



Bryant University

HONORS THESIS

The Role That Exercise Plays on Hormones, Leadership Effectiveness & Job Engagement

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Engagement**
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ABSTRACT

This research project aimed to find a connection between exercise, hormone levels, and job outcomes. It is largely known that many successful people workout, but there is limited research that connects working out to leadership effectiveness and job engagement. Therefore, a survey was distributed to Bryant University students asking them to self-report using hormone dimensions, and job outcome Likert scales. The OLS regression did not result in significant p-values however, using a means comparison there were interesting revelations in the data. Those who exercised with others had increased levels of serotonin and leadership effectiveness. Those that exercised before work had increased leadership effectiveness, but it decreased their job engagement. Those that exercised more frequently had increased serotonin and dopamine scores. Those that exercised more intensely had increased dopamine scores. These results contribute to the current body of knowledge of exercise and all the benefits that it can have in a person's life outside of the gym. This study has significant potential to increase the productivity and therefore the profitability of employees, managers, and organizations.

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INTRODUCTION

According to the World Health Organization 1.4 billion adults do not meet the recommended level of physical activity. This is concerning because a sedentary lifestyle exposes them to cardiovascular disease, cancer, and type-2 diabetes. These diseases along with others could be life threatening, but the good news is that adults can reverse these effects by choosing to be physically active. Adults who work out improve their health by decreasing their odds of getting these life-threatening illnesses. Furthermore, regular fitness results in improved mental and cognitive health (World, 2020). Physical activity causes heightened brain functions that lead to better long-term memory, reasoning, attention, problem-solving, and creative abilities. Research shows that mood is also impacted as when energy is exerted the body releases endorphins that create happy feelings that continue throughout the day. This results in optimism, confidence, and intrinsic motivation because self-esteem levels increase. It is no wonder why when coworkers are asked to rate their boss's ability to lead, bosses who exercised achieved a higher leadership effectiveness rating (Center, 2020). However, there are different levels of intensity ranging from low to vigorous and each has different results. If an adult wants to create positive exercise outcomes a person must engage in moderate to vigorous level exercise. This could be anything from a brisk walk to playing a game of soccer or basketball. Adults who perform this level of exercise will be intrinsically motivated resulting in a happier and healthier life (Waehner, 2021). There is some controversy, however, on the amount of time said exercise should be performed. Popular opinion is that an hour is the standard amount of time to work out for, but research does not support this opinion. Medical News Today says that thirty minutes of exercise is more beneficial than the entire hour; in fact, in their experiment people who spent 30 minutes exercising lost 3.6 kg whereas, the people who completed a full hour lost only 0.4 more kilograms (Rattue, 2012). In fact, even 15 minutes running can have a major impact on improving mental health. A study by Harvard T.H. Chan School of Public Health found that running reduces the potential of depression by 26% (More, 2019). This study will aim to prove that exercise causes the release of endorphins, which increase a person's mood and intrinsic motivation, as well as their

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mental and cognitive health, which result in heightened leadership effectiveness and job engagement.

LITERATURE REVIEW

Physical activity has a multitude of benefits that change with the length of time and intensity in which exercise is performed. Research shows that 20 minutes of exercise, 3 times a week, at a moderate level improved mental health by decreasing depression. There is even research to prove that initiating a training program for people with major depressive disorder helped to improve their mood within a shortened timeframe. Using the Hamilton Scale for Depression (HAMD) a study found that after just 12 days of exercise the participants had decreased levels of depression that were equal to 5 to 10 degrees. The same result was not achievable with hospitalization for 15 days as the only solution (Dimeo et. al., 2000). This is due to the endorphins that are released when working out, which resulted in better mood and well-being that hospitalization and medicine simply could not compete with. It was found that many depressed people do not currently workout which is likely a contributing factor in their lack of happiness. Reasons for not working out were people found it to be too difficult or it took too much time, but when performed for a minimal amount of time exercise can change a person's life. The key to continued participation is finding enjoyment in exercise so that it does not feel like a burden (Craft & Perna, 2004). These benefits impact a person's decision to work out, but the most common motivations for working out are related to body image and performance. A study asked 147 undergraduate college students to rate a list of statements to see which items they perceived as benefits. The top subjects were perceived physical fitness and body image (Grubbs & Carter, 2002). It can be concluded that the main motivations for working out come from how the person perceives their body, which can have a negative effect. "Diagnosed by negative body emotions where the person is filled with guilt, shame, envy, or embarrassment result in body dissatisfaction (Huellemann et. al., 2014). Often a guilty person will restrict themselves on their food intake by eliminating carbohydrates from their diet or decreasing their caloric intake with the hope of losing weight. This negative relationship with food deprivation and body shaming leads to depression and eating disorders such as anorexia and bulimia (Homan & Tylka, 2014; Vatanian et. al., 2012). Therefore,

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instead of increasing mental health, exercise driven by body image, an external factor, has detrimental effects on a person's health. To achieve the positive benefits that come along with exercise a person must work out for intrinsically motivated reasons that do not pertain to their body, which will be highlighted later in this review.

When people exercise and have “attitudes and behaviors that reflect a healthy acceptance of and appreciation for the body that goes beyond the absence of body dissatisfaction” they have been proven to achieve all the benefits of exercise (Homan & Tylka, 2014). In an investigation done to understand how female athletes were able to compete against societal norms and take part in a predominately male sport, researchers found female collegiate athletes to be motivated by muscle. They said they worked out because they were proud of their muscles and had increased strength to put into their game (Krane et. al., 2004). Knowing that many people are motivated by perceived physical fitness, it makes sense that exercise has such a positive impact on their mental health. Also, increased body appreciation was highly positively correlated with lower: weight concern, body surveillance, and body shaming resulting in higher self-esteem and overall confidence (Avalos, 2005). With the endless benefits that fitness can have on a person's life, why does 76.8% of the population live a sedentary lifestyle (Centers for Disease Control, 2019)?

As previously mentioned, a study found that the most statistically significant items for not working out had a theme that there was too much physical exertion involved. The surveyed undergraduates reported that exercise tired them, was too hard, took too much time, and they were not encouraged by their family members (Grubbs & Carter, 2002). However, we know from previous research that a person only needs to work out for 20 minutes to better their mental and cognitive health (Craft & Perna, 2004). The result of improving mental and cognitive health is increased self-efficacy and confidence because with a more positive mindset performance is heightened.

One way to understand that self-efficacy is linked to the ability to perform is with the Social Cognitive Theory that Albert Bandura created in the 1960s. It says that self-efficacy results in

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the activities and goals a person decides to take part in as well as the amount of effort and persistence they complete them with, and what kind of achievements and learning are attained through them (The Social Cognitive Theory, 2019). Recall that exercise has been linked to increased levels of self-efficacy and according to the Social Cognitive Theory this results in greater persistence toward one's goals. Undergraduate students in an entrepreneurship class were asked to self-report for self-efficacy by answering questions such as: How confident are you that you will get an A on your exam? Or will you get at least a B. This was compared to their performance which was measured by their final exam grade, class participation, and written performance. In the end there was a positive relationship between self-efficacy and performance with a 79% chance of linkage (Prussia et. al., 1998). Researchers wanted to find out if there was a link between self-efficacy and leadership effectiveness as past research did not take this approach. A later study found this relationship to have a positive correlation; they created a developmental program for managers that was meant to increase their self-efficacy which would increase their leadership effectiveness. The programs lead the managers to have increased self-efficacy and the company reported heightened leadership skills post development program (Seibert et. al., 2017). Another question that researchers asked was what is the connection between performance and self-efficacy? Performance is defined as what an individual contributes to an organization and what impact that contribution leaves with the organization. Performance is necessary in a job, but people will not perform if they do not have a leader. Leadership effectiveness is a leader's success in influencing an individual to complete a task. Research done with the intent to prove that there was a positive relationship between self-efficacy and effective leadership found that the two were moderately correlated with a correlation coefficient of 0.34% (Ramchunder & Martins, 2014). This study expanded on previous research as it built a deeper correlation by using a taxonomy approach to identify different parts of leadership and self-efficacy, and then had people self-report on each. Later colleagues filled out the leadership effectiveness survey regarding their executives as well which eliminated self-report bias and gave a unique perspective. The study found that perceived self-efficacy about their ability to lead was related to their leadership effectiveness (Anderson et al., 2008). For example, Anderson (2008), found that "managers who tended to have a low degree of leadership self-efficacy with respect to decisiveness; a

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high degree of leadership self-efficacy with respect to motivating others; and a high degree of leadership self-efficacy for establishing/maintaining positive business relationships with others; were more effective at Relational Leadership” (paras. 64-71). This study found a positive correlation between many other types of leadership and their degrees of self-efficacy in a range of areas relating to that type of leadership. However, research has yet to prove that the Social Cognitive Theory explains why managerial leaders who are confident in their ability to lead will have greater leadership effectiveness (McCormick, 2001). Knowing that the Social Cognitive Theory uses self-efficacy to predict the level of persistence a person exerts to achieve a desired outcome, this study will aim to use it to explain the correlation between leadership effectiveness and self-efficacy.

As mentioned in the beginning, self-efficacy is a result of intrinsically motivated exercise. There are two types of motivation for exercise with extrinsic motivation being driven by a person’s appearance or weight. Intrinsic motivation is when people exercise for fitness or health, stress or mood, and socializing reasons. These motivations are directly correlated with very positive results, whereas extrinsic motivations can be very detrimental to a person's life and mindset (Huellemann et. al., 2021).

The flip side of reducing the risk of chronic medical conditions is being motivated for the wrong reasons which in turn causes health issues. A study that asked 321 female college students to rate their level of body appreciation found that “positive contribution of exercise to internal body orientation was weakened by the extent to which exercise was pursued for appearance reasons” (Homan, 2014). When a person has negative body emotions because of their image their reasons for working out have a negative impact on their health. “Diagnosed by negative body emotions where the person is filled with guilt, shame, envy, or embarrassment result in body dissatisfaction (Huellemann et. al., 2021; Homan, 2014). Consequently, the intent behind exercise matters and will impact the results. Specifically, individuals who are motivated to exercise for appearance-related reasons will experience negative outcomes.

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Those motivated based on intrinsic factors such as health and fitness goals were shown to have a positive relationship with their body image (Homan, 2014). This “refers to attitudes and behaviors that reflect a healthy acceptance of and appreciation for the body that go beyond the absence of body dissatisfaction” (Homan, 2014). Women found exercise when motivated intrinsically served to promote wellbeing which decreased their stress and allowed them to have fun (Avalos et. al., 2005). Researchers wanted to understand the effects that differences in motivation had on the outcome of exercise, so they looked at how intrinsic and extrinsic factors affected how 181 college women rated their body image. The study found that higher body appreciation came with higher self-esteem and confidence, which is likely because more frequent exercise led to satisfaction with what one’s body could do (Homan 2014; Vartanian et. al., 2012). Also, higher body appreciation was highly positively correlated with lower: weight concern, body surveillance, and body shaming which resulted in higher self-efficacy (Avalos, 2005).

Based on the Social Cognitive Theory, Bandura has explained that the more self-efficacy a person has the better their performance will be (The Social Cognitive Theory, 2019). Research supports this theory by showing that people with higher self-confidence and optimism make more effective leaders. Based on the previous information we know that intrinsically motivated exercisers display higher levels of confidence and self-esteem. A military science professor completed a study that measured junior collegiate students' leadership ability based on an army leadership assessment. Students were rated by their peers, officers, and trained assessors on these measures. The different dimensions included oral and written communication, initiative, influence, and delegation, but more significantly physical stamina. The military found that physical stamina was a must as it helped with confidence levels making more effective leaders. More specifically leadership efficacy was correlated to confidence with a beta of 40% (Chemers et. al., 2000). This added to existing research that said the higher your self-efficacy is the higher your ability to lead will be (Gist, & Mitchell, 1992) and a higher self-esteem was associated with a greater chance of accepting a leadership role in the first place (Deci & Ryan, 1985).

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Based on the current research it is hypothesized that exercise leads to increased levels of self-efficacy due to the endorphins that are released upon exerting physical activity so long as it was pursued for intrinsically motivated reasons. Research also shows that higher self-efficacy led to an increase in leadership effectiveness. This relationship was explained using the social cognitive model. Although research has connected physical activity to self-efficacy and self-efficacy to leadership effectiveness, there is a gap in the current research when connecting exercise to leadership effectiveness. Seeing as heightened self-efficacy is the output of exercise and the input of leadership effectiveness it is likely that one predicts the other. Furthermore, the current research on leadership effectiveness has yet to distinguish between extrinsic and intrinsic motivation regarding the Social Cognitive Theory. It simply proves that heightened self-efficacy results in higher leadership effectiveness without testing the difference between internal and external motivation within this model. This study will aim to prove that exercise when motivated by intrinsic factors has a positive influence on leadership effectiveness, with the link being self-efficacy.

HYPOTHESES

- H1a. Exercise before work will increase serotonin.
- H1b. Exercise before work will increase dopamine.
- H2a. Exercise with others will increase serotonin.
- H2b. Exercise with others will increase dopamine.
- H3a. Exercise frequency will increase serotonin.
- H3b. Exercise frequency will increase dopamine.
- H4a. Exercise intensity will increase serotonin.
- H4b. Exercise intensity will increase dopamine.
- H5a. Exercise before work will increase leadership effectiveness.
- H5b. Exercise before work will increase job engagement.
- H6a. Exercise with others will increase leadership effectiveness.
- H6b. Exercise with others will increase job engagement.
- H7a. Exercise frequency will increase leadership effectiveness.
- H7b. Exercise frequency will increase job engagement.

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H8a. Exercise intensity will increase leadership effectiveness.

H8b Exercise intensity will increase job engagement.

METHODS

Participants and Procedure

An online survey was created using Qualtrics and the link was distributed through email and faculty Canva classroom pages ($n = 130$). The data was collected between the Fall of 2022 and the Spring of 2023. All survey participants were Bryant University students and they received extra credit for completing the survey. A little more than half of the survey participants were male (55.6%) ranging in age from 18 to 52 years old. Most participants were between 18 and 23, but there were two faculty aged 34 and 52 who completed the survey. Most participants were white (84.6%) with some African American (3.8%), some Hispanic or Latino (3.8%) some Asian (5.4%), and some individuals who identified with two or more racial/ethnic categories (1.5%). About half of the participants had a leadership role (44.5%) and of those 18.3% were president, 16.7% were vice president, 16.7% were secretary, 6.7% were treasurer, 8.3% were general members and 33.3% reported other leadership roles.

Measures

The 4 dependent variables were rated on a self-reported 5-point Likert-based scale with strongly agree (5) as the highest measure followed by somewhat agree (4), neither agree nor disagree (3), somewhat disagree (2) and strongly disagree (1) as the lowest measure. The survey began by asking students exercise questions to assess their frequency, intensity, and time of exercise. These questions were multiple choice, yes or no responses, or varying degrees of participation levels. Next, the students were asked to self-report on the serotonin and dopamine dimensions and the leadership effectiveness and job engagement Likert scales. Finally, students were asked demographic, leadership, and education level questions.

Job Engagement. Job engagement was measured from a 6-statement scale developed by Cammann (Cammann et al., 1983). The scale assessed a participant's overall satisfaction with their work as a whole. The Cronbach's alpha for the scale was 0.92. A sample item includes "At work, I feel bursting with energy".

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Leadership Effectiveness. Leadership effectiveness was measured through a 6-statement Likert scale developed by (Merino-Soto et. al., 2022). This scale assesses participants' attitude toward their employees or coworkers and how they interact with them. The Cronbach's alpha for the scale was 0.83. An example statement is "I foster unity, collaboration, and ownership, and recognize individual team contributions".

Serotonin Dimension. Serotonin was measured through the temperament scale (Fisher et. al., 2010). This 10-item scale assessed a participant's attitude toward following the law, being honest, and planning things ahead of time. The Cronbach's alpha for the scale was 0.79. A sample item includes "I tend to be meticulous in my duties".

Dopamine Dimension. Dopamine was measured through the temperament scale by Fisher (Fisher et. al., 2010). The survey assessed the participants' levels of creativity, adventure, and energy. Cronbach's alpha was 0.75. One of the scale items was "I get restless if I must stay home for any length of time".

Control Variables. No control variable was used in this exploratory analysis. As a means comparison was used to complete a supplemental analysis.

ANALYSIS

Table 1 displays the OLS regression model of all the 16 hypotheses that were tested. The regression analysis did not result in any p-values of significance, however some of them were close. The 4 hypotheses that were close to significance will be analyzed. Also, a means comparison was conducted to see if there were any patterns in the data to signify that one of the hypotheses could have some truth to it. Therefore, my results are based on the OLS regression results that are close to significance and the means comparison that was conducted between the independent variables (exercise before work, exercise with others, exercise frequency, and exercise intensity) and the dependent variables (serotonin, dopamine, leadership effectiveness, and job engagement).

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RESULTS

OLS REGRESSION

Using the OLS regression analysis, I found 4 hypotheses to have a close to significant p-value. They can be found in Table 2 and will be explained here as well.

Hypothesis 2a stating that exercising with others would lead to increased levels of serotonin was close to significant ($B=.171$, $p < .062$). Serotonin is your satisfaction hormone which makes you feel happy, calm, and focused. Those who exercised with others felt even better than those who exercised alone because they had someone to talk to that they could relate with and encouraged them to work harder. This resulted in increased happiness and therefore increased levels of serotonin.

Hypothesis 3a stating that more frequent exercise would increase levels of dopamine was not supported ($B=-.211$, $p < .087$). Those who exercised, but not every week reported higher levels of serotonin than those that exercised 6-7 times a week. However, those that exercised 1-3 times per week reported lower serotonin than those that exercised 6-7 times a week therefore, we may say that consistent exercisers reported higher serotonin the more consistent they were in going to the gym every day. Previous research has said those who exercise more have increased levels of self-efficacy which results in higher serotonin levels.

Hypothesis 4b was close to significance ($B=.215$, $p < .070$). It stated that the more intense you exercise the higher your dopamine will be. Dopamine is your alertness hormone and is responsible for your motivation and how productive you feel. So, it makes sense that those who work out at the maximum level of intensity would report increased levels of dopamine because they are pushing their bodies to the limits and accomplishing more. At this level of intensity, they can hit personal records, sweat harder and master new exercises which make them feel more accomplished and motivated.

Hypothesis 5b stating that exercise before work would increase a person's job engagement was not supported ($B=-.167$, $p < .099$). This result is highly inconsistent to previous research that states that individuals who exercise will have higher motivation and be more engaged with their job. This may be since the survey is based on college students and many of them do not have a full-time job yet. The data that was collected based on 1st Phorm employees

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consisted of 25 respondents and as a result was not analyzed. However, the 1st Phorm study reported increased levels of job engagement compared to the Bryant University students results.

SUPPLEMENTAL ANALYSIS

Using the means comparison, I found that exercise did impact a person's hormonal levels, leadership effectiveness, and job engagement.

Hypothesis H7a stated that the more frequently a person worked out the higher their leadership effectiveness would be. Those that worked out 1-3 times a week had a mean score of 3.76 for leadership effectiveness; those that exercised 6-7 times a week had a mean score of 4.14 therefore, the more frequently a person exercised the higher their leadership skills were the following is displayed in Table 3. This could be an effect of the Social Cognitive theory where the more frequently a person works out the higher their self-efficacy and with heightened self-efficacy, they will have more belief in themselves to lead. Those that believe more in themselves will be better communicators and encourage those around them to get more involved, which transforms a business.

Hypothesis H5a stated that people who exercise before work will have increased leadership effectiveness. Using the means comparison, exercising before work results in a higher mean (4.06) compared to exercising after work (3.91) which is displayed in Table 4. This may be since those that work out before work have increased energy and are wide awake when they go into work. They can get out all their pent-up energy and stress before they go to work whereas those that go after work do not have this advantage. When you can get all this energy and stress out before work you are more present and as a result you can lead more effectively.

Hypothesis H6a stated that exercise with others would increase your leadership effectiveness. This was true, those that worked out with others had a higher mean (4.04) compared to those who exercised alone (3.87) which is shown in Table 5. This could be because if you are working out with others you may be giving them guidance on their form or even just talking to them. This will teach leadership skills that will heighten an individual's ability to communicate at work, making someone more effective in their leadership skills.

Hypothesis H3b stated that those who exercise more frequently will have increased dopamine. Using the means comparison, individuals who exercised 1-3 times a week saw a lower mean

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(3.38) than those who exercised 6-7 times per week (3.83) shown in Table 6. This may be since dopamine is responsible for motivation and alertness and those that exercise more are going to see and feel more benefits. When people realize these benefits, they will continue to feel more and more motivated to continue to work out. Also, as the Social Cognitive theory states the better someone feels about themselves the more effort, they will put out so they will continue to hit personal records and feel stronger which will add to the motivation.

DISCUSSION/ THEORETICAL CONTRIBUTIONS

This study explored the potential effects that working out could have on a person's levels of serotonin, dopamine, leadership effectiveness, and job engagement. The findings contribute to our understanding of the positive impact that exercise has on a person's ability to perform well outside of the gym. This can be viewed through the social cognitive theory that says that the more self-efficacy one has about themselves the higher they will be able to perform. Therefore, by working out one can increase their self-efficacy which leads to heightened performance. Knowing that working out has positively impacted a person's hormonal level, and their leadership effectiveness, and job engagement offers an enormous benefit to potential employees, managers, and organizations that are trying to be better.

LIMITATIONS

Although this survey did contribute to the body of knowledge on the positive impacts that exercise can have on a person's hormonal levels, and job outcomes it does have limitations. It was a convenient study done with college students. Therefore, it only covers one age group in a close geographic location. Most participants were white (84.6%) which means there was not a lot of diversity in cultural views. Furthermore, the responses were self-reported so due to personal bias the responses may be heightened to make the participant appear to score higher. Also, there were no control variables so we cannot know if gender, race, job position, or level of education made an impact on the results. Finally, most of the respondents do not yet have full-time jobs, but they had to answer the job engagement and leadership effectiveness questions like they did have jobs. Therefore, this data may not be based on real life experiences; it may be based on perceived attitudes and behaviors.

IMPLICATIONS AND FURTHER RESEARCH

This study offers the potential to help employees, managers, and organizations heighten their success and overall profitability if they apply exercise programs to their daily routine.

Employees who work out can increase their serotonin, dopamine, leadership effectiveness, and job engagement. With these positive effects they will have heightened opportunities for raises, promotions, and even better opportunities outside their organization. They will feel better while they are at work as well, which will give them more energy to engage in other activities when they are done at the office, making them feel more productive overall.

Managers can experience these positive benefits if they begin to workout themselves. Also, if they encourage their employees to work out, they will have to do less. When their employees are performing better and more engaged with their job the managers will be able to rely on and trust in them more often, freeing up time within the managers' schedule.

Organizations can use these benefits to become more profitable. They can offer discounts on gym memberships, exercise competitions where the winner gets an extra day of vacation or exercise classes after work. Overall, knowing all the benefits that working out can have on a person's performance has the potential to increase the overall output that a company can have. Further research on the effects that exercise has on hormones and job outcomes needs to be done. It could measure a person's hormonal levels based on blood test before and after exercise which would eliminate personal bias of self-report. Also, it could have coworkers fill out questionnaires about their managers or bosses on days they workout versus do not work out to see if there is a difference. Still more research can control gender, type of exercise, race, and weight of individual to see if any of these conditions influence the outcome.

CONCLUSION

This study hypothesized that exercise would result in higher levels of serotonin, dopamine, leadership effectiveness, and job engagement. The findings of this study did not find a significant relationship between exercise and hormonal levels, and exercise and job outcomes however, future research can be conducted with a more diverse group of participants in the work world to increase the significance with a higher number of responses. Overall, this

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research shows the positive benefits that exercise can have on a person's performance levels outside the gym and their overall mood in life.

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APPENDICES

Table 1

Hypothesis	Relationship
H1 (a)	Exercise before work (+) → (+) Serotonin
H1 (b)	Exercise before work (+) → (+) Dopamine
H2 (a)	Exercise with others (+) → (+) Serotonin
H2 (b)	Exercise with others (+) → (+) Dopamine
H3 (a)	Exercise Frequency (+) → (+) Serotonin
H3 (b)	Exercise Frequency (+) → (+) Dopamine
H4 (a)	Exercise Intensity (+) → (+) Serotonin
H4 (b)	Exercise Intensity (+) → (+) Dopamine
H5 (a)	Exercise before work(+) → (+) leadership effectiveness
H5 (b)	Exercise before work(+) → (+) job engagement
H6 (a)	Exercise with others (+) → (+) leadership effectiveness
H6 (b)	Exercise with others (+) → (+) job engagement
H7 (a)	Exercise Frequency (+) → (+) leadership effectiveness
H7 (b)	Exercise Frequency (+) → (+) job engagement
H8 (a)	Exercise Intensity(+) → (+) leadership effectiveness
H8 (b)	Exercise Intensity(+) → (+) job engagement

Table 2

Hypothesis		Beta	P-value
H2a	Exercise with others increased serotonin levels	0.171	0.062
H3a	More frequent exercise decreased serotonin	-0.211	0.087
H4b	More intense exercise increased dopamine	0.215	0.070
H5b	Exercise before work decreased job engagement	-0.167	0.099

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Table 3

Leadership Effectiveness	Exercise Frequency	M	SD
	I never exercise		3.76 0.59
	I exercise, but not every week		4.19 0.46
	1-3 times/week		3.76 0.39
	4-5 times/ week		3.83 0.57
	6-7 times/ week		4.14 0.62

Table 4

Leadership Effectiveness	Exercise Before Work	M	SD
	After Work		3.91 0.51
	Before Work		4.06 0.61

Table 5

Leadership Effectiveness	Exercise with Others	M	SD
	Alone		3.87 0.60
	With Others		4.04 0.50

Table 6

Dopamine	Exercise Frequency	M	SD
	I never exercise		3.28 0.49
	I exercise, but not every week		3.60 0.66
	1-3 times/week		3.38 0.46
	4-5 times/ week		3.48 0.49
	6-7 times/ week		3.83 0.53

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