. These include yoga, dance, tai chi, and boxing. Individuals with Parkinson's disease who exercise have better functioning and less disability than their counterparts who don't participate in regular exercise (ADPA,

2023). By participating in PD-specific exercises, individuals maximize the participation benefits and can significantly reduce symptoms and impairments associated with the disorder. An important consideration is individualizing the exercise program to meet individual needs and preferences in order to promote long-term adherence. Rock Steady Boxing is a PD specific exercise class that includes aerobics, strengthening, balance, stretching, and vocal components to target all areas of impairment. It also provides a support group where camaraderie is created among individuals with PD. Although this is a newer form of PD management, it has been shown to have significant benefits for managing the disorder and improving the quality of life of its participants.

The impact of Parkinson's disease on quality of life

The World Health Organization defines quality of life as "an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns". Maintaining quality of life is important for everyone but is a special concern for individuals with chronic disease. Health-related quality of life is a subjective and multidimensional construct that includes three main domains: physical, psychological, and social functioning (Megari 2013). These domains may be affected by disease or treatment for disease to various extents. Wilson and Cleary (1995) developed a model that conceptualizes health-related quality of life where "physiological variables influence symptom status, symptom status influences functional health, functional health influences general health perceptions and general health perceptions influence overall quality of life". In the case of Parkinson's disease, both the motor and non-motor symptoms influence a person's overall functioning, thus impacting their health perceptions and quality of

life. I will now discuss how each of the three domains of health-related quality of life relate to Parkinson's disease. First, physical functioning is compromised with this disorder. Motor impairments include tremor, muscle stiffness, bradykinesia, impaired balance and coordination, and altered gait mechanics. As the disorder progresses, each of these may become worse, impacting the individual's ability to perform daily tasks such as driving a car, grocery shopping, chewing, swallowing, and writing. Inability to perform basic tasks and feeling “out of control” require help from others to complete the activities that these individuals were once independent of. This often leads to feelings of helplessness and reduces personal confidence as they are more reliant on others to meet their needs. This ties into the psychological domain of health-related quality of life. Reduction in physical capabilities can lead to diminished psychological wellbeing as patients may compare their current functional levels to their past abilities or to others in their environment. For this reason, it is common for individuals with PD to experience depression, anxiety, and sleep disturbances. These may lead to decreased social participation, the third domain of health-related quality of life. Having a support group is an excellent option for people with chronic diseases because it promotes camaraderie and social connections with others going through similar challenges. Parkinson’s disease can have an impact on physical, psychological, and social aspects of life and influence a person’s quality of life. These domains are interconnected and can impact one’s desire to live and seek disease management. Several interventions exist to minimize the decline of quality of life, and include social support, physical activity, education, and access to healthcare. Managing symptoms will also reduce the risk of decline but has to stem from the individual’s willingness to improve and live without their disease defining them. By identifying that chronic disease isn’t their identity, rather just a part of

them, they can put the person first, and show them that there is so much more to live for and motivate them to rise above their circumstances and live their life to the fullest.

What exactly is Rock Steady Boxing?

Rock Steady Boxing (RSB) is a nonprofit organization founded by Scott C. Newman, who is currently living with a Parkinson's disease diagnosis. RSB is a non-contact boxing program designed specifically for people living with all levels of Parkinson's disease (Larson *et.al.* 2021). Classes are typically 90 minutes long and consist of multi-modal exercises that aim to improve both fine and large motor impairments and encourage loud vocalizations to improve participant's speech (Larson *et.al*. 2021). Classes typically are set up in a circuit which includes boxing, agility training, and stretching. The program emphasizes aerobic, strength, stability, balance, and flexibility which are areas that are often compromised by Parkinson's disease. These classes also foster empowerment and camaraderie among participants with shared backgrounds and experiences living with PD. Thus, there are many benefits, both physiological and psychological, that result from this program. Classes are led by RSB coaches who are trained at the company's headquarters. RSB classes are taught at local boxing studios, YMCAs, community centers, and athletic clubs. According to Larson *et.al.* 2021, there are estimated to be 43,500 participants at over 900 locations worldwide. As the benefits of this program are being studied and confirmed by its participants, participation continues to grow. The cost for each class varies by location and may be a barrier to participation for many individuals. As this is still a new option for symptom management, insurance companies will not cover the cost, but as research continues to support its benefits, this may become an option later down the road,

making participation more accessible. RSB has targeted benefits for managing PD symptoms and slowing the rate of disease progression and is an encouraging treatment option.

Physiological Benefits of RSB

It is common knowledge that exercise has many physiological benefits. However, when an individual has a disease, special considerations must be made for exercise accommodations, and identifying the most beneficial mode of exercise. Rock Steady boxing incorporates functional exercises that target the impairments characteristic of Parkinson's disease. Exercise also reduces the risk of other geriatric diseases including diabetes, hypertension, and cardiovascular disease which may contribute to PD pathogenesis (Xu *et al* 2019). According to Xu *et al* 2019, exercise also modulates a range of supporting systems for brain maintenance and plasticity such as inhibiting oxidative stress, repairing mitochondrial damage, and promoting growth factor production. These adaptations promote large scale benefits that aid in symptom management and a healthier body. Participating in 90 minutes of RSB once a week was associated with improvements in gait velocity, mobility, and quality of life (Coombs *et al* 2013). Motor impairments vary between individuals with PD, but by just attending one class per week, participants can see results. In a study conducted by the Cleveland Clinic in 2013, "forced" or intense exercise was found to use the same pathways to produce symptomatic relief as medication in patients with PD. Components of RSB, such as boxing and interval training, can be classified as forced exercise, therefore supporting the notion that participants will notice an improvement in their symptoms. According to the ADPA (2023), exercise is thought to increase dopamine signaling, which encourages new brain connections and increases neurogenesis. Dopamine production and utilization is impacted in Parkinson's disease, so this benefit is an

encouraging suggestion of the benefits of exercise on disease management. In a survey conducted by The Department of Neurology at Northwestern University, 1709 individuals with Parkinson's disease and a median age of 69 were asked a series of questions to compare demographics, self-reported symptom burden, health-related quality of life, and self-efficacy for exercise between participants and non-participants of Rock Steady Boxing. The survey results showed that compared to non-participants, 44% of those who currently participate saw reductions in tremor, 45% experienced less falls, 44% experienced decreased gait freezing (akinesia), and 27% reported decreased medication wear-off and associated symptoms. In addition to these, RSB promotes cardiovascular fitness, muscular strength and endurance, flexibility, and agility. These components will leave participants feeling stronger, and better able to manage their daily tasks. RSB also promotes improvements in hand-eye coordination during boxing activities, and vocal speech production as the participants are encouraged to call out their punches prior to making a move.

Psychological Benefits

Participating in regular exercise, especially RSB which is targeted for individuals with Parkinson's disease, can also have many psychological benefits. Some of these benefits are closely correlated with the physiological benefits and increased confidence that gaining strength and endurance brings. Others are based off the chemical changes that occur in the body because of exercise. In the previously mentioned study conducted by Northwestern University's Neurology department it was found that there are many psychological improvements in RSB participants. 70% of RSB participants experienced improvements in their social life, 63% reported decreased fatigue, 62% had decreased fear of falling, 60% experienced decreased

depression and depressive symptoms, and 59% of participants reported decreased anxiety. With these findings, it is suggestive that RSB has many psychological benefits. Rock Steady Boxing also promotes a sense of identity among participants because they can connect with other individuals with the same diagnosis. This shifts them from the victim mindset to the mindset that they can relate to others with similar challenges and recognize that although PD is a part of their life, it doesn't define them. This camaraderie and empowerment are what makes RSB so special, and having a supportive environment plays a key role in the psychological benefits associated with the program.

RSB and Parkinson's Management and Improving Quality of Life

With the aforementioned physiological and psychological benefits of Rock Steady Boxing, quality of life can be improved. Not only will these leave the individual feeling better, but they will also contribute to symptom management. When compared to other treatment options, there are little to no side effects experienced with RSB. Individuals will gain confidence in their ability to complete daily tasks and encourage them to continue with their hobbies and careers. Taking your mind off of PD and combating its decline in class is an excellent outlet for individuals struggling with their diagnosis. Exercise, specifically RSB which is targeted for PD, promotes neural plasticity which can slow the rate of disease progression. Thus, participants can expect to live longer, more functional lives. Connecting with other individuals with PD provides social support, and willingness to thrive and embrace their diagnosis. This gives participants the fighting spirit for their PD diagnosis and gives them a sense of control over their diagnosis.

Conclusion

The Rock Steady Boxing website contains many testimonials that attest to the personal benefits that participants have experienced as a part of the program. Liz V. who has been regularly participating in RSB since 2016 states "I used to feel like a person living with Parkinson's-it was my constant companion. Now, I can sometimes forget that I have PD. It is fading more into the background in terms of how I define myself". Ruth B. discovered RSB through her Parkinson's support group, and states that when she started going, it made a dramatic difference. Her balance gradually got better, and she stopped stumbling and falling. She also saw improvements in her ability to get up from the floor. She notes that "we all know that RSB is not going to cure Parkinson's, but it helps us cope with it in some beautiful ways". While these testimonials are not scientific evidence, they support the previously mentioned research findings about how, through the physiological and psychological benefits of targeted exercise, Rock Steady Boxing can improve quality of life and symptom management in individuals with Parkinson's disease.

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