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### The Motivation for Movement

Children are often introduced to exercise through gym class, participation in recreational sports, or regular outdoor activity. The functioning of a human brain has the ability to process experiences in adolescence, and these experiences impact subconscious thought and behavior in later life. The way a child perceives exercise can impact their motivational levels throughout their life regarding physical activity and the importance of staying active. Many factors contribute to this individualized motivation, such as hormonal levels, gender-related differences, and the potential experience with childhood obesity. As humans age, physical activity becomes essential for proper range of motion, stability, and overall physical health. In addition to the physical benefits of movement, physical activity is essential in the cognitive aging of an older individual, prolonging and preventing the effects of chronic mental diseases. A child's early experience and perceptions of physical activity will greatly impact their motivation levels and adherence to exercise into adulthood which will contribute to their physical and mental health in later life.

### **Motivation and Participation**

#### *The Roles of Oxytocin and Dopamine*

Motivation is defined as the set of processes through which organisms regulate the probability, proximity, and availability of stimuli.<sup>1</sup> There are two types of motivation that a person can experience; intrinsic motivation and extrinsic motivation. Intrinsic motivation is

defined as the motivation to do something because it is interesting or enjoyable.<sup>2</sup> Extrinsic motivation is defined as the motivation to do something because it leads to a certain outcome.<sup>2</sup> One hormone that is critical in the development of a person's motivation is oxytocin. Oxytocin is released in response to psychological and physical stressors, including exercise. If a person is participating in physical activity that triggers a stress response, oxytocin is released and can inhibit the production of dopamine, a hormone that regulates motivation.<sup>1</sup> If dopamine is inhibited, the person may not develop the desired motivation for that activity.<sup>1</sup> Oxytocin interacts closely with specific neural pathways that are responsible for processing stimuli that are motivationally relevant, such as ones that trigger the release and circulation of dopamine.<sup>1</sup>

The hormone that directly impacts and regulates motivation is dopamine. Dopamine is a “reward” hormone, originally coding for the pleasure that is derived from reward.<sup>1</sup> Dopaminergic neurons influence the assignment of motivational value or salience, which impact the drive towards rewards.<sup>1</sup> These rewards can be from either extrinsic or intrinsic factors, leading to further formation of motivation. Tiffany Love found that certain dopamine neurons become excited by 'appetitive stimuli', which promote approach and are inhibited by 'aversive stimuli', which become excited by salient events.<sup>1</sup> Based on this research, an adverse stimulus, such as a negative experience with exercise in childhood, can inhibit the release of dopamine and negatively impact individualized motivation. Appetitive stimuli, such as an exciting sports event, can have a positive impact on motivation.<sup>1</sup> A positive experience with exercise in childhood can stimulate the release of dopamine, positively impacting motivational levels.

The interaction of oxytocin and dopamine is critical for the formation of individualized motivation. Oxytocin enhances the importance of certain social stimuli, such as validation from team interaction, which then provokes shifts in the production of dopamine.<sup>1</sup> The effect of

oxytocin is dependent on the number of social stimuli being processed.<sup>1</sup> Oxytocin improves the detection of positive and emotional stimuli, while dopamine forms the motivation based on the positive or negative stimuli one may experience.<sup>1</sup> In early development, these hormones are crucial in the formation of intrinsic motivation, which is the most impactful for long-term adherence to any form of physical activity. If a child is authentically interested and is enjoying the exercise they are doing, they are more likely to continue participating long-term. This is much more impactful than extrinsic motivation, where a child may only be participating in a form of physical activity to obtain a reward or is being encouraged by a friend or family member. Oxytocin and dopamine interact with each other to distinguish between these different types of motivation in adolescence that have the ability to translate into their adulthood.

#### *Participation in Sports and Recreational Activities*

One way in which children are exposed to exercise and physical activity at a young age is through either team sports or recreational activity. Physical activity is described as a voluntary movement produced by the skeletal muscles that result in increased energy expenditure.<sup>3</sup> Exercise is described as a subcategory of physical activity which is planned, structured, and repetitive, with the intent of improving or maintaining these patterns of physical fitness.<sup>3</sup> Based on this definition, sports participation would be considered exercise, as it is structured and regular. Participation in sports teaches children the importance of exercise at a young age, which can then set them up for a more physically active lifestyle.<sup>3</sup> As children engage in sports regularly, they will eventually form a habit. A habit is the automatic component of activity that is strengthened when physically active behavior becomes a routine and is incorporated into everyday life.<sup>3</sup> These habits then become a component of everyday life, continuing into their adulthood.

The foundation of a habit that is developed in a person's childhood can be based on positive or negative experiences with exercise. According to Mirja Hirvensalo, physical activity habits are assumed to develop during childhood through adolescence into adulthood.<sup>3</sup> If a child has a positive experience with exercise in their adolescence, they will see physical activity as enjoyable and essential in their daily routine.<sup>3</sup> This will result in a habit of keeping their body moving and valuing activity. If a child has a negative experience with exercise in their adolescence, they may form a habit of avoiding any form of physical activity, seeing it as a chore in their later life.<sup>3</sup> Although this experience occurs in early life, the person may continue with these harmful habits into their adulthood, setting up a sedentary lifestyle for themselves.<sup>3</sup> These habits are instilled in a person through their early experiences and can be impacted by socioeconomic factors, as well as the inclusiveness of programs.

The availability of sports and recreational areas designated for physical activity, such as a park or field, can have socioeconomic limitations. The people who are classified in the lower socioeconomic position often live in urban neighborhoods and clustered areas. Due to their location, there is often no easy access to facilities and areas for exercise. According to a study done by Nicola Burton, inconvenient access was the major barrier identified within the low socioeconomic group.<sup>4</sup> Many participants lived in outer suburbs and described a lack of facilities in their immediate neighborhood with poor public transport.<sup>4</sup> Along with inconvenient access to facilities or poor transportation, varying work schedules between the socioeconomic groups create another barrier to activity.<sup>4</sup> Individuals with lower levels of education, income, and occupational status typically report that they partake in lower levels of activity.<sup>4</sup> In addition to socioeconomic status, children who are not classified as neurotypical may not have the same opportunities and access to sports or recreational activities as 'normal' children.

Children who live with disabilities are often not as eager or able to participate in a team sport as normal children. Research shows that children with disabilities are more restricted in their participation, have lower fitness levels, and have higher levels of obesity than any neurotypical children.<sup>5</sup> Due to these factors, children with disabilities often do not engage in recreational activities or any exercise at all. Although most children with disabilities are not regularly active, they are the population that benefits most from physical activity.<sup>5</sup> Regardless of knowing that there are benefits to activity, these children often feel excluded and unable to participate in sports and recreational activity, which then impacts their adherence in later life. To prepare and set these children up for an active and healthy lifestyle in their adulthood, it is important to positively promote exercise when they are in their adolescence.<sup>5</sup>

Children with disabilities often do not engage in sports and they are reported as being less active than other children.<sup>5</sup> The participation of children with disabilities in sports and recreational activities promotes inclusion, minimizes deconditioning, increases physical functioning, and enhances their well-being.<sup>5</sup> Children with disabilities that engage in regular physical activity often benefit the most concerning their health. Murphy et al argue that in addition to the physiologic benefits of decreased body fat and increased fitness, regular physical activity for children with disabilities has been shown to help in controlling or slowing the progression of the chronic disease.<sup>5</sup> Regular activity can also improve the overall health and function of these children.<sup>5</sup> Health Care Professionals who assist these children often prescribe exercise as a way to reverse their impaired mobility.<sup>5</sup> Early exposure to physical activity can prepare these children for a life of movement and mobility. If children with disabilities are exposed to the importance of exercise and learn that it can be enjoyable, they are more likely to

continue these habits into their adulthood, setting themselves up for a more physically active lifestyle.<sup>5</sup>

If children with disabilities feel uncomfortable being a member of a team, there are other ways in which they can engage in physical activity in safe environments. In Florida, DreamPlex offers these types of opportunities for children with disabilities. DreamPlex is a family-owned business that creates fitness and fun for people with disabilities.<sup>6</sup> This facility is open for people of all ages, having opportunities for exercise that will engage those of all ages, including dance class for both the adults and older kids, and a play area for the younger children.<sup>6</sup> Along with the exercise component they are exposed to in this facility, they also engage in peer interaction, which further leads to adherence to the program. Amy Gomes, the owner of this business states that as the kids got older, they saw as therapists that they weren't staying active, they didn't have peer interaction, and they didn't have jobs.<sup>6</sup> They knew they had to do something about that, so they created this business to keep these kids and adults active while continuing to educate them on the importance of physical activity.<sup>6</sup> Exercise is extremely important for those with disabilities due to their greater risk for health issues in later life.<sup>5</sup> If they understand the importance at a young age, they are more likely to stay motivated to keep active in their adulthood.

#### *Gender-Related Differences and How They Impact Motivation*

Males and females often possess different motivations for exercise. For boys, they are more likely than females to describe the enjoyment of physical activity participation.<sup>4</sup> This can be related to the competitive and challenging nature of the physical activity, both physically and mentally.<sup>4</sup> Men enjoy the feeling of a challenge and the adrenalin produced of trying to win against a competitor or increase their personal record.<sup>4</sup> Although this can increase motivation,

this also can negatively impact it. Since they are extremely competitive, boys may be less inclined to play a sport if they know that they are less than average than if they knew they were above average.<sup>4</sup> Although they are more likely to have a motivation to achieve success, they may have a motivation to avoid failure when they know they are not as skilled as their opponent is.<sup>4</sup> While boys are often motivated by the competitive nature of the sport, most girls are motivated by the physical benefits and safety of regular activity.

Females are more likely to describe influences of expected physical benefits, companionship, and time of the day on their motivation to be active. The major physical benefit that most girls value is weight management, with some participants beginning activity to prepare for events such as a wedding or vacation, events that are related to body image.<sup>4</sup> As many women often do not feel safe walking in unknown areas alone, they may be motivated by the companionship and affiliation of their peers.<sup>4</sup> Overall, research shows that women are more likely to be motivated by external factors, especially in their adulthood.<sup>4</sup> To increase their internal motivation, which will positively impact their long-term adherence and motivation, they should partake in activities that they enjoy, such as hiking or dancing. Although external factors such as weight management can be effective short term, they can not keep the person interested and enjoying being physically active into their late adulthood.<sup>4</sup> Along with the different motivational factors between the two genders, gender roles can also have a large impact on participation in sports.

Sports participation has been seen as a male role for decades. The expanding role of sports in the lives of both boys and girls in the United States could lead to more progressive ideas regarding what constitutes a gender-appropriate sport.<sup>7</sup> Some sports are seen as masculine, such as football, wrestling, and baseball, some sports are seen as feminine, such as gymnastics, ballet,

and figure skating. Hardin et al argue that the more strongly a male college student adhered to traditional gender roles, the less likely he was to participate in sports not considered masculine.<sup>7</sup> Young women, even if they strongly adhered to gender roles, were more likely to try masculine sports because masculine sports are considered more 'valuable'.<sup>7</sup> This research shows that predominantly male sports are considered superior to female sports. Due to this idea, more women have been pushing back against the sports gender roles, participating in the more masculine sports, showing that they have the ability to engage in them as well.<sup>7</sup> This increases the women's motivation to achieve success, while it may decrease the males' motivation, as they may want to avoid failure, getting 'beat by a girl'.<sup>7</sup> In this sense, the world of sports seems to be moving in a more progressive direction, but there is still a long way to go to ensure that the participation of girls in sports continues to increase.<sup>7</sup> Teaching the importance of exercise at a young age, no matter the gender, positively impacts foundational motivation, which will then lead to a healthier lifestyle, physically and mentally, in later life.

## **Body and Brain**

### *Weight Stigma and Obesity Levels*

The way a child perceives their body in early life can have a lasting impact on their exercise habits in their early adulthood. Weight stigma is a large problem in the world today and can impact both children and adults. In childhood, a negative experience with exercise, especially if they are obese, can lead to a more sedentary lifestyle.<sup>8</sup> Due to potential ridicule from their peers, these children may decide against participating in a sports team or recreational activity.<sup>8</sup> This repeated behavior can cement this negative mindset and the child may then begin to develop low self-esteem or depression.<sup>8</sup> Weight-stigma leads to lower psychological functioning, increasing anxiety and depression levels amongst these children.<sup>8</sup> In the early stages



of life, children should be enjoying their time with friends and not worrying about their body image. These behaviors will often have a lasting impact on the child, impacting the way they see their body in later life.<sup>8</sup>

The effects of childhood obesity and weight stigma at a young age can lead to exercise adversity in early adulthood. In a study done by Lenny Vartanian et al, they found that weight stigma in college-aged females positively correlates with BMI and body dissatisfaction.<sup>8</sup> Due to this, many females were unhappy with their bodies and were embarrassed to go to the gym.<sup>8</sup> The stigma they experienced in childhood increased their desire to avoid exercise, resulting in less frequent strenuous and moderate exercise.<sup>8</sup> The findings in this study suggest that weight stigma can decrease physical activity levels in adulthood and old age.<sup>8</sup> To escape this weight stigma, it is important to ensure a healthy and safe environment for kids who suffer from childhood obesity, allowing them to feel confident while participating in physical activity.

The way a child who is suffering from obesity sees exercise is essential in ensuring that they remain physically active throughout the rest of their lives. Some ways that an obese child can feel more comfortable being active is if the parents provide constant support and encouragement.<sup>9</sup> This includes allowing them to choose what activities they enjoy doing the most, as this will lead to greater adherence in the future.<sup>9</sup> For example, if the child expresses that they do not feel comfortable joining a team or participating in a gym class, the parents should encourage them to engage in other forms of activity, such as riding their bike or swimming in the pool. Research by Melinda Sothorn shows that encouraging free play is effective in reducing obesity in 5-8-year-old girls.<sup>8</sup> If children begin regular physical activity at a young age, they are at less of a risk for obesity in the future.<sup>9</sup> One of the best ways to keep a child suffering from obesity interested in activity is by providing the opportunity for rest, keeping activity intermittent

and sporadic.<sup>9</sup> Children will often not participate in prolonged exercise without rest periods, so providing them an opportunity for intermittent nonstructured physical activity will increase the likelihood of them participating regularly.<sup>9</sup> Ensuring children who suffer from obesity understand the importance of activity can have a long-term impact on their aging body and mind.

### *Exercise and Aging*

As humans age, their body begins to lose range of motion, muscle strength, and stability. Participation in a regular exercise routine can lessen these effects and maintain the body's musculature for a longer time.<sup>10</sup> An increase in muscle mass is achievable only with progressive resistance training or generalized weight gain from extra energy via protein consumption.<sup>10</sup> An increase in muscle mass can prevent health issues such as diabetes, functional dependency, and falls and fractures.<sup>10</sup> Exercise can be used as a treatment for chronic illness as well, with research supporting that exercise designed to stimulate skeletal muscle can be beneficial in patients with congestive heart failure.<sup>10</sup> Along with physical benefits, there can be psychological benefits of regular exercise, such as being almost as effective as antidepressants.<sup>10</sup> Exercise can be used as a treatment for some of the effects of aging, but it is important to individualize each approach, especially with older patients.

Exercise is a useful tool that can be used to combat the effects of aging, but there are a few risk factors that apply to the elderly. When an individual is frail or of extreme age, they are still encouraged to engage in physical activity, but specific modifications are needed to assess their individual needs.<sup>10</sup> Instead of resistance training, they are encouraged to partake in light aerobic training, such as walking on a treadmill or around their neighborhood.<sup>10</sup> This reduces some of the risk factors that are associated with geriatric needs while strengthening their musculature and increasing their endurance, which can be beneficial for individuals with

respiratory or cardiovascular diseases. An individualized exercise plan is essential for geriatric patients in order to tailor to their specific needs.

Physical activity is a useful tool in boosting the cognitive health of an aging individual. In a TED Talk given by Wendy Suzuki, she discusses the brain-changing benefits of exercise based on her own research and experience. When Suzuki, a middle-aged woman, participated in weekly activity, she noticed an increase in her mood, memory, and alertness.<sup>11</sup> The changes she noticed impacted her day-to-day life, reporting a more happy and healthy mind.<sup>11</sup> She also noticed an increase in her cognitive performance, completing her tasks in a more timely manner as well as a more positive outlook on her daily routine.<sup>11</sup> In addition to her own experience, Suzuki discussed the possible prevention of cognitive diseases, such as Alzheimer's and Dementia.<sup>11</sup> Suzuki notes that although exercise is not going to cure Alzheimer's or Dementia, it can increase the size of the hippocampus and prefrontal cortex of the brain, delaying the effects of these diseases.<sup>11</sup> To experience the brain-changing effects of exercise, aerobic exercise is recommended to increase heart rate and brain volume.<sup>11</sup>

Exercise can increase brain volume as well as prevent incurable cognitive diseases. In a study done by Stanley Colcombe et al, they found that there is a significant increase in both the gray and white matter of the brain regions as a result of participation in aerobic fitness training.<sup>12</sup> Gray and white matter in the brain are responsible for processing information, learning, and brain function.<sup>12</sup> Decline in the gray and white matter of the brain are often caused by sedentary behavior or nonaerobic training, such as resistance training.<sup>12</sup> A decline in these regions of the brain are often associated with many clinical syndromes, such as Schizophrenia.<sup>12</sup> These researchers found that these changes were only significant in older individuals, and exercise did not impact brain volume in the younger participants.<sup>12</sup> The engagement in regular aerobic

physical activity in older individuals can have an impact on the cognitive and physical health of their aging bodies. In order to protect against the physical and mental effects of aging, it is important to engage in both resistance and aerobic training to maximize these benefits for both the body and brain.

When a child has exposure to physical activity at a young age, their experiences and perceptions of physical activity have an immense impact not only in real-time to their motivation levels and constancy to exercise, but also follows them into adulthood, contributing to both their physical and mental health as they age. The interaction of hormonal contributions shapes their foundational motivation based on their early attitudes towards exercise. These attitudes can come from participation in sports and recreational activities, early formed habits, and based on their gender. Weight stigma can have negative effects on their confidence, which impacts their motivation and adherence to exercise as they get older. By understanding and being exposed to the benefits of exercise at a young age, this ensures that they have the knowledge to change the quality of their life, especially in old age. Exercise has been proven to have a direct impact on the cognitive and physical health of an aging individual, especially concerning their brain and body function. Overall, it is essential to educate young children on the importance of movement in order to shape their motivation and positively impact the trajectory of the rest of their lives.

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