



BSc in Psychology
Department of Psychology

The Relationship Between Physical Activity and Anxiety and
Depressive Symptoms Among Adolescents in 8th to 10th
Grade Primary School in Iceland

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Foreword

Submitted in partial fulfillment of the requirements of the BSc Psychology degree, Reykjavík University, this thesis is presented in the style of an article for submission to a peer-reviewed journal.

This thesis was completed in the Spring of 2021 and may therefore have been significantly impacted by the COVID-19 pandemic. The thesis and its findings should be viewed in light of that.

Abstract

Anxiety and depression disorders are the most common types of mental disorders. Research has established the benefits of physical activity in the reduction of anxiety and depressive symptoms. Parental support plays an important role in promoting good lifestyle choices, such as physical activity, in their children. The aim of this study was to test whether there is an association between physical activity and anxiety and depressive symptoms among adolescents in the 8th–10th grades in primary schools in Iceland. A sample of 2,122, 13 to 15 years old students was drawn out of a large population of pre-collected survey data, 51% females, 48% males and 1% who did not indicate their gender. Results demonstrate that males engage more in physical activity than females, while females reported higher levels of anxiety and depressive symptoms. Overall, results indicated that physical activity significantly reduced anxiety and depressive symptoms among adolescent males and females, while controlling for parental support.

Key words: anxiety, depressed mood, physical activity, parental support.

Útdráttur

Kvíði og þunglyndiseinkenni geta komið fram á marga mismunandi vegu og er ein algengasta tegund geðraskana sem getur haft veruleg áhrif á daglegt líf einstaklinga. Rannsóknir hafa leitt í ljós samband á milli líkamlegrar hreyfingar og umfangs kvíða- og þunglyndiseinkenna. Stuðningur foreldra gegnir stóru hlutverki þegar kemur að hreyfingu barna þeirra. Markmið þessarar rannsóknar var að sjá hvort samband væri á milli hreyfingar og umfangs kvíða- og þunglyndiseinkenna meðal ungmenna í 8. - 10. bekk í grunnskóla á Íslandi. Alls voru 2.122 þátttakendur á aldrinum 13-15 ára valdir af handahófi úr þýðisgögnum Rannsókna & greiningar. Hlutfallsleg skipting eftir kyni var nokkuð jöfn, 1093 stúlkur (51%), 1029 drengir (48%) en tuttugu (1%) greindu ekki frá kyni sínu. Niðurstöður sýndu marktækan mun á tíðni hreyfingar milli kynja og umfangi kvíða- og þunglyndiseinkenna. Á meðan drengir stunduðu meiri hreyfingu, var umfang kvíða- og þunglyndiseinkenna hærra meðal stúlkna en drengja. Þegar á heildina er litið, bentu niðurstöður til þess að líkamleg hreyfing dragi verulega úr umfangi kvíða- og þunglyndiseinkenna þegar stýrt er fyrir stuðningi foreldra.

Lykilorð: kvíði, þunglyndiseinkenni, líkamleg hreyfing, stuðningur foreldra.

The Relationship Between Exercise and Anxiety Symptoms Among Adolescents in 8th to 10th Grade Primary School

Stress is a normal part of life that affects everyone from time to time. The body's response to stress presents itself through changes in memory, mood, attention and well-being (Cleveland Clinic, 2015). Stress can become unhealthy when it has a negative impact on individuals in their daily lives and can lead to distress. Physical symptoms of stress include nausea, headache, chest pain, sleep problems, muscle tension, cold and sweaty palms. Further, psychological symptoms of stress can be depression, anxiety attacks, worry, anger and helplessness (Cleveland Clinic, 2015; Baum & Posluszny, 1999).

Anxiety and Depressive Symptoms

According to the Diagnostic and statistical manual of mental disorders, *DSM-5* (2013a), anxiety disorders are described as a gathering of mental health disorders which are characterized by feelings of extreme concern, physical discomfort, unreasonable fear and concern about what the future holds (American Psychiatric Association, 2013a). Individuals with anxiety disorders struggle with physical discomfort and behavioral disorders, and they experience intense worry that can last for several hours or even throughout a whole day. Individuals who are diagnosed with anxiety disorder often feel as they don't have any control of their thoughts, regardless whether they know their thoughts are helpful or not. Thoughts like these are more likely to have negative impact on individuals rather than positive (Rowa & Antony, 2008).

Symptoms of anxiety include tiredness, irritability, lack of concentration, excessive worrying and intrusive, often overwhelming thoughts (Craske et al., 2011). These symptoms can lead to physical symptoms like increased heart rate and blood pressure, increased sweating, shivers, muscle tension, upset stomach, and much more. During an anxiety reaction, individuals may feel an instant release of energy into their bodies, triggered by the

hypothalamus. This reaction activates the autonomic nervous system which has direct impact on muscles and organs (Craske et al., 2011; Sóley Dröfn Davíðsdóttir, 2014).

Generalized anxiety disorder (GAD) is one of the most common anxiety disorders. According to the *DSM-5*, GAD is defined as „excessive, uncontrollable worry about a number of life events/activities, accompanied by at least three of six associated symptoms of negative affect/tension“. An example of these symptoms is irritability, restlessness, muscle tension, sleep disturbance and more. In order to examine patient's overall health and diagnose generalized anxiety disorder, patients are often given a seven-item self-report scaled questionnaire, referred to as the GAD-7, where they are asked to rate their symptoms on a four-point scale in the past two weeks (Brown et al., 2001; Williams, 2014).

Mental illness is a public health concern around the world (James et al., 2018). In recent years, there has been an increase in mental disorders such as anxiety and depression in the world, along with Iceland (Goodyer et al., 2010; Kristjánsson et al., 2012). Anxiety is one of the most common mental disorders among children and adolescents and is likely to be associated with other common mental disorders such as depression (Davey, 2014). This suggests that early prevention to reduce the chance of children developing anxiety and depression is important in order to protect them later in life. Goodyer et al. (2010) found that if there was an early onset of any particular mental disorders with adolescents, then there was a greater risk of continuity and recurrence of mental disorders into the adult life. It has been demonstrated that 15-20% of all people develop some kind of anxiety disorder before entering the adult life (Goodyer et al., 2010).

According to *DSM-5* (2013), depression is defined as „a common and serious medical illness that negatively affects how you feel, the way you think and how you act“. Symptoms of depression can differ from mild to severe. It can cause feelings such as sadness, depressed mood, indifference to things you were interested in before, sleep pattern disturbance,

worthlessness, suicidal or death thoughts and much more. To be considered depressed, five of these symptoms mentioned above must be present every day for at least two weeks, and must cause a change in behavior and function (American Psychiatric Association, 2013b).

Major depression (MDD) and bipolar disorder are the two main types of clinical depression. Major depression is the most common type of depression and is also known as unipolar depression. According to the *DSM-5* the probability of major depression is 10-25% for females, while for males the probability is 5-12% (Davey, 2008).

Depression is one of the most common mental illnesses and is the leading cause of disability in the world, affecting more than 264 million people of all age groups. Around 76% - 85% of individuals with mental disorders who live in low- or middle-income countries do not receive treatment for their disorder. Nevertheless, in the worst case, depression can lead to suicide and up to 800,000 individuals take their own lives due to depression. Suicide is the second major cause of death among individuals aged 15-29 (Goodyer et al., 2010).

In contrast, preadolescent males are more likely to be depressed than females, however, the depression rate reverses between 11-13 years of age and becomes more common with females. By the time females are 15 years old, they become twice as likely to have experienced depression compared to males, and this gender gap continues until late adulthood. The onset of this gender gap in depression can be attributed to a noticeable change, which occurs at the age of 11-13. This change is associated with gonadal hormones during puberty which can lead to mood disturbances, as well as social roles, peer, parental and romantic/sexual relationships and major changes in school environments (Cyranowski et al., 2000; Susman et al., 1987).

Some studies have established that physical exercise is effective in reducing depression (Dunn et al., 2001; Stanton & Reaburn, 2014). In the modern times, sedentary lifestyle is more common and has been linked to negative feelings such as hopelessness and

depression (Cicek et al., 2015). Depression can also be a contributor to a worsen physical health following by a reduced quality of life. While studies demonstrate the effectiveness of various treatments for depression, most commonly in the form of either antidepressants or therapy or a combination of both, some individuals choose other treatments such as physical activity (Cicek et al., 2015).

Physical Activity (PA)

Physical activity is described as „any bodily movement produced by skeletal muscles that require energy expenditure”. All physical activity contains bodily movement including walking, cycling, playing sports, exercise, leisure-time physical activity and so much more. The benefits of physical activity are that it improves public health, life expectancy, strengthens your bones and muscles and reduces health risks (Caspersen et al., 1985).

A few biological mechanisms, such as routine physical activity, can significantly reduce the risk of chronic diseases and premature death (Warburton et al., 2006). It has been shown that routine physical activity reduces blood pressure, systematic inflammation and blood coagulation, as well as improving weight control, high density lipoprotein and cholesterol levels. Routine physical activity also affects improved psychological well-being as reduction of stress, anxiety and depression. Psychological well-being is also an important component of overall health, the impicators of poor mental health can lead to cardiovascular disease, diabetes, cancer, etc. (Warburton et al., 2006).

In addition, exercise training has been shown to have an impact on different symptoms and signs that are related to generalized anxiety disorder (GAD), such as poor concentration, depression, feelings of anxiety, muscle tension and pain (Herring et al., 2011). Research has established the effectiveness of resistance exercise training (RET) in comorbid population that suffer from chronic, physical diseases in addition to anxiety. Resistance exercise training (RET) is important for maintaining bone and muscle health and increases

muscle strength and mass, endurance and power (Hootman, 2009). Furthermore, in a study on cancer patients, it was shown that RET effectively reduces symptoms of anxiety, depression, fatigue and pain as well as showing greater improvement in GAD related symptoms, such as reducing fatigue among patients and physically healthy adults, increasing overall quality of life, and reducing depressive symptoms among cancer patients compared to aerobic exercise training. RET has also shown greater improvement in depression and disturbed sleep among MDD patients (Herring et al., 2011).

The proportion of children nationwide who meet the 60-minute of daily physical activity recommendation from the U.S. Department of Health and Human Services (2008) is relatively low. Recent estimation indicates that about 42% of children aged 6-11 meet the daily recommendation, but only 8% of children aged 12-17 (Beets et al., 2010).

Parental Support

Parental support is described as „parental behaviors toward the child, such as praising, encouraging and giving physical affection, which indicates to the child that he or she is accepted and loved“ (Barnes et al., 2000). Parents play a significant role in the development of lifestyle behaviors in their children (Ornelas et al., 2007). Parents that participate in physical activities with their children as well as show support and provide encouragement, can foster positive health outcomes in their children that continues into adulthood. Studies have shown that parental social support has significant influence on physical activity among children and adolescents, as well as help to reduce the likelihood of obesity among children and adolescents (Sallis et al., 2000; Strauss et al., 2001; Springer et al., 2006). Therefore, it is possible that parenting styles can influence depression and low self-esteem indirectly by their level of participation in physical activities (Ornelas et al., 2007).

Those who struggle with mental health problems are more likely to show risky behaviors and to experience other consequences that are negative to their mental and physical health (Laird & Kuhn, 2014). But mental health problems among adolescents can also have a negative impact on their families. Family support programs can be used as a part of treatment for adolescents, who have been diagnosed with mental health or behavior problems. Furthermore, family support can also be used as a part of treatment to prevent the onset or the increase of mental or behavior problems (Laird & Kuhn, 2014).

Every child needs a reasonable amount of motor skills to be able to participate in activities, which involves the facilitation of good functioning of the immune system, maintaining appropriate bodyweight and building physical fitness (Bunker, 1998). It is also important to keep in mind that males and females may have different needs when it comes to exercise. Studies demonstrate that physical inactivity among females seems to be rising compared to males. It is possible that circumstances and/or social conditions may possibly reduce female's participation in sports. Therefore, opportunities for females should be included in childhood activities that are associated with physical activities and sports. These opportunities consist of developing basic skills and acquire motor skills which are necessary for leisure activities and lifelong learning. Development in motor skills is one of the main benefits of physical activity. Physical activity and participation in sports is important for both males and females (Bunker, 1998).

Engagement in physical activity and sports has a positive impact on emotional well-being. With increased level of physical activity, it can be beneficial for children who have an emotional problem or depression (Biddle, 1995), as they reported lower levels of general anxiety and depression (Morgan, 1994; Landers & Petruzzello, 1994).

The association between Anxiety and Depressive Symptoms and Physical Activity

According to Smits and Zvolensky (2006), physical inactivity has a great impact on anxiety and it can affect the severity of panic disorder. Individuals who are likely to experience stress in their life, benefit more from exercise training. Their research showed that patients with panic disorders with or without agoraphobia, who followed structured exercise (running) experienced a significant reduction in anxiety symptoms compared to a comparison group of patients who received placebo pill but no exercise program. Patients with anxiety disorders showed even greater improvement when exercise was combined with antidepressants (Jayakody et al., 2014).

There are some studies which indicate that mental disorders and physical inactivity are related and when physical activity increases, mood improvement occurs (Ströhle, 2009; Bhui & Fletcher, 2000; Dunn et al., 2001; Abu-Omar, 2004). A cross-sectional study conducted by De Mello and colleagues (2013), was to see the association between physical activity, depression and anxiety symptoms. They randomly selected 1,042 volunteers from Sao Paulo, representative of the demographics and the socioeconomic status in the area. Ten trained psychologists submitted the following questionnaires to the volunteers before their usual bedtime. The questionnaires used were the Brazilian versions of the Beck Depression Inventory (BDI) and the Beck Anxiety Inventory (BAI) along with self-report measures of regular physical activity and measures of socioeconomic status according to Brazil's Economic Classification Criterion (CCEB). Their results showed that 24.4% of the population claimed to practice regular physical activity three times or often per week, 12.4% claimed to practice physical activity two times or less per week and 63.2% did not practice any regular physical activity. Those who reported no physical activity had a greater chance of displaying depression and anxiety symptoms compared to those who practiced regular physical activity (De Mello et al., 2013).

McMahon et al. (2017) conducted a cross-sectional study on approximately eleven thousand European adolescents, where they explored physical activity, sport participation and associations with anxiety, depression, and well-being. Results indicated that adolescents who engaged in organized sports reported lower levels of anxiety and depression and higher levels of well-being in comparison to adolescents who did not engage in organized sports. Furthermore, adolescents who were least active reported the highest level of anxiety symptoms compared to adolescents who were somewhat active and the most active (McMahon et al., 2017).

A meta-analysis containing 73 studies, was conducted by Ahn & Fedewa (2011) to examine the relationship between physical activity and mental health among children. Their results indicated that overall, there was a significant but small effect of physical activity on mental health, indicating that physical activity on average leads to improved mental health in children. It showed that increased level of physical activity reduced anxiety, depression, emotional disturbances and psychological distress among children as well as those who were overweight or obese. Randomized controlled trials showed the greatest effects on children's mental health when the intervention involved the combination of both aerobic and resistance exercise training, although some non-randomized controlled trials showed the greatest effects in moderate intensity exercise. The more children participated in these types of exercises, the less they experienced mental health issues (Ahn & Fedewa, 2011).

Current study

The main purpose of this study was to explore the relationship between physical activity and anxiety and depressive symptoms among young people in the 8th – 10th grades in primary school in Iceland. Based on prior knowledge, the following three hypotheses were proposed:

(1) Increased physical activity (measured in number of days in the past week) is correlated with lower levels of anxiety and depressive symptoms.

(2) On average, females are more likely than males to report higher level of anxiety and depressive symptoms.

(3) The relationship between physical activity and levels of anxiety and depressive symptoms is present after controlling for parental support.

Method

Research design

The current study is based on a cross sectional questionnaire survey. The independent variables (predictor variables) were gender, physical activity, and parental support. The dependent variable was anxiety and depressive symptoms.

Participants

Participants were selected with a random sample of 2,122 students in the 8th - 10th grades drawn out of a large population of all 8th -10th graders (13-16 years old) in compulsory schools in Iceland in 2018. The sample in question was selected based on key variables; age, and gender. There were 1,093 girls (51%), 1,029 boys (48%), and in addition 20 (1%) participants who did not indicate their gender. The overall population response rate was 84%, the response rate included 3,606 students in 8th grade, 3,523 in 9th grade, 3,312 in 10th grade and 122 students who did not indicate which grade they were in.

Measures

The data come from a self-report survey questionnaire. The instrument used in the study was a printed questionnaire containing 83 questions in different multiple sections, which was 30 pages in total. The questions that participants received were related to several dimensions on adolescent's environment, daily lives and well-being (see Appendix A).

Anxiety and Depressed Mood

The variable anxiety and depressed mood consisted of 15 items from the depression and anxiety dimensions of the SCL-90 symptom list (Derogatis et al., 1973). Participants were asked “How often did you notice the following negative feeling or discomfort during the last week?” and responded to the following items: “Nervous”, “You felt lonely”, “Sudden fear for no reason”, “You were bored or had little interest in doing things”, “You were tense”, “You had little appetite”, “You cried easily or wanted to cry”, “You had difficulty falling asleep or staying asleep”, “You were depressed or sad”, “You were not excited to do anything”, “You felt slow or powerless”, “You felt hopeless”, “You thought about shortening your life”, “You felt like everyone had failed you”, “You had no one to talk to”, on an ordinal 4-point scale ranging from 1 = *almost never* to 4 = *frequently*. The questions were computed into a new continuous variable ranging from 15-60 with higher scores reflecting higher levels of anxiety and depressive symptoms. The internal consistency was good, Cronbach’s alpha $\alpha=.930$.

Parental Support

The variable parental support consisted of five items following the question “How easy or difficult would it be for you to get the following from your parents?”. Participants responded on a 4-point ordinal scale from 1 = *very difficult* to 4 = *very easy*. The items were “Caring and warmth”, “Conversations about personal issues”, “Advice regarding education”, “Advice regarding other subjects”, and “Assistance with various tasks”. For internal consistency, the questions were all combined into one scale ranging from 1 = *very difficult* to 4 = *very easy*. Cronbach’s alpha was good $\alpha=.867$.

Physical Activity

The question that was used to measure physical activity (PA) was: “How many days, of the last seven days, did you exercise for a total of at least 60 minutes so that your heart rate

increased, and you were sometimes out of breath?” It had eight possible answer options ranging from 1 = *no day* to 8 = *seven days*. For interpretation purposes, the variable was recoded with the new range from 0 = *no day* to 6 = *seven days*.

Procedure

The study “Ungt fólk 2018” was performed by Rannsóknir & greining which is a research center that specializes in studying the well-being of young people and their welfare, both in Iceland and several other countries. In the study, paper questionnaires were sent to all primary schools in Iceland in February 2018. Teachers were responsible for submitting the questionnaires and the survey took place on the same day in every primary school in Iceland. All students who attended school that day were asked to answer the questionnaire.

Participants were asked not to write neither their ID number, nor their name, on the questionnaire or the envelope provided, so their answers could not be traced back to them. After completing the questionnaire, students were instructed to put the questionnaires into unmarked envelopes and give to their teachers. Students were also instructed to answer the questions to the best of their ability, with openness, and were encouraged to ask for help if something was unclear.

Data analysis

The statistical analysis was conducted using the Statistical Package for the Social Sciences 27 (SPSS). Descriptive statistics were generated for means, standard deviations and range of the dependent variable (anxiety and depressive symptoms) and the continuous variables, physical activity and parental support. Independent sample t-tests were conducted to see whether there was a significant mean difference in the independent and dependent variables by gender. Two multiple regression analysis were performed to examine the association between physical activity and anxiety and depressive symptoms for each gender while controlling for parental support. The main purpose of this study was to see whether

physical activity reduced symptoms of anxiety and depression among adolescents in primary schools. The independent variables were three: gender, physical activity, and parental support, and the dependent variable was a composite measure of anxiety and depressive symptoms.

Results

Descriptive statistics for the dependent variable, anxiety and depressive symptoms, and the predictor variables; gender, physical activity, and parental support, are presented in table 1. Most participants (89.8%) reported engagement in sports or physical activity for at least one day in the past seven days.

Table 1

Descriptive Statistics for physical activity, parental support, and anxiety and depressed mood.

	<i>N</i>	Range	<i>M</i>	<i>SD</i>
Physical Activity	1998	0-7	3.94	2.25
Parental Support	2060	1-4	3.50	0.61
Anxiety and Depressed Mood	1951	15-60	25.7	10.18

To test for gender differences in anxiety and depressive symptoms, physical activity and parental support, independent sample t-tests were conducted. As is shown in table 2, males were significantly more physically active than females, $t(2.066) = 2.948; p < .001$. Females had on average a significantly higher level of anxiety and depressive symptoms than males, $t(99.289) = -12,780; p < .001$. This was consistent with the first hypothesis that females are more likely to report anxiety and depressive symptoms than males. On the other hand, there was no significant difference in perception of parental support by gender ($p > .05$).

Table 2

Means, standard deviations for anxiety and depressed mood, physical activity, and parental support by gender.

	Males			Females		
	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>
Anxiety and Depressed Mood	920	22.75	8.33	1021	28.37***	10.97
Physical Activity	933	4.10	2.3	1051	3.80**	2.21
Parental Support	979	3.46	0.61	1068	3.50	0.62

Note. ** Results significant at the .01 level. *** Results significant at the .001 level.

Two multiple linear regressions were conducted for males and females separately to assess the relationship between physical activity and anxiety and depressive symptoms, controlling for parental support. For males, physical activity and parental support explained 14% of the total variance in anxiety and depressive symptoms ($F(2, 840) = 69.61, p < .001$, adjusted $R^2 = .140$). For females, physical activity and parental support explained 19% of the total variance in anxiety and depressive symptoms ($F(2, 968) = 113.73, p < .001$, adjusted $R^2 = .189$).

Table 3

Multiple regression results for males and females

	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>p</i>
Constant	2.70	.11		25.72	< .001
Males					
Physical activity	-.42***	.12	-.12	-3.521	< .001
Parental Support	-.463**	.46	-.33	-10.147	< .001
R^2			.142		
Adjusted R^2			.140		
Females					
Physical activity	-.83***	.15	-.17	-5.537	< .001
Parental Support	-.66***	.54	-.37	-12.245	< .001
R^2			.190		
Adjusted R^2			.189		

Note: *** Results are significant at the .001 level.

The results indicate that physical activity (measured in number of days in the past week) significantly predicted reduced levels of anxiety and depressive symptoms among adolescents, for males and females. For each additional day of physical activity, anxiety and depressive symptoms among males decreased significantly while controlling for parental support, ($B = -.42$), $p < .001$). Females scored significantly higher than males on anxiety and depressive symptoms, however, unlike males, physical activity reduced anxiety and depressive symptoms among females ($B = -.83$, $p < .001$) while controlling for parental support. Participants who exercised more reported lower levels of anxiety and depressive symptoms, regardless of parental support ($p < .001$). It seems therefore that physical exercise/activity reduces symptoms of anxiety and depression among 13 to 15 years old adolescents in Iceland. From this, it can be inferred that physical activity and parental support are significantly related to decreased anxiety and depressive symptoms for both males and females, however the relationship is a little bit stronger for females.

Discussion

The primary purpose of this study was to explore the relationship between physical activity and anxiety, and depressive symptoms among students in the 8th – 10th grades in primary school in Iceland. Based on prior knowledge on the subject, three hypotheses were proposed.

The first hypothesis was that increased physical activity (measured in the number of days in the past week) reduces the extent of anxiety and depressive symptoms in males and females. Results indicated that higher frequency of physical activity was associated with a reduction in symptoms of anxiety and depression, which supports the first hypothesis.

The second hypothesis proposed that females are more likely than males to report higher levels of anxiety and depressive symptoms. The results supported the hypothesis; there was indeed a significant gender difference in both physical activity and anxiety and

depressive symptoms. On average, females were less physically active than males and reported higher levels of anxiety and depressive symptoms.

The third hypothesis proposed that the relationship between physical activity among males and females and the extent of anxiety and depressive symptoms holds while controlling for parental support. The results demonstrated that parental support is significantly associated with physical activity among males and females, and so the main effect of physical activity on anxiety and depressive symptoms, while holding other factors constant.

In the United States, around 30% of adolescents did not meet the national recommendation for moderate (MPA) to vigorous physical activity (VPA) in 2005 (Ornelas et al., 2007). In MPA the heart rate goes up higher than one is at rest, up to about 50% - 60%. An example of MPA is walking, playing sports, dancing etc. However, VPA requires a lot of oxygen utilization to move forward with the activity, which includes running, swimming, bicycling etc. (World Health Organization, 2018).

In Europe, mental health problems are common among adolescents. There is a convincing evidence that adolescent's physical health increases by frequency of physical activity (Strong et al., 2005). For children and adolescents aged 5-17, it is recommended that they participate in at least 60 minutes of daily moderate to vigorous physical activity. Despite of this, it has been noted that 80% of adolescents aged 13-15 worldwide do not meet these recommendations (World Health Organization, 2010; Hallal et al., 2012).

There are few longitudinal studies that have explored the causal relationship between physical activity and parental support (Schmitz et al., 2002; Neumark-Sztainer et al., 2003). Parents play an important role for setting an example for their children by promoting behaviors such as physical activity and a healthy lifestyle (Ornelas et al., 2007).

Previous studies have demonstrated that the promotion of physical activity among adolescents has become an increasing priority in public health in Europe (Kelly et al., 2012;

James et al., 2018; Eithsdottir et al., 2008). Studies have shown that increasing obesity rate among children and adolescents in the world is associated with decreased physical activity (Raj & Kumar, 2010; Wyszynska et al., 2020). An interesting factor that has received great attention in research is the role of parents in physical activity among their children. By encouraging their children to participate in physical activities, along with providing the necessary financing, parents can have a great impact on their children's health (Ornelas et al., 2007).

The benefits of this current study were the size of the population and the high response rate. The Ungt Fólk study (2018) is based on population research as their goal is to reach as many participants as possible from the population and is therefore not based on traditional sampling. All students who attended school on a particular day received a questionnaire which is done in order to minimize the margin of error. The results of these surveys are hence very reliable in comparing various groups or sub-populations. Reliability and validity of the scales used are paramount in the study by Rannsóknir og greining. The Ungt Fólk study (2018) uses solely validated and tested measurement scales that can be used in comparative studies nationally and internationally (Pálsdóttir et al., 2018).

The main limitations of this study are that it does not utilize the potential benefit of adding more explanatory variables in the model. It is quite possible that because of this, the model suffers from some specification errors. Future research on this topic could include more latent variables, such as socioeconomic status and the overall physical health of participants. Of course, it is possible that some students have limited mobility and therefore seem to exercise less when exercise frequency is measured in number of days. Perhaps it would be more appropriate to measure PA in terms of heart rate.

In conclusion, depression and anxiety disorders are among the most common disorders that fall under psychiatric conditions (Kalin, 2020). Many studies have shown that

physical activity and/or exercise help to decrease symptoms of anxiety, depression, stress and other negative consequences of mental disorders (Bunker, 1998; De Mello et al., 2013; Caspersen et al., 1985; Sharma et al., 2006; Ströhle, 2009; Warburton et al., 2006; Wolff et al., 2011;). Physical activity is now considered to be a treatment of anxiety and depressive symptoms, along with medication and therapy (Jayakody et al., 2011; Cicek et al., 2015; Peluso & Andrade, 2005). Physical activity does not cause as many side effects as antidepressants and could therefore be a valid alternative to more traditional treatments (Kvam et al., 2016; Schuch et al., 2016).

However, there is not a lot of published research on the long-term effects of exercise on anxiety symptoms. Longitudinal studies on the long-term benefits of continued physical activity in relation to symptoms of stress in various social groups are needed in order to increase knowledge and develop targeted treatments for those who suffer from stress.

References

- Abu-Omar, K., Rütten, A., & Lehtinen, V. (2004). Mental health and physical activity in the European Union. *Sozial- Und Praventivmedizin*, 49(5), 301–309.
<https://doi.org/10.1007/s00038-004-3109-8>
- Ahn, S., & Fedewa, A. L. (2011). A meta-analysis of the relationship between children's physical activity and Mental Health. *Journal of Pediatric Psychology*, 36(4), 385–397. <https://doi.org/10.1093/jpepsy/jsq107>
- American Psychiatric Association. (2013a). *Diagnostic and statistical manual of mental disorders* (5th ed.). <https://www.psychiatry.org/patients-families/anxiety-disorders/what-are-anxiety-disorders>
- American Psychiatric Association. (2013b). *Diagnostic and statistical manual of mental disorders* (5th ed.). <https://www.psychiatry.org/patients-families/depression/what-is-depression>
- Barnes, G. M., Reifman, A. S., Farrell, M. P. & Dintcheff, B. A. (2000). The effects of parenting on the development of adolescents alcohol misuse: A six-wave latent growth model. *Journal of Marriage and the Family*, 62, 175-186.
- Baum, A., & Posluszny, D. M. (1999). Health psychology: Mapping bio behavioral contributions to health and illness. *Annual Review of Psychology*, 50(1), 137–163.
<https://doi.org/10.1146/annurev.psych.50.1.137>
- Beets, M. W., Cardinal, B. J., & Alderman, B. L. (2010). Parental social support and the physical activity-related behaviors of youth: A review. *Health Education & Behavior*, 37(5), 621-644. <https://doi.org/DOI: 10.1177/1090198110363884>
- Bhui, K., & Fletcher, A. (2000). Common mood and anxiety states: Gender differences in the protective effect of physical activity. *Social Psychiatry and Psychiatric Epidemiology*, 35(1), 28–35. <https://doi.org/10.1007/s001270050005>

- Biddle, S. (1995). Exercise and psychosocial health. *Research Quarterly for Exercise and Sport* 66(4), 292-297.
- Bunker, L. K. (1998). Psycho-physiological contributions of physical activity and sports for girls. *President's Council on Physical Fitness and Sports Research Digest*, 3, 1-8.
- Brown, T. A., O'Leary, T. A., & Barlow, D. H. (2001). Generalized anxiety disorder. In D. H. Barlow (Ed.), *Clinical handbook of psychological disorders: A step-by-step treatment manual* (pp. 154-208). The Guilford Press.
- Caspersen, C. J., Powell, K. E., & Christenson, G. M. (1985). Physical activity, exercise, and physical fitness: Definitions and distinctions for health-related research. *Public Health Reports*, 100(2), 126-131.
- Cicek, G., Atan, T., Kamuk, Y. U., Imamoglu, O., Yamaner, F., & Aslan, V. (2015). Effects of exercise on levels of depression. *The Anthropologist*, 20(3), 670-674.
<https://doi.org/10.1080/09720073.2015.11891772>
- Cleveland Clinic. (2015). *Stress: Signs, Symptoms, Management & Prevention*. Health.
https://my.clevelandclinic.org/health/articles/11874-stress?fbclid=IwAR17k7J0UBr3_b4siVYGUR6cm79_MT3FclNGeAGdZiK6Hx_-1j2zmjVxKGU
- Craske, M. G., Rauch, S. L., Ursano, R., Prenoveau, J., Pine, D. S., & Zinbarg, R. E. (2011). What is an anxiety disorder? *FOCUS*, 9(3), 369-388.
<https://doi.org/10.1176/foc.9.3.foc369>
- Cyranowski, J. M., Frank, E., Young, E., & Shear, M. K. (2000). Adolescent onset of the gender difference in lifetime rates of major depression: A theoretical model. *Archives of General Psychiatry*, 57(1), 21. <https://doi.org/10.1001/archpsyc.57.1.21>
- Davey, G. C. (2008). *Psychopathology: Research, assessment and treatment in clinical psychology* (1 Pap/DVD edition). Malden, MA ; Oxford: John Wiley & Sons.

- Davey, G. (2014). *Psychopathology: Research, assesment and treatment in clinical psychology* (2nd edition).
- De Mello, M. T., Lemos, V. de A., Antunes, H. K. M., Bittencourt, L., Santos-Silva, R., & Tufik, S. (2013). Relationship between physical activity and depression and anxiety symptoms: A population study. *Journal of Affective Disorders, 149*(1–3), 241–246. <https://doi.org/10.1016/j.jad.2013.01.035>
- Derogatis, L., Lipman, R., & Covi, L. (1973). SCL-90: An outpatient psychiatric rating scale—preliminary report. *Psychopharmacology Bulletin, 9*(1), 13-28.
- Dunn, A. L., Trivedi, M. H., & O’Neal, H. A. (2001). Physical activity dose-response effects on outcomes of depression and anxiety. *Medicine and Science in Sports and Exercise, 33*(6 Suppl), S587-597; discussion 609-610. <https://doi.org/10.1097/00005768-200106001-00027>
- Eithsdottir, S. Th., Kristjansson, A. L., Sigfusdottir, I. D., & Allegrante, J. P. (2008). Trends in physical activity and participation in sports clubs among Icelandic adolescents. *The European Journal of Public Health, 18*(3), 289–293. <https://doi.org/10.1093/eurpub/ckn004>
- Goodyer, I. M., Croudace, T., Dunn, V., Herbert, J., & Jones, P. B. (2010). Cohort Profile: Risk patterns and processes for psychopathology emerging during adolescence: The ROOTS project. *International Journal of Epidemiology, 39*(2), 361-369. [doi:10.1093/ije/dyp173](https://doi.org/10.1093/ije/dyp173)
- Hallal, P. C., Andersen, L. B., Bull, F. C., Guthold, R., Haskell, W., & Ekelund, U. (2012). Global physical activity levels: Surveillance progress, pitfalls, and prospects. *The Lancet, 380*(9838), 247–257. [https://doi.org/10.1016/S0140-6736\(12\)60646-1](https://doi.org/10.1016/S0140-6736(12)60646-1)

- Herring, M. P., Jacob, M. L., Suveg, C., & O'Connor, P. J. (2011). Effects of short-term exercise training on signs and symptoms of generalized anxiety disorder. *Mental Health and Physical Activity*, 4(2), 71–77. <https://doi.org/10.1016/j.mhpa.2011.07.002>
- Hootman, J. M. (2009). 2008 Physical activity guidelines for Americans: An opportunity for athletic trainers. *Journal of Athletic Training*, 44(1), 5–6. <https://doi.org/10.4085/1062-6050-44.1.5>
- James, S. L., Abate, D., Abate, K. H., Abay, S. M., Abbafati, C., Abbasi, N., Abbastabar, H., Abd-Allah, F., Abdela, J., Abdelalim, A., Abdollahpour, I., Abdulkader, R. S., Abebe, Z., Abera, S. F., Abil, O. Z., Abraha, H. N., Abu-Raddad, L. J., Abu-Rmeileh, N. M. E., Accrombessi, M. M. K., ... Murray, C. J. L. (2018). Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990–2017: A systematic analysis for the Global Burden of Disease Study 2017. *The Lancet*, 392(10159), 1789–1858. [https://doi.org/10.1016/S0140-6736\(18\)32279-7](https://doi.org/10.1016/S0140-6736(18)32279-7)
- Jayakody, K., Gunadasa, S., & Hosker, C. (2014). Exercise for anxiety disorders: Systematic review. *British Journal of Sports Medicine*, 48(3), 187–196. <https://doi.org/10.1136/bjsports-2012-091287>
- Kalin, N. H. (2020). The critical relationship between anxiety and depression. *American Journal of Psychiatry*, 177(5), 365–367. <https://doi.org/10.1176/appi.ajp.2020.20030305>
- Kelly, P., Matthews, A., Foster, C., Organisation mondiale de la santé, & Bureau régional de l'Europe. (2012). *Young and physically active: A blueprint for making physical activity appealing to youth*. World Health Organization, Regional Office for Europe.

Kristjánsson, Á. L., Sigfússon, J., Sigfúsdóttir, I. D. & Pálsdóttir, H. (2012). *Ungt fólk 2012*.

Menntun, menning, íþróttir, tómstundir, hagir og líðan nemenda í 8., 9. og 10. bekk grunnskóla. Rannsókn og Greining. Mennta- og menningarmálaráðuneytið.

Kvam, S., Kleppe, C. L., Nordhus, I. H., & Hovland, A. (2016). Exercise as a treatment for depression: A meta-analysis. *Journal of Affective Disorders*, 202, 67–86.

<https://doi.org/10.1016/j.jad.2016.03.063>

Laird, R., & Kuhn, E. (2014). Family support programs and adolescent mental health:

Review of evidence. *Adolescent Health, Medicine and Therapeutics*, 5, 127-142.

<https://doi.org/10.2147/AHMT.S48057>

Landers, D. M., & Petruzzello, S. J. (1994). Physical activity, fitness and anxiety. In C.

Bouchard, R.J. Shepard, & T. Stephens (Eds.), *Physical activity fitness and health* (pp. 868-882). Champaign, IL: Human Kinetics Publishers.

McMahon, E. M., Corcoran, P., O'Regan, G., Keeley, H., Cannon, M., Carli, V., Wasserman, C., Hadlaczky, G., Sarchiapone, M., Apter, A., Balazs, J., Balint, M., Bobes, J., Brunner, R., Cozman, D., Haring, C., Iosue, M., Kaess, M., Kahn, J.-P., ...

Wasserman, D. (2017). Physical activity in European adolescents and associations with anxiety, depression and well-being. *European Child & Adolescent Psychiatry*, 26(1), 111–122. <https://doi.org/10.1007/s00787-016-0875-9>

Morgan, W.P. (1994). Physical activity, fitness and depression. In C. Bouchard, R.J. Shepard, & T. Stephens (Eds.), *Physical activity, fitness and health* (pp. 851-867). Champaign, IL: Human Kinetics Publishers.

Neumark-Sztainer, D., Story, M., Hannan, P. J., Tharp, T., & Rex, J. (2003). Factors associated with changes in physical activity: A cohort study of inactive adolescent girls. *Archives of Pediatrics & Adolescent Medicine*, 157(8), 803–810.

<https://doi.org/10.1001/archpedi.157.8.803>

- Ornelas, I. J., Perreira, K. M., & Ayala, G. X. (2007). Parental influences on adolescent physical activity: A longitudinal study. *International Journal of Behavioral Nutrition and Physical Activity*, 4(1), 3. <https://doi.org/10.1186/1479-5868-4-3>
- Pálsdóttir, H., Þórisdóttir, I. E., Sigfússon, J., Jón Sigfússon, Kristjánsson, Á. L., Guðmundsdóttir, L. G., Skúlason, Þ., & Sigfúsdóttir, I. D. (2018). *Ungt Fólk 2018. Nám og skóli, félags- og tómstundastarf, íþróttir og hreyfing, foreldrar og uppeldi, heilsa og líðan, atvinnuþátttaka og fjárhagur fjölskyldunnar og vímuefnanotkun ungmenna í 8., 9. og 10. bekk á Íslandi. Samanburður rannsókna árin 2000 til 2018. Staða og þróun yfir tíma. Rannsóknir og greining / Mennta- og menningarmálaráðuneytið.*
- Peluso, M. A. M., & Andrade, L. H. S. G. de. (2005). Physical activity and mental health: The association between exercise and mood. *Clinics*, 60(1), 61–70. <https://doi.org/10.1590/S1807-59322005000100012>
- Raj, M., & Kumar, R. K. (2010). Obesity in children & adolescents. *The Indian Journal of Medical Research*, 132(5), 598–607.
- Rowa, K., & Antony, M. M. (2008). *Generalized anxiety disorder*. In W. E. Craighead, D. J. Miklowitz, & L. W. Craighead (Eds.), *Psychopathology: History, diagnosis, and empirical foundations* (p. 78–114). John Wiley & Sons Inc.
- Sallis, J. F., Prochaska, J. J., & Taylor, W. C. (2000). A review of correlates of physical activity of children and adolescents. *Medicine and Science in Sports and Exercise*, 32(5), 963–975. <https://doi.org/10.1097/00005768-200005000-00014>
- Schmitz, K. H., Lytle, L. A., Phillips, G. A., Murray, D. M., Birnbaum, A. S., & Kubik, M. Y. (2002). Psychosocial correlates of physical activity and sedentary leisure habits in young adolescents: The teens eating for energy and nutrition at school study. *Preventive Medicine*, 34(2), 266–278. <https://doi.org/10.1006/pmed.2001.0982>

Schuch, F. B., Vancampfort, D., Richards, J., Rosenbaum, S., Ward, P. B., & Stubbs, B.

(2016). Exercise as a treatment for depression: A meta-analysis adjusting for publication bias. *Journal of Psychiatric Research*, 77, 42–51.

<https://doi.org/10.1016/j.jpsychires.2016.02.023>

Sharma, A., Madaan, V., & Petty, F. D. (2006). Exercise for mental health. *Primary Care Companion to The Journal of Clinical Psychiatry*, 8(2), 106.

Smits, J. A. J., & Zvolensky, M. J. (2006). Emotional vulnerability as a function of physical activity among individuals with panic disorder. *Depression and Anxiety*, 23(2), 102–106. <https://doi:10.1002/da.20146>

Sóley Dröfn Davíðsdóttir. (2014). *Náðu tökum á kvíða, fælni og áhyggjum*. Edda publication.

Springer, A. E., Kelder, S. H., & Hoelscher, D. M. (2006). Social support, physical activity and sedentary behavior among 6th-grade girls: A cross-sectional study. *The International Journal of Behavioral Nutrition and Physical Activity*, 3, 8. <https://doi.org/10.1186/1479-5868-3-8>

Stanton, R., & Reaburn, P. (2014). Exercise and the treatment of depression: A review of the exercise program variables. *Journal of Science and Medicine in Sport*, 17(2), 177–182. <https://doi.org/10.1016/j.jsams.2013.03.010>

Strauss, R. S., Rodzilsky, D., Burack, G., & Colin, M. (2001). Psychosocial correlates of physical activity in healthy children. *Archives of Pediatrics & Adolescent Medicine*, 155(8), 897–902. <https://doi.org/10.1001/archpedi.155.8.897>

Strong, W. B., Malina, R. M., Blimkie, C. J. R., Daniels, S. R., Dishman, R. K., Gutin, B., Hergenroeder, A. C., Must, A., Nixon, P. A., Pivarnik, J. M., Rowland, T., Trost, S., & Trudeau, F. (2005). Evidence based physical activity for school-age youth. *The Journal of Pediatrics*, 146(6), 732–737. <https://doi.org/10.1016/j.jpeds.2005.01.055>

- Ströhle, A. (2009). Physical activity, exercise, depression and anxiety disorders. *Journal of Neural Transmission*, 116(6), 777–784. <https://doi.org/10.1007/s00702-008-0092-x>
- Susman, E. J., Nottelmann, E. D., Inoff-Germain, G., Dorn, L. D., & Ghrousos, G. P. (1987). Hormonal influences on aspects of psychological development during adolescence. *Journal of Adolescent Health Care*, 8(6), 492-504. [https://doi.org/10.1016/0197-0070\(87\)90050-7](https://doi.org/10.1016/0197-0070(87)90050-7)
- Warburton, D. E. R., Nicol, C. W., & Bredin, S. S. D. (2006). Health benefits of physical activity: The evidence. *Canadian Medical Association Journal*, 174(6), 801–809. <https://doi.org/10.1503/cmaj.051351>
- Williams, N. (2014). The GAD-7 questionnaire. *Occupational Medicine*, 64(3), 224-224. <https://doi.org/10.1093/occmed/kqt161>
- Wolff, E., Gaudlitz, K., von Lindenberger, B.-L., Plag, J., Heinz, A., & Ströhle, A. (2011). Exercise and physical activity in mental disorders. *European Archives of Psychiatry and Clinical Neuroscience*, 261(2), 186. <https://doi.org/10.1007/s00406-011-0254-y>
- World Health Organization. (2010). *Global recommendations on physical activity for health*.
- World Health Organization. (2018). *More active people for a healthier world: Global action plan on physical activity 2018-2030*.
- Wyszyńska, J., Ring-Dimitriou, S., Thivel, D., Weghuber, D., Hadjipanayis, A., Grossman, Z., Ross-Russell, R., Dereń, K., & Mazur, A. (2020). Physical activity in the prevention of childhood obesity: The position of the European Childhood Obesity Group and the European Academy of Pediatrics. *Frontiers in Pediatrics*, 8, 662. <https://doi.org/10.3389/fped.2020.535705>

Appendix A

1. Ert þú strákur eða stelpa? (Merktu aðeins í EINN reit)

Strákur Stelpa

3. Í hvaða bekk ert þú? (Merktu aðeins í EINN reit)

8. bekk 9. bekk 10. bekk

18. Hversu auðvelt eða erfitt væri fyrir þig að fá eftirtalið hjá foreldrum þínum?
(Merktu í EINN reit í hverjum lið)

	Mjög erfitt	Frekar erfitt	Frekar auðvelt	Mjög auðvelt
a) Umhyggju og hlýju	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Samræður um persónuleg málefni	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) Ráðleggingar varðandi námið	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d) Ráðleggingar varðandi önnur verk (viðfangsefni) þín	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e) Aðstoð við ýmis verk	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

23. Hversu oft varðst þú var/vör við eftirfarandi vanlíðan eða óþægindi síðastliðna viku?
(Merktu í EINN reit í hverjum lið)

	Nær aldrei	Sjaldan	Stundum	Oft
a) Höfuðverk	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Verk í maga	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) Taugaóstyrk	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d) Skyndilega hræðslu án nokkurrar ástæðu	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e) Þú varst uppspennt/ur	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f) Þú varst leið/ur eða hafðir lítinn áhuga á að gera hluti	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g) Þú hafðir litla matarlyst	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h) Þér fannst þú einmana	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i) Þú grést auðveldlega eða langaði til að gráta	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j) Þú áttir erfitt með að sofna eða halda þér sofandi	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
k) Þú varst niðurdregin(n) eða dapur/döpur	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
l) Þú varst ekki spenntur fyrir að gera nokkurn hlut	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
m) Þér fannst þú vera hægfara eða hafa lítinn mátt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
n) Þér fannst framtíðin vonlaus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
m) Þú hugsaðir um að stytta þér aldur	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
n) Þér leið eins og allir hefðu brugðist þér	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
o) Þú hafðir engan til að tala við	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



Vísindasiðanefnd

Dr. Sunna Snædal, Formaður

Borgartúni 21 – 4. hæð

105 Reykjavík

Ágæta Vísindasiðanefnd,

Ég undirritaður, Jón Sigfússon, Framkvæmdastjóri Rannsókna og greiningar (RG) kt. 450399-2489, veiti hér með Erlu Valgerði Birgisdóttur, fullan aðgang að gögnum RG til greininga úr Ungt Fólk rannsókninni árið 2018 vegna verkefnisins „Samband milli hreyfingar og kvíðaeinkenna meðal ungmenna í 8.-10.bekk grunnskóla“. Verkefnið verður unnið úr ópersónulekjanlegum gögnum RG og er ætlað til birtingar í BS ritgerð umsækjanda.

Hafi nefndin einhverjar frekari spurningar til mín hvað þetta varðar þá vinsamlega hafið samband símleiðis eða með tölvupósti.

Virðingarfyllt,

A handwritten signature in black ink, appearing to read 'J. Sigfússon', written over a horizontal line.

Jón Sigfússon, Framkvæmdastjóri

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