BSc in Psychology

Organized Sports as a Preventative Factor for Substance Abuse: A comparison of ADHD and non-ADHD individuals

May, 2018

Name: Bjarki Jóhannsson

ID number: 051191 – 3239

Foreword

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

Abstract – English

Research has shown that individuals with attention deficit-hyperactivity disorder (ADHD) have a greater chance of developing substance use disorders than individuals without ADHD. Substance abuse amongst teenagers in Iceland has been decreasing in the past decade, in part due to the encouragement for adolescents to participate in organized sports. This study investigated whether organized sports had the same preventative effects on lifetime alcohol, smoking and marijuana use between ADHD and non-ADHD individuals. A questionnaire was administered by ISCRA, all the participants were students in 8th, 9th and 10th grade, aged from 13 to 18. There was a total of 11.013 responses with a response ratio of 86.3%. For this study a random sample of 2127 participants was used, gender distribution was even with 1045 boys and 1063 girls, 19 participants did not disclose their gender. Results showed that the effect of organized sports on lifetime alcohol use and smoking was not significantly different for participants with ADHD and without ADHD. However organized sports had more of a protective effect on individuals with ADHD when it came to lifetime marijuana use.

Keywords: attention deficit-hyperactivity disorder, organized sports, substance abuse

Abstract – Icelandic

Rannsóknir hafa sýnt að einstaklingar með athyglisbrest og ofvirkni (ADHD) eru líklegri til þess að neyta vímuefna en einstaklingar sem ekki hafa ADHD. Vímuefnanotkun meðal unglinga hefur farið minnkandi á Íslandi undanfarinn áratug, að hluta til vegna aukinnar áherslu á skipulagða íþróttastarfsemi meðal unglinga. Þessi rannsókn skoðaði hvort skipulögð íþróttastarfsemi hefði sömu verndandi áhrif gagnvart lífstíðar áfengis-, reykinga- og maríjúananotkunar meðal einstaklinga með og án ADHD. ISCRA lagði fyrir spurningalista meðal allra nemenda í áttunda, níunda og tíunda bekk. Í heildina fengust 11.013 svör, svarhlutfallið var 86,3%. Fyrir þessa rannsókn var notað slembiúrtak sem innihélt 2127 þátttakendur, kynjahlutfall var jafnt með 1045 stráka og 1063 stelpur, 19 þátttakendur gáfu ekki upp kyn sitt. Niðurstöður sýndu að skipulögð íþróttastarfsemi hafði ekki mismunandi áhrif á lífstíðarneyslu á áfengi og reykingum þegar borið var saman einstaklinga með og án ADHD. Skipulögð íþróttastarfsemi hafði meiri verndandi áhrif fyrir einstaklinga með ADHD en ekki en þá sem ekki höfðu ADHD þegar kom að maríjúana neyslu.

Lykilhugtök: athyglisbrestur og ofvirkni, skipulögð íþróttastarfsemi, vímuefnaneysla

Organized sports as a preventative factor for substance abuse: A comparison of ADHD and non-ADHD individuals

Past research has indicated that individuals with attention deficit-hyperactivity disorder (ADHD) have a greater chance of developing substance use disorders than individuals without ADHD (Biederman et al., 1995; Charach, Yeung, Climans & Lillie, 2011; Gudjonsson, Sigurdsson, Sigfusdottir & Young 2012). In addition to that it has been shown that participation in organized sports can work as a protective factor against substance abuse amongst adolescents (Elder, Leaver-Dunn, Wang, Nagy & Green, 2000; Page, Hammermeister, Scanlan & Gilbert, 1998). ADHD is one of the most common childhood disorders, it is a neurodevelopmental disorder which main subtypes are disorganization, inattention and hyperactivity-impulsivity (American Psychiatric Association, 2013). ADHD affects 3-9% of the general childhood population and about 1-5% of the adult population (Faraone, 2005; Kalbag & Levin, 2012).

Since 1998 the diagnosis of ADHD and treatment medication has increased markedly in Iceland (International Narcotics Control Board, 2005) and Iceland now has a prevalence of ADHD medication that is more like that of the United States than that of other Nordic countries (Einarsdóttir, 2008; Geirs, Pottergard, Halldorsson & Zoëga, 2014; Zoëga et al., 2011). One-year period prevalence of ADHD drug use in Iceland rose from 2.9% in 2003 to 12.2% in 2012 with the biggest increase being amongst adults aged 19-24 (Geirs et al., 2014).

Substance abuse among adolescents has increased in many European countries in the past decade, but at the same time in Iceland there has been a drastic decrease (Sigfusdottir, Kristjansson, Thorlindsson & Allegrante, 2008). In 1997, 66% of Icelandic 8th to 10th graders had tried alcohol of any type once or more in their lifetime, compared to 23% in 2015 (Palsdottir, Sigfusson, Sigfusdottir & Kristjansson). From 1997 to 2015 individuals in the 8th to 10th grade who had tried smoking in their lifetime went from 49% to 10%. Marijuana use

has not been researched for as long in Iceland but from 2009 to 2015 individuals in the 8th to 10th grade who had tried marijuana at least once went from 4% to 3.6%, however, having tried hashish went from 8.3% to 2% from 1997 to 2015 (Palsdottir, Sigfusson, Sigfusdottir & Kristjansson, 2015)

Sigfusdottir et al. (2008) hypothesized that the decrease was a result of the Icelandic Model. The Icelandic Model is an approach that emphasizes on the collaboration between community policy makers, researchers and practitioners who work with young people. It focuses on increasing community, school and parental protective factors while reducing known risk factors (Sigfusdottir et al, 2009), participation in organized recreational activities is one of the main components of the Icelandic Model. In Iceland, there is a common belief that organized sport participation has great benefits for adolescents and children (Halldorsson, 2017) which makes organized sports for that age group extremely popular in Iceland (Halldorsson, 2014). The sports clubs in Iceland are community based, which means individuals who lack the skills to become professional athletes are not excluded (Halldorsson, 2017). In Iceland there are funded municipal programs that provide children and adolescents with memberships that allow them to participate in supervised sporting activities and youth work (Sigfusdottir, Kristjansson, Gudmundsdottir & Allegrante, 2011), this is important on a social level because more people have the opportunity to gain from organized sports. A study performed by Gudmundsdottir et al. (2016) compared adolescents in the 8th to 10th grade in Iceland who participated in organized sports once or more times per week and who didn't participate in organized sports. When looking at alcohol use 13% of adolescents who didn't participate in organized sports had gotten intoxicated from alcohol use at least once in their lifetime, compared to 4% of adolescents who participated in organized sports. Smoking was not common for this age group, 3% of adolescents who did not participate in organized sports smoked daily compared to only 1% of adolescents who participated in organized sports.

When it came to marijuana use, 7% of adolescents who did not participate in organized sports had tried it, compared to 2% of adolescents who participated in organized sports. It is important for maximizing the preventative effect of sports that the sports are organized, and not disorganized (Gudmundsdottir, Sigfusson & Sigfusdottir, 2014). A study performed by Gudmundsdottir, Sigfusson and Sigfussdottir (2014) showed that if the sport was not maintained by adults the protective factor of sport participation disappeared, in some cases there was even an increase in substance use.

The benefits of organized sports were not only visible in Iceland, a study performed in Alabama examined the effect of organized extracurricular group participation on alcohol, smoking and marijuana use. Students in 10th through 12th grade, with the age of 14 to 17 years in three different schools answered a self-report questionnaire. Students were categorized into three groups when it came to organized extracurricular group participation: no organized group participation, 1-2 activities per week and more than two activities per week. Results showed that participants who took part in one or more organized extracurricular activities per week were significantly less likely to use alcohol, marijuana and smoke than nonparticipating peers (Elder et al., 2000). These results were similar to the results of Page et al. (1998) which examined the relationship between participation in school sports and health risk behaviors in a nationwide sample of 12,272 high school students in the United States. Their results showed that participants who participated in school sports were significantly less likely to have smoked cigarettes and engage in illicit substance abuse. The benefits of supervised sports and youth activities can be far reaching, since it enables children and adolescents to develop skills, improve self-esteem and set life goals (Sigfusdottir, Kristjansson, Gudmundsdottir & Allegrante, 2011).

As mentioned before ADHD affects 3-9% of the general child population and about 1-5% of adult population, however, it affects 11-35% of individuals with substance abuse

disorder (Kalbag & Levin, 2012), suggesting a greater risk of SUD among individuals with ADHD. Lifetime risk for developing SUD is 27% for adults without ADHD, but 52% for adults with ADHD (Biederman et al., 1995). Research has shown that teenagers who are impulsive, which is a common trait amongst individuals with ADHD, are more likely to try alcohol and illicit substances (Levin & Kleber, 1995). In a study amongst Icelandic adolescents Gudjonsson et al. (2012) found that ADHD symptoms were related to greater likelihood to use alcohol, nicotine and illicit drugs.

Charach et al. (2011) performed a meta-analysis examining the effect of childhood ADHD on future SUDs. The included studies compared children with ADHD to non-ADHD children, ADHD participants fulfilled standardized criteria by age 12. Results showed that childhood ADHD increased the risk of alcohol use disorder in young adulthood significantly (Odds Ratio = 1.35), the same could be said about cannabis (OR = 1.51), psychoactive SUDs (OR = 1.59) and nicotine use (OR = 2.36).

In a 2001 study of substance abuse among 889 college students with ADHD, Glass and Flory found that ADHD symptoms, especially inattentive symptoms, were positively correlated with heavier cigarette smoking and more risky alcohol drinking which could lead to substantial alcohol-related problems. However, no positive correlation was found between ADHD and marijuana or cocaine (Glass & Flory, 2001). But what is the reason behind the connection between ADHD and substance abuse? According to self-reports some individuals with persistent ADHD symptoms said they tried drugs because of their impulsive behaviors and that they associated with peers who made early access to alcohol and illicit drugs easier (Kalbag & Levin, 2012). This is in accordance with past research showing that impulsivity was a risk factor for substance abuse (Moeller & Dougherty, 2002). ADHD has been associated with early nicotine consumption and higher likelihood of continuing to smoke into adulthood (Wilens, 2004). Nicotine is a psychostimulant which improves arousal and

attention (Conners et al., 1996) so it could be hypothesized that increased nicotine consumption amongst individuals with ADHD is a way to self-medicate.

It is important to understand the relationship between ADHD, organized sports and substance abuse to know if specific measures must be taken toward preventing substance abuse amongst individuals with ADHD. It was obvious from past research that individuals with ADHD were at a risk to develop substance abuse disorders. Organized sport participation however seemed to be a protective factor against substance abuse. This brings up the question whether organized sport participation has the same protective effect for individuals with ADHD compared to individuals without ADHD. The first hypothesis for this study was that individuals with ADHD scored significantly higher on lifetime alcohol, smoking and marijuana use than individuals without ADHD. The second hypothesis was that individuals who took part in organized sports scored significantly lower on lifetime alcohol, smoking and marijuana use compared to individuals that did not participate in organized sports. The third and final hypothesis was that organized sports had the same protective effect for individuals with ADHD and without ADHD.

Method

Participants

To achieve a high response rate, the survey was conducted on the same day in February 2014 in every primary school in Iceland, each student present that day took part in the survey (Palsdottir et al., 2014). Participants were all students from grades 8, 9 and 10. There was a total of 11.013 responses, the response ratio was 86.3%. The sample used for data analysis included 2127 participants randomly drawn from the original sample. Gender distribution of the sample was even with 1045 boys and 1063 girls, 19 participants did not disclose their gender. Most participants in this study were 14-16 years old, however, three

participants were 17, two were 18 and two participants were 13 years old . The participants in this study did not receive any compensation for their participation.

Instruments

The questionnaire used was 28 pages long and contained 82 questions with a variable amount of sub questions (Palsdottir et al., 2014). Various scales were used to improve reliability and validity of the questions, the most commonly used scale was the Likert-scale. For this study five questions were used, two were used as independent variables and three as dependent variables. The first independent variable was ADHD which had two values, the question used was “Have you been diagnosed with attention deficit-hyperactivity disorder?”, the possible answers were yes and no. The second independent variable was amount of organized sports. The question used was “How many times per week do you attend organized sports?”, this question contained seven values which were recoded into three groups. The first value was “I do not attend organized sports” and was not recoded. Once, twice and three times per week was recoded into “1-3 times per week” and four, five and six or more times per week was recoded into “4 or more times per week”, this type of grouping is in accordance to past research on organized sport participation (Gudmundsdottir, Sigfusson & Sigfusdottir, 2014; Palsdottir et al., 2014). The three questions used as dependent variables were “How often have you smoked cigarettes in your lifetime?”, “How often have you drank alcohol of any sort in your lifetime?” and “How often have you used marijuana in your lifetime?”. All three questions used the same scale which contained seven values labeled “never”, “1-2 times”, “3-5 times”, “6-9 times”, “10-19 times”, “20-39 times” and “40 times or more”. The questions for alcohol, smoking and marijuana use were not recoded.

Procedure

The survey was performed by the Icelandic Centre for Social Research and Analysis (ISCRA; Palsdottir et al., 2014). ISCRA had a permit from the Icelandic Data Protection

Authorities to execute this survey. A self-report questionnaire was used in this study, the questionnaire was sent to every secondary school in Iceland to be conducted on the same day in February 2014 in every primary school in Iceland. Parents were notified of the study and if they did not want their child to take part they were asked to contact ISCRA. Teachers assigned the questionnaires to the participants, which were urged not to write down their name or social security number so that the survey could not be traced back to them. Participants were asked to answer truthfully and to ask for help if needed. When finished answering the participants put the questionnaire in an unmarked envelope and handed it to the teacher.

Design and Data Analysis

In this study qualitative data was used, the Statistical Package for the Social Science (SPSS) was used to analyze all data. Factorial Analysis of Variance (FANOVA) was used to see if organized sports have the same preventive effect against substance abuse amongst individuals with ADHD and without ADHD (2 x 3 x 2 design). A large sample was used which increases the dependability of the results. To examine the assumptions of FANOVA Kolmogorov-Smirnov was used to see if substance abuse was normally distributed and Levene's test assessed the covariance.

Results

The lowest value of alcohol, smoking and marijuana use was one and the highest value was seven, the mean for lifetime alcohol use was 1.48 (*SD* = 1.07), the mean for lifetime cigarette smoking was 1.28 (*SD* = 1.04) and for lifetime marijuana use it was 1.08 (*SD* = 0.57). As can be seen in Figure 1, substance use was very uncommon. Results showed that 74% of participants had never tried alcohol, 88.9% of participants had never tried smoking and 97.1% of participants had never tried marijuana in their lifetime. Alcohol, smoking and marijuana use were all positively skewed.

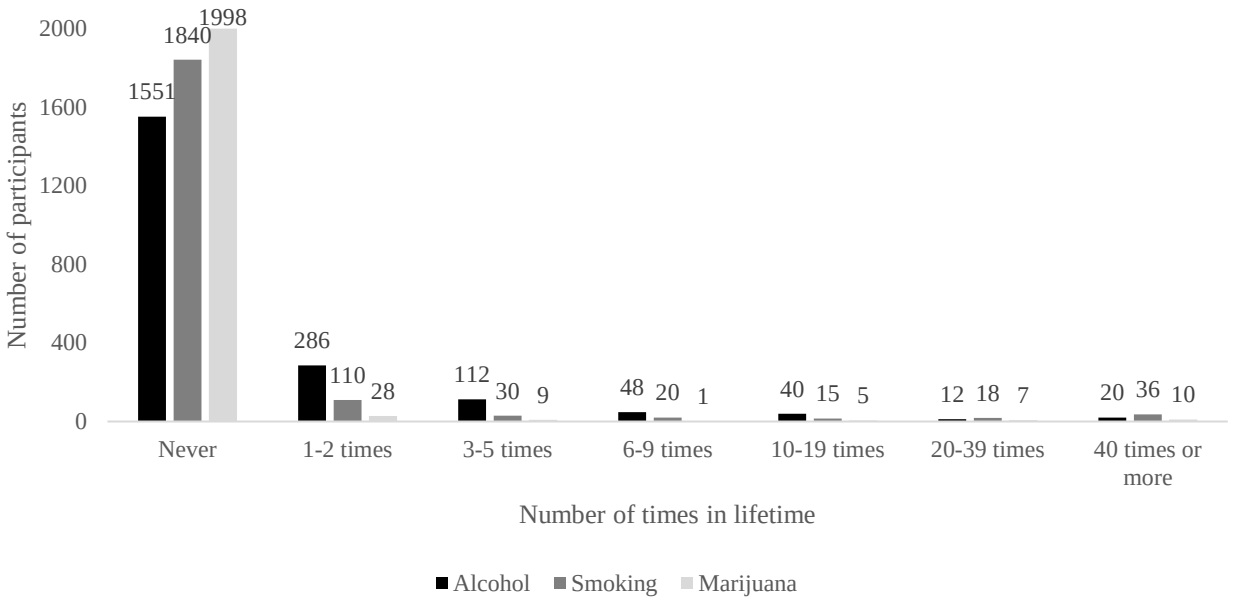

Figure 1. Number of times participants had tried alcohol, smoking and marijuana in their lifetime

Table 1 shows the number of participants by frequency of organized sport participation and ADHD. The table shows that the difference in number of participants between groups was large, the smallest group was participants with ADHD who participated in organized sports 1-3 times per week and the largest group was participants without ADHD who participated in sports 4 or more times per week.

Table 1

Number of participants by frequency of organized sport participation and ADHD

	No organized sports	1-3 times per week	4 or more times per week
Non-ADHD	601	343	833
ADHD	112	46	77

Table 2 shows the mean and standard deviation for alcohol, smoking and marijuana use by frequency of organized sport participation and ADHD.

Table 2

Descriptive statistics showing the mean and standard deviation of alcohol, smoking and marijuana, by frequency of organized sport participation and ADHD

	Alcohol				Smoking				Marijuana			
	ADHD		Non-ADHD		ADHD		Non-ADHD		ADHD		Non-ADHD	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
No organized sports	1.96	1.51	1.71	1.32	1.77	1.75	1.45	1.30	1.38	1.24	1.13	0.72
1 - 3 times per week	1.46	1.13	1.45	1.01	1.46	1.36	1.18	0.72	1.11	0.74	1.02	0.17
4 or more times per week	1.29	0.63	1.28	0.71	1.32	1.15	1.11	1.13	1.01	0.11	1.02	0.31
Total	1.64	1.24	1.46	1.03	1.56	1.51	1.24	0.92	1.20	0.93	1.06	0.55

By looking at Table 2 it can be seen that mean substance use was low for every group, the lowest substance use was of marijuana amongst participants with ADHD who participated in organized sports 4 or more times per week and the highest score was of alcohol use amongst participants with ADHD who did not participate in organized sports. Distribution in the groups had a wide range from 0.11 in lifetime marijuana use for participants with ADHD who participated in organized sports 4 or more times per week to 1.75 in lifetime smoking for participants with ADHD who did not participate in organized sports.

Factorial ANOVA was used to see the effect of organized sports and ADHD on alcohol, smoking and marijuana use. Figure 2 shows mean lifetime alcohol use amongst ADHD and non-ADHD participants between amounts of organized sport participation.

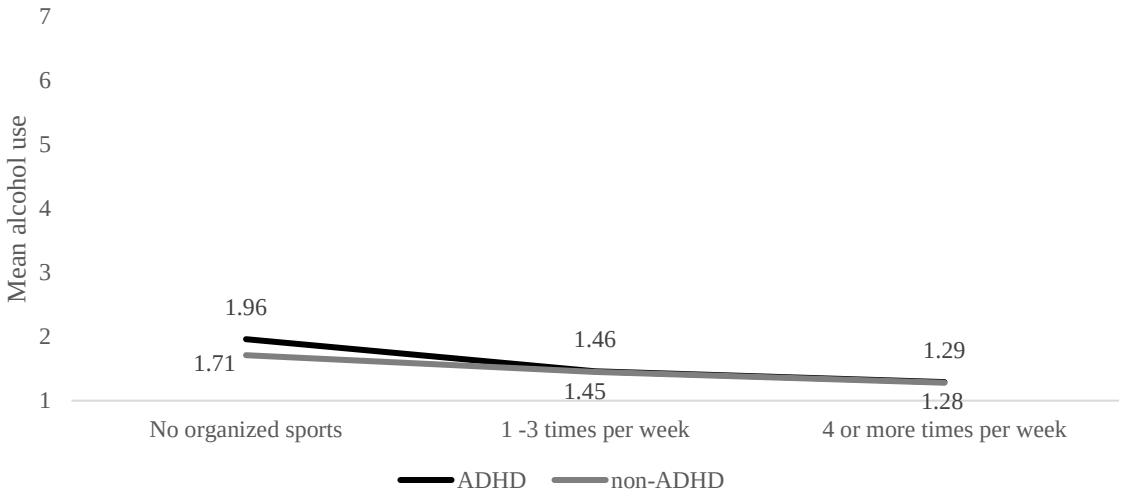

Figure 2. Mean lifetime alcohol use amongst ADHD and non-ADHD participants between amounts of organized sport participation

Results from FANOVA showed that there was not a significant main effect of ADHD on lifetime alcohol use ($F(1, 2006) = 1.307$, $p = .253$). However, there was a decreasing main effect of organized sports on lifetime alcohol use ($F(2, 2006) = 23.840$, $p < .001$). Bonferroni posts hoc test revealed that participants who did not participate in organized sports scored significantly higher on lifetime alcohol use than both participants who did organized sports 1-3 times per week and 4 or more times per week ($p < .001$). Participants who participated in

organized sports 4 or more times per week scored significantly lower on lifetime alcohol use than participants that participated in organized sports 1-3 times per week ($p < .05$). The effect of organized sports on lifetime alcohol use was not significantly different for ADHD and non-ADHD participants ($F(2, 2006) = 1.383$, $p = .251$).

FANOVA revealed that when it came to cigarette smoking there was a significant main effect, ADHD participants scored significantly higher on lifetime cigarette smoking than non-ADHD participants ($F(1, 2004) = 13.221$, $p < .001$). There was also a significant main effect on lifetime smoking between amount of organized sport participation ($F(2, 2004) = 13.554$, $p < .001$). The Bonferroni post hoc test showed that participants who did no organized sports scored significantly higher on lifetime cigarette smoking than participants that participated in organized sports 1-3 times per week and 4 or more times per week ($p < .05$). There was not a significant difference between participating in organized sports 1-3 times per week and 4 or more times per week ($p = .574$). In Figure 3 the lines are almost parallel to each other, indicating that the effect of organized sports on lifetime cigarette smoking was not significantly different for ADHD and non-ADHD participants ($F(2, 2004) = 0.280$, $p = .756$).

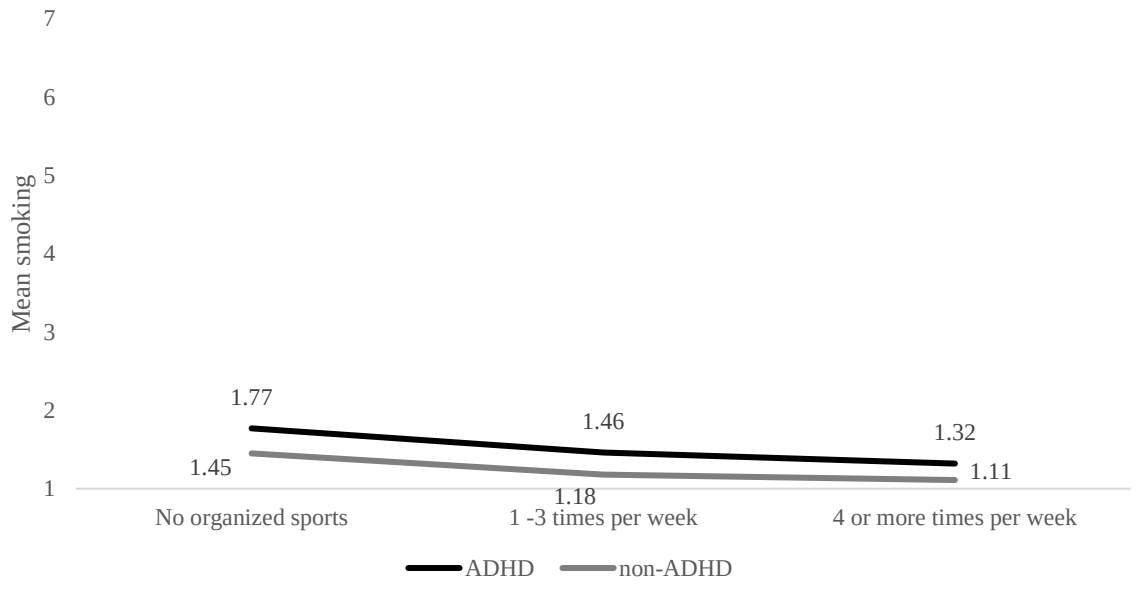

Figure 3. Mean lifetime smoking amongst ADHD and non-ADHD participants between amounts of organized sport participation

Results from FANOVA showed that organized sports had a significant main effect on lifetime marijuana use ($F(1, 1994) = 7.040$, $p < .05$), participants with ADHD scored significantly higher on lifetime marijuana use. There was also a significant main effect between amount of organized sports ($F(2, 1994) = 4.712$, $p < .001$). Results from a Bonferroni post hoc test showed that those who did not participate in organized sports scored significantly higher on marijuana use than both participants who participated in organized sports one to three times per week and four or more times per week ($p < .001$), there was not a significant difference between participating one to three times per week and four or more times per week ($p = 1.000$). The effect of organized sports on lifetime marijuana use was significantly different for ADHD and non-ADHD participants ($F(2, 1994) = 1.352$, $p < .05$). These significant interactions can be seen in Figure 4, organized sports had more of a decreasing effect on individuals with ADHD than non-ADHD participants.

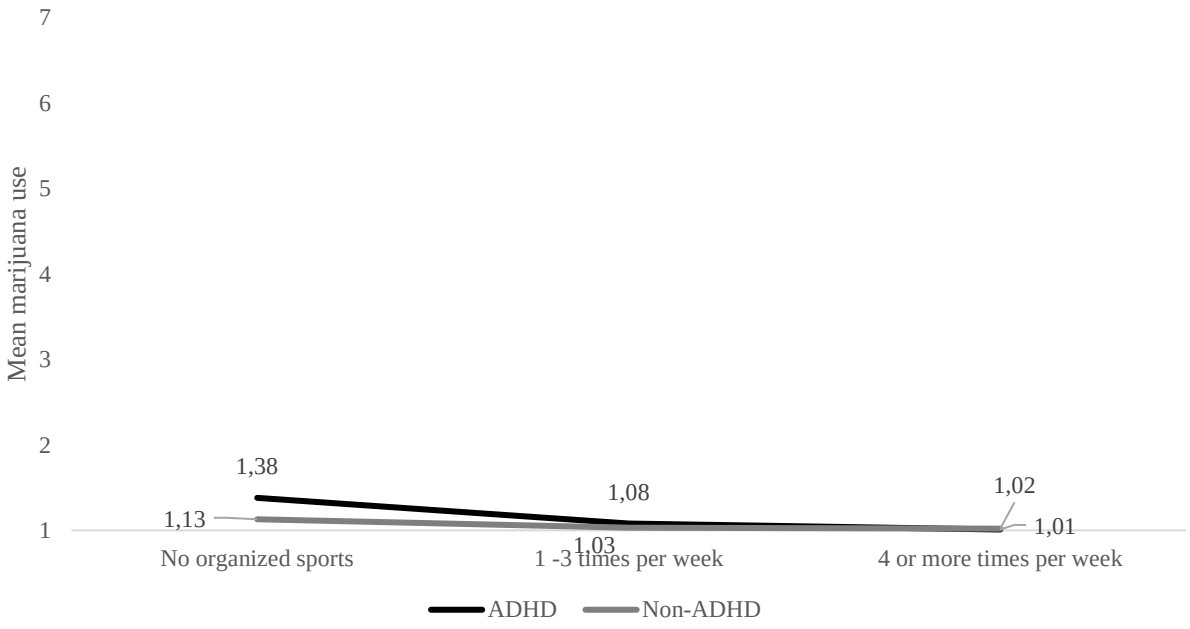

Figure 4. Mean lifetime marijuana use amongst ADHD and non-ADHD participants between amounts of organized sport participation

Discussion

The aim of this study was to investigate if organized sports have the same effect on substance abuse amongst adolescents with ADHD and without ADHD. The first hypothesis was that participants with ADHD scored significantly higher on lifetime alcohol, smoking and marijuana use, this hypothesis was partially supported as participants with ADHD did score significantly higher on smoking and marijuana use. These findings support the results of Glass and Flory (2001) and Wilens (2004) which also showed increased smoking amongst individuals with ADHD. In addition to that the results are in accordance with the results of Gudjonsson et al. (2012) which showed increased smoking and marijuana use amongst adolescents with ADHD. However, there was not a significant difference in lifetime alcohol use between ADHD and non-ADHD participants, which is not in accordance with the results of Gudjonsson et al. (2012). The results of this study supported the second hypothesis stating that participants who participated in organized sports scored significantly lower on lifetime alcohol, smoking and marijuana. These results support the findings of Gudmundsdottir, Sigfusson and Sigfusdottir (2004), Elder et al. (2000) and Page et al. (1998). It is interesting that there was a significant difference between participating in organized sports 1-3 times per week and 4 or more times per week when it came to alcohol use, but not for smoking and marijuana use. The third hypothesis was that organized sports would have the same effect on substance abuse between ADHD and non-ADHD participants. Organized sports did not have a different effect on lifetime smoking and alcohol use, so this hypothesis was supported in part. However, when it came to marijuana use, organized sports had more of a protective effect on participants with ADHD than non-ADHD participants. This may be due to the fact that average marijuana use was not high for this age group and participants without ADHD who participated in organized sports 4 or more times per week was much larger than participants with ADHD who participated in organized sports 4 or more times per week. This

study had a few limitations, the biggest limitation being that not all assumptions were met in the FANOVA analysis. The assumption for normality of the dependent variables was broken for alcohol, smoking and marijuana use as the Kolmogorov-Smirnov tests were all significant ($p < .001$). The assumption for covariance was also broken because the Levene's tests were significant for alcohol, smoking and marijuana use ($p < .001$). It was also a factor that they were not asked about exactly how much time was spent in organized sports since no questions asked about the length of training, only number of times per week. Another limitation is the fact that causality between ADHD, organized sports and substance abuse can't be determined since the research was cross-sectional. A self-report questionnaire was used, so how truthfully participants answered is unknown. The most obvious strength of this research was the large sample size and high response rate, 86.3% of all 8^{th} – 10^{th} grade students in Iceland were part of the original sample. There was also total anonymity as the answers could not be traced back to the participant. Participants were told to ask for help if they didn't understand a question which may have reduced the amount of unanswered or wrongly answered questions.

It was obvious from these results that individuals with ADHD are at risk for substance abuse and it could be concluded that both adolescents with and without ADHD could benefit from organized sports, since both ADHD and non-ADHD participants who practiced organized sports scored lower on alcohol, smoking and marijuana than participants who never practiced organized sports. Participating in organized sports only 1-3 times per week made a significant difference for reducing alcohol, smoking and marijuana use, showing that participants did not have to be elite athletes to benefit from organized sport participation. These results supported the participation of organized sports as an important part of the Icelandic Model. Organized sports were a protective factor against substance use like past research has suggested (Gudmundsdottir, Sigfusson & Sigfusdottir, 2014). For future research it would be interesting to look into whether hours per week and intensity of organized sports

made a difference for substance use. It would also be possible to compare years of training, to see if participants who take part in organized sports from an earlier age had more to gain. Furthermore, it would be possible to compare the protective effect between organized sports and sports which do not have an organized structure. In addition to that it would be possible to compare different organized sports and different areas in the country to see if the protective effect of organized sports on substance use differed between sports and areas. Organized sport participation is not the only factor that could affect substance abuse, according to the Icelandic Model, parental, school and community protective factors were the cause of reduced substance abuse in Iceland (Sigfusdottir, Thorlindsson, Kristjansson, Roe & Allegrante, 2008). Future research could focus on each of these factors mentioned above to see if they have the same protective effect toward substance abuse amongst ADHD and non-ADHD individuals.

In conclusion organized sports had the same effect on alcohol use and smoking amongst ADHD and non-ADHD individuals, but organized sports were a greater protective factor for individuals with ADHD than non-ADHD individuals when it came to lifetime marijuana use. It can be concluded that the benefits of organized sports were obvious for both ADHD and non-ADHD individuals, since both ADHD and non-ADHD participants who participated in organized sports scored lower on alcohol, smoking and marijuana use than participants who did not participate in organized sports. It is therefore of great importance to keep motivating children and adolescents in Iceland to take part in organized sports whether they have ADHD or not.

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing

Biederman, J., Wilens, T., Mick, E., Milberger, S., Spencer, T. J., & Faraone, S. V. (1995). Psychoactive substance use disorders in adults with attention deficit hyperactivity disorder (ADHD): Effects of ADHD and psychiatric comorbidity. *The American Journal of Psychiatry, 152*(11), 1652-1658. doi:10.1176/ajp.152.11.1652

Charach, A., Yeung, E., Climans, T., & Lillie, E. (2011). Childhood attention-deficit/hyperactivity disorder and future substance use disorders: Comparative meta-analyses. *Journal of the American Academy of Child & Adolescent Psychiatry, 50*(1), 9-21.

Committee on Sports Medicine and Fitness, & Committee on School Health. (2001). Organized sports for children and preadolescents. *Pediatrics, 107*(6), 1459-1462.

Conners, C. K., Levin, E. D., Sparrow, E., Hinton, S. C., Erhardt, D., Meck, W. H., … & March, J. (1996). Nicotine and attention in adult attention deficit hyperactivity disorder (ADHD). *Psychopharmacology Bullitin, 31*(1), 67-73.

Craig, E., Leaver-Dunn, D., Wang, M. Q., Nagy, S., & Lee, G. (2000). Organized group activity as a protective factor against adolescent substance use. *American Journal of Health Behavior, 24*(2), 108-113. doi:10.5993/AJHB.24.2.3

Einarsdóttir, J. (2008). Teaching children with ADHD: Icelandic early childhood teachers' perspectives. *Early Childhood Development and Care, 178*(4), 375-397. doi:10.1080/03004430701321696

Faraone, S. V. (2005). The scientific foundation for understanding attention deficit-hyperactivity disorder as a valid psychiatric disorder. *European Child Adolescent Psychiatry, 14*, 1-10.

Geirs, D. P., Pottegard, A., Halldorsson, M., & Zoëga, H. (2014). A nationwide study of attention-deficit/hyperactivity disorder drug use among adults in Iceland 2003-2012. *Basic & Clinical Pharmacology & Toxicology, 115*(5), 417-422. doi:10.1111/bcpt.12243

Glass, K., & Flory, K. (2012). Are symptoms of ADHD related to substance abuse among college students? *Psychology of Addictive behaviors, 26*(1), 124-132. doi:10.1037/a0024215

Gudjonsson, G. H., Sigurdsson, J. F., Sigfusdottir, I. D., & Young, S. (2012). An epidemiological study of ADHD symptoms among young persons and the relationship with cigarette smoking, alcohol consumption and illicit drug use. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 53*(3), 304-312. doi:10.1111/j.1469-7610.2011.02489.x

Gudmundsdottir, M. L., Sigfusson, J., Palsdottir, H., Tolgyes, E. M., Kristjansson, A. L., & Sigfusdottir, I. D. (2016). *Ánægja í íþróttum 2016: Könnun meðal ungmenna sem stunda íþróttir innan Ungmennafélags Íslands og Íþrótta- og Ólympíusambands Íslands.* Reykjavík: Rannsóknir og Greining

Gudmundsdottir, M. L., Sigfusson, J., & Sigfusdottir, I. D. (2014). *Ánægja í íþróttum: Niðurstöður rannsókna meðal framhaldsskólanema: Unnið fyrir Þróunar- og fræðslusvið ÍSÍ. Reykjavík:* Rannsóknir og Greining, Íþrótta- og Ólympíusamband Íslands

Halldorsson, V. (2014). Íþróttaþáttaka íslenskra ungmenna: Þróun og helstu áhrifaþættir. *Netla,* Retrieved December 16, 2017 from http://netla.hi.is/greinar/2014/ryn/007.pdf

Halldorsson, V. (2017). *Sport in Iceland: How small nations achieve international success.* London: Routledge.

International Narcotics Control Board. (2005). *2004 Psychotropic substances*. Retrieved December 7, 2017 from https://www.incb.org/documents/Publications/AnnualReports/AR2005/AR_05_English.pdf

Kalbag, A. S., & Levin, F. R. (2012). Adult ADHD and substance abuse: Diagnostic and treatment issues. *Substance Use & Misuse, 40*, 1955-1981. doi:10.1080/10826080500294858

Levin, F. R., & Kleber, H. D. (1995). Attention-deficit hyperactivity disorder and substance abuse: Relationships and implications for treatment. *Harvard Review of Psychiatry, 2*(5), 246-258.

Moeller, F. G., & Dougherty, D. M. (2002). Impulsivity and substance abuse: What is the connection? *Addictive Disorders & Their Treatment, 1*, 3-10.

Page, R. M., Hammermeister, J., Scanlan, A., & Gilbert, L. (1998). Is school participation a protective factor against adolescent health risk behaviors? *Journal of Health Education, 29*(3), 186-192. doi:10.1080/10556699.1998.10603332

Palsdottir, H., Sigfusson, J., Sigfusdottir, I. D., & Kristjansson, A. L. (2015). Vímuefnaneysla unglinga á Íslandi: Þróun frá 1997 til 2015. Reykjavík: Rannsóknir og Greining.

Palsdottir, H., Sigfusson, J., Þorisdottir, I. E., Gudmundsdottir, M. L., Kristjansson, A. L., & Sigfusdottir, I. D. (2014). *Ungt fólk 2014 – Grunnskólar. Menntun, menning, félags, íþrótta og tómstundastarf, heilsa, líðan og vímuefnaneysla unglinga í 8., 9. og 10. bekk á Íslandi.* Reykjavík: Rannsóknir og Greining. Mennta- og menningarmálaráðuneyti.

Sigfusdottir, I. D., Kristjansson, A. L., Gudmundsdottir, M. L., & Allegrante, J. P. (2011). Substance use prevention through school and community-based health promotion: A

transdisciplinary approach from Iceland. *Global Health Promotions, 18*(3), 23-26. doi:10.1177/1757975911412403

Sigfusdottir, I. D., Kristjansson, A. L., Thorlindsson, T., & Allegrante, J. P. (2008). Trends in prevalence of substance use among Icelandic adolescents, 1995–2006. *Substance Abuse Treatment, Prevention, and Policy*, *3*(1), 12. doi:10.1186/1747-597X-3-12

Sigfusdottir, I. D., Thorlindsson, T., Kristjansson, A. L., Roe, K. M., & Allegrante, J. P. (2008). Substance use prevention for adolescents: The Icelandic model. *Health Promotion International, 24*(1), 16-25. doi:10.1093/heapro/dan038

Wilens, T. E. (2004) Attention-deficit/hyperactivity disorder and the substance use disorders: The nature of the relationship, subtypes at risk, and treatment issues. *Psychiatric Clinics of North America, 27,* 283-301.

Wilens, T. E. (2006). Attention deficit hyperactivity disorder and substance use disorders. *The American Journal of Psychiatry, 163,* 2059-2063. doi:10.1176/ajp.2006.163.12.2059.

Zoëga, H., Furu, K., Halldorsson, M., Thomsen, P. H., Sourander, A., & Martikainen, J. E. (2011). Use of ADHD drugs in the Nordic countries: A population-based comparison study. *Acta Psychiatrica Scandinavica, 123*, 360–367. doi:10.1111/j.1600-0447.2010.01607.x