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AMELIORATION OF INATTENTIVE CHARACTERISTICS IN CHILDREN DIAGNOSED WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER BY FENCING TRAINING PROGRAMS

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ABSTRACT. Background: Recently influenced by studies on the impact of martial arts on ADHD the self-consciousness of the society prevailed and fencing started spreading its roots into the field of healing methods by making use of the skills important to a warrior, such as speed, strength, accuracy and courage. As a means for developing self-perception, of competence in various areas of ability and function, self-confidence, physical conditioning, and emotional balance, Martial Arts activity was previously found to be a method for ameliorating ADHD symptoms. We appreciate that fencing, as a combat type Physical Activity (PA), can be used for similar purposes. **Objectives**: The present article focuses mainly on the Inattentive aspect of ADHD. The aim of this study was to examine the influence of a fencing training program activated on Attention Deficit Hyperactivity Disorder (ADHD) diagnosed children. **Methods**: The study population of 40 children mean age 10, diagnosed with ADHD, was divided into two groups: one undergoing a fencing training program and the other a control group of about the same age and characteristics undergoing a physical training program. For evaluation, we used ADHD Rating Scale – IV: Home Version questionnaire at the beginning and at the end of the study. Data were processed statistically to evaluate reliability using Cronbach's Alpha. Overtime Inattentive Analysis, we performed 3 Way Anova using the factors time, gender and training and run for all questions followed by a Holm-Sidak Post Hoc test for interactions. **Results**: The performance evaluation disclose consistently positive greater total value for the fencing training program over the control group undergoing only PA training program by 11%. **Conclusions**: The fencing training program has greater total value on moderating ADHD Inattentive symptoms over the control group undergoing only PA training program.

Keywords: *ADHD, fencing, physical activity, inattention, children*

REZUMAT. ***Ameliorarea caracteristicilor lipsei de atenție la copiii diagnosticați cu tulburarea hiperkinetică cu deficit de atenție prin antrenamente de scrimă*****. Introducere.** Studii de dată recentă privitoare la impactul artelor marțiale asupra ADHD s-au impus în conştiinţa de sine a societății, iar scrima a început sa-si extindă influența în sfera metodelor de tratament, făcând uz de însușirile specifice războinicilor, ca viteza, forța, precizia şi curajul. Ca mijloc de dezvoltare a cunoaşterii de sine, a competenţei în diverse domenii de activitate şi funcţionare a

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încrederii în sine, condiției fizice și echilibrului emoțional, activitatea artelor marțiale s-a descoperit încă mai demult ca fiind metodă de ameliorare a simptomelor ADHD. Considerăm că scrima, ca activitate fizică de luptă (PA) poate fi folosită în scopuri similare. **Obiective:** Articolul de față se concentrează cu precădere asupra aspectelor lipsei de atenție la persoanele cu ADHD. Scopul acestui studiu a fost de a examina influența unui program de antrenament de scrimă conceput pentru copiii diagnosticați cu tulburarea hiperkinetică cu deficit de atenție (ADHD). **Metode**: Eșantionul de studiu, format din 40 de copii cu vârsta medie de 10 ani, diagnosticați cu ADHD a fost împărțit în două grupuri, dintre care unul a urmat un program de antrenament de scrimă, iar celălalt a constituit grupul de control, format din copii având aproximativ aceeași vârstă și aceleași caracteristici, care au urmat un program de antrenament fizic. Pentru evaluare am folosit ADHD Rating Scale – IV chestionare Home Version la începutul și la sfârșitul studiului. Datele au fost procesate statistic folosindu-se Cronbach's Alpha pentru evaluarea încrederii. Pentru analiza suplimentară a lipsei de atenție am efectuat 3 Way Anova folosind factorii timp, gen și antrenament, parcurgând toate cerințele, urmate de un test Holm-Sidak Post Hoc pentru interacționare. **Rezultate**: Evaluarea rezultatelor scoate în evidență o valoare pozitivă mult mai mare pentru grupul care a urmat programul de antrenament de scrimă, față de grupul de control, în procent de 11%. **Concluzii**: Programul de antrenament de scrimă a prezentat o valoare totală mai mare în diminuarea simptomelor lipsei de atenție ADHD prin comparație cu grupul de control care a efectuat numai antrenamente de activități fizice (PA).

Cuvinte-cheie: *ADHD, scrimă, activitate fizică, lipsa de atenție, copii*

Introduction

According to Diagnostic and Statistical Manual of Mental Disorders (DSM) 5 most widely used in USA "*ADHD is a neurodevelopmental disorder defined by impairing levels of inattention, disorganization, and/or hyperactivity-impulsivity. Inattention and disorganization entail inability to stay on task, seeming not to listen, and losing materials, at levels that are inconsistent with age or developmental level".* The term used by the International Classification of Mental and Behavioral Disorders 10th revision (ICD10)widely used in Europe is hyperkinetic disorder (HKD) and population surveys affirmed that ADHD occurs in most cultures in about 5%of children (about75,000 children in Israel) and about 2.5% of adults, being about 3 times more common in boys than in girls.

The concurrent validity of the DSM definition for ADHD subtypes was supported by Gaub and Carlson (1996).There are 3 subtypes of ADHD behaviors: the Inattentive type, the Hyperactive-impulsive type, and the combined type. The Inattentive type considered in this article refer to individuals expressing behavior more like daydreamers with their own cosy impeccable world, consistently drawn away by factors that seem more intriguing or interesting them. In order to maintain their interest or to keep them in the physical world it is needed to draw their attention from time to time.

The identification of ADHD is most often performed by pedagogic personnel during elementary school years, and inattention becomes more prominent and impairing, according to Faraone S. (1998) the inattentive type is about 3 times more persistent than the hyperactivity\impulsivity type.

Fencing is sport activity used with three different weapons: Foil (Floret), Sabre and Epee. Each one has a different set of rules and different body target areas. The bouts are conducted by referees according to the weapon rules with the assistance of electronic apparatus displaying the touch on the target area. Different from the past, nowadays boys and girls participate in all three weapons.

Recently influenced by studies on the impact of martial arts on ADHD the self-consciousness of the society prevailed and fencing started spreading its roots into the field of healing methods by making use of the skills important to a warrior, such as speed, strength, accuracy and courage as a means for developing self-perceptions, of competence in various areas of ability and function, self-confidence, physical conditioning, and emotional balance as mentioned by Johnson R. C. (2000).

Lately, Complementary and Alternative Medicine (CAM) therapies are becoming common treatments for ADHD, and research by Searight (2012) implies that stimulant pharmacotherapy is the evidence-based treatment of choice for ADHD. During the past years the relationship between PA and ADHD was deeply investigated from several aspects – Verret (2012) conducted over 10-week moderate to high-intensity PA program on fitness, cognitive functions, and ADHD-related behaviour in children concluded that structured PA program might have clinical relevance in the functional adaptation of children with ADHD and research by Rommel (2015). Matthew B. P. (2013) concluded that single bouts of 20 minutes moderately aerobic exercise might have positive implications in children with ADHD.

Choi (2014) investigated during a six-week methylphenidate treatment and exercise or methylphenidate treatment and education the hypothesis that aerobic exercise might be an effective adjunctive therapy for enhancing the effects of methylphenidate on the clinical symptoms, cognitive function, and brain activity and concluded that aerobic exercise increased the effectiveness of methylphenidate on clinical symptoms, perseverative errors, and brain activity.

Significant difference between fencers & swimmers in the Brixton Spatial Anticipation Test (BSAT) was found by Vetropoulos (2010) during investigation of visual memory task and spatial anticipation ask of 15 to 22 years old athletes concluding that fencers are superior in rule detection, comparing to swimmers. The fencer profile was characterize during a multiple anthropometric variables, Alberto Ochoa (2013) and broad research by Putukian M. (2011) on ADHD management in athletes mentioned of reports from children and teachers suggesting activity may mitigate inattentiveness that characterizes ADHD.

Research Objective

The main objective of this study was to evaluate the possible effect of a fencing training program on ADHD symptoms among elementary school age children.

Materials and Methods

The actual research is based on 9 months, 90-min twice a week experiment with study population of 40 children, all diagnosed with ADHD, mean age 10, divided into two groups: one group of 20 children undergoing fencing training program consisting of 10 boys and 10 girls and the second group is 20 children of control group undergoing a PA training program, consisting of 10 boys and 10 girls. Similar research was conducted by Kang K.D (2011) with 13 ADHD children having sport activity evaluated against a control group of 15 ADHD children undergoing education on behaviour control sessions during a 6-week, 90-min twice a week experiment.

The applied Intervention fencing program included three steps:

- Step one: basic fencing skills and general physical condition;
- Step two: tactical fencing skills and physical condition particular to fencing;
- Step three: competitive fencing skills.

First stage in the study was to obtain first assessments evaluation using the well-known ADHD Rating Scale – IV: Home Version questionnaire, DuPaul et al. (1994), McGoey, K. E. (2007), Goodman D. (2010), – Appendix A.

Dually used in the research and completed by the research cadre. The questionnaire was filled for each participant at the beginning of the study and once again at the end of the study after completing the fencing training program for the experiment group or the physical activity program of the control group.

The questionnaire evaluates three disorder parameters: inattention, hyperactivity-impulsivity and combined manifestation. The actual study will concentrate with the Inattentive parameter. For data interpretation, we processed statistically to evaluate reliability using Cronbach's Alpha. Overtime Inattentive Analysis, we performed three Way Anova using the factors time, gender and training and run for all questions followed by a Holm-Sidak Post Hoc test for interactions.

Results and Discussion

The results enlisted in the following tables and figures comply with the inattentive characteristic of ADHD as reflected from the odd questions of ADHD RS IV questionnaire.

Table 1. Inattention characteristic summary

Group	Test	ADHD RS IV Question									
		Q1	**Q3**	**Q5**	**Q7**	**Q9**	**Q11**	**Q13**	**Q15**	**Q17**	**Total**
Fencing	Preliminary	47	42	35	43	23	38	36	55	16	347
	Final	23	12	10	18	22	13	22	24	10	154
Control	Preliminary	49	42	38	38	27	41	36	40	24	335
	Final	36	37	31	32	26	38	33	27	23	283

From the data on Table 1 it can be seen that the preliminary values at the beginning of the research of both fencing and control groups are high and nearly identical (347, 335) indicating of homogeneity between the groups. The final results at the end of the research of both fencing and control groups are lower than the initial values indicating of decisive improvement of both fencing and control activities. Among fencing and control groups at the final stage, the difference is distinctively lower for the fencing group (154) than for the control group (283) indicating a better improvement of the fencing program over the physical activity control program.

Table 2. Inattention characteristic data of ADHD as reflected by the questionnaire

Group	Gender	Test	ADHD RS IV Question									
			Q1	**Q3**	**Q5**	**Q7**	**Q9**	**Q11**	**Q13**	**Q15**	**Q17**	**Total**
Fencing	Girls	Preliminary	24	22	20	21	13	24	14	29	8	175
		Final	11	5	5	12	10	9	10	12	5	79
	Boys	Preliminary	23	20	15	22	22	14	22	26	8	172
		Final	12	7	5	6	12	4	12	12	5	75
Control	Girls	Preliminary	24	21	19	20	9	23	17	20	8	161
		Final	19	18	16	19	9	22	16	13	7	139
	Boys	Preliminary	25	21	19	18	18	18	19	20	16	174
		Final	17	19	15	13	17	16	17	14	16	144

Table 2. reflects the Inattentive data for all subjects regarding ADHD RS IV questionnaire. The research population is divided into two group characteristics – Fencing and Control – and each group is observed by gender at two stages of the research – Preliminary and Final. With the exception of two samples that indicate of no behavioural change – Q9: "Has difficulty organizing tasks and activities", for control girls (9, 9) and Q17: "Is forgetful in daily" for control boys (16, 16) – all data indicate lower values at final stage relative to preliminary stage indicating of greater positive difference. The greatest change of 17 points between preliminary to final stage is achieved by the fencing girls group at two parameters reflected by questions: Q3 (22, 5) "Has difficulty sustaining attention in tasks or play activities", and Q15 (29, 12): "Is easily distracted". Following after is Q7 on fencing boys group with a difference of 16 points (22, 6).

Among the fencing group there is no consistency between the genders regarding the change between preliminary to final stage and the data indicates greater difference for the boys group only at questions: Q3 "Has difficulty sustaining attention in tasks or play activities", Q9 "Has difficulty organizing tasks and activities", and Q13: "Looses things necessary for task or activities" and lower or equal at all other questions.

Among the control group there is either no consistency between the genders regarding the change between preliminary to final stage and the data indicates greater difference for the boys group only at questions Q3: "Has difficulty sustaining attention in tasks or play activities", Q15: "Is easily distracted" and Q17: "Is forgetful in daily" and lower or equal at all other questions.

The results of the fencing group relative to the control group vividly indicate greater difference of the fencing group at all questions regardless gender.

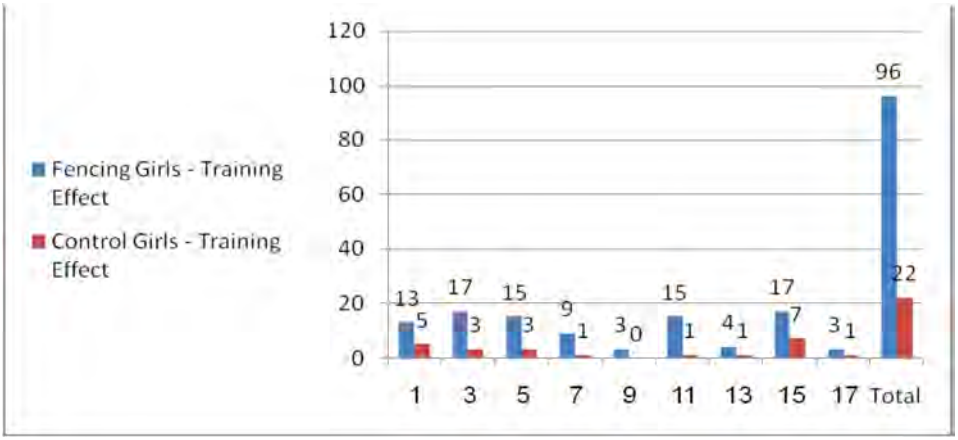

Fig. 1. Training effect on the subjects' girls

Fig. no. 1 represents the girl's gender training effect of the program as resulting from Table 2 namely the difference between ADHD RS IV question values at the preliminary stage to the value at the final stage of the research. The evaluation of girl's gender is accomplished between the fencing group undergoing the fencing training program to the control group undergoing PA program. It is vividly seen from the data that the total value of the Fencing group (96) is much greater than of the control group (22).

Questions no.9: "Has difficulty organizing tasks and activities", Q13: "Looses things necessary for task or activities" and Q17: "Is forgetful in daily" indicate insignificant changes on the fencing group while questions Q7:" Does not follow through instructions and fails to finish work", Q9: "Has difficulty organizing tasks and activities", Q11: "Avoids tasks (e.g. schoolwork, homework) that require sustained mental effort", Q13: "Looses things necessary for task or activities" and Q17: "Is forgetful in daily", indicate insignificant changes on the control group.

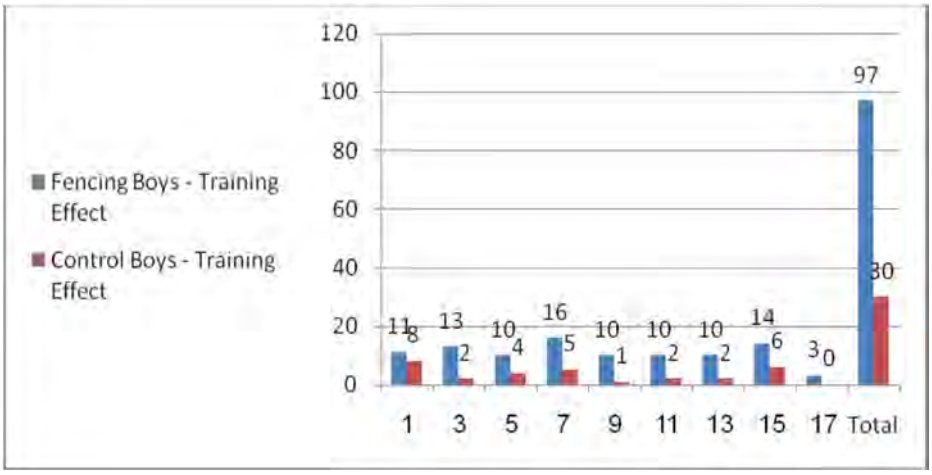

Fig. 2. Training effect on the subjects' boys

Fig no. 2 represents the boy's gender training effect of the program as resulting from Table 2 namely the difference between ADHD RS IV question values at the preliminary stage to the value at the final stage of the research. The evaluation of boy's gender is accomplished between the fencing group undergoing the fencing training program to the control group undergoing PA program. As in the previous Fig no 1 of girl's gender training effect, it is vividly seen from the data that the total value of the Fencing group is much greater than of the control group and actually in all questions the superiority of fencing group persist.

Q17: "Is forgetful in daily", indicate insignificant changes on fencing group while questions Q3: "Has difficulty sustaining attention in tasks or play activities", Q9: "Has difficulty organizing tasks and activities", Q11: "Avoids tasks (e.g. schoolwork, homework) that require sustained mental effort", Q13: "Looses things necessary for task or activities" and Q17: "Is forgetful in daily", indicate insignificant changes on control group.

Table 3. ANOVA 3-way analysis

Source of Variation	DF	SS	MS	F	p
Time	1	750.313	750.313	98.924	< 0.001
Intervention	1	171.112	171.112	22.560	< 0.001
Gender	1	1.512	1.512	0.199	0.657
Time x Intervention	1	248.513	248.513	32.765	< 0.001
Time x Gender	1	1.013	1.013	0.133	0.716
Intervention x Gender	1	7.813	7.813	1.030	0.314
Time x Intervention x Gender	1	0.612	0.612	0.080	0.777
Residual	72	546.100	7.585		
Total	79	1726.987	21.861		

Table 3 is ANOVA 3 Way analysis for the total data whereas the Normality Test (Shapiro-Wilk) passed (p=0.236>0.050) indicating the data came from a normally distributed population.

The main effects for Time and Intervention cannot be properly interpreted since the size of the factor's effect depends upon the level of another factor. The difference in the mean values among the different levels of Gender are not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Time and Intervention. There is not a statistically significant difference (p = 0.657).

The effect of different levels of Time depends on what level of Intervention is present. There is a statistically significant interaction between Time and Intervention (p<0.001). The effect of different levels of Time does not depend on what level of Gender is present. There is not a statistically significant interaction between Time and Gender (p = 0.716). The effect of different levels of Intervention does not depend on what level of Gender is present. There is not a statistically significant interaction between Intervention and Gender. (P = 0.314)

For Overtime Inattentive Analysis, we performed 3 Way Anova using the factors time, gender and training and run for each question individually followed by a Holm-Sidak Post Hoc test for interactions. The results describes below:

- Q1: *"Fails to give close attention to details or makes careless mistakes in schoolwork"* (e.g., overlooks or misses details, work is inaccurate). There is a significant difference between the 2 time point (p<0.001). There is also a difference between the control and the fencing group (p=0.013) and this is independently of the gender (p=0.865). But it doesn't appear related as the effect of the training does not have a significant effect over time (p=0.065).

- Q3: *"Has difficulty sustaining attention in tasks or play activities"* (e.g., has difficulty remaining focused during lectures, conversations, or lengthy reading). There is significant difference overtime (p<0.001) and this is due to the Training Regimen (p<0.001) independently of the gender (p=0.879). Furthermore, there is no difference between group at the initial time point (p=1.000) but the Fencing Group is different from its initial value (p<0.001) and from the Control Group at the final time point (p<0.001).

- Q5: *"Does not seem to listen when spoken to directly"* (e.g., mind seems elsewhere, even in the absence of any obvious distraction). There is significant difference overtime (p<0.001) and this is due to the Training Regimen (p=0.021) independently of the gender (p=0.601). Furthermore, there is no difference between group at the initial time point (p=1.000) but the Fencing Group is different from its initial value (p<0.001) and from the Control Group at the final time point (p<0.001).

- Q7: *"Does not follow through instructions and fails to finish work"* (e.g., starts tasks but quickly loses focus and is easily sidetracked). There is significant difference overtime ($p<0.001$) and this is due to the Training Regimen ($p=0.006$), independently of the gender ($p=0.058$). Furthermore, there is no difference between group at the initial time point ($p=0.299$) but the Fencing Group is different from the Control Group at the final time point ($p=0.005$).

- Q9: *"Has difficulty organizing tasks and activities"* (e.g., difficulty managing sequential tasks; difficulty keeping materials and belongings in order; messy, disorganized work; has poor time management; fails to meet deadlines). There is no time effect ($p=0.061$) or group effect ($p=0.589$) but there is a difference between Boys and Girls ($p<0.001$) independently of the time ($p=0.281$) and the Training ($p=0.418$)

- Q11: *"Avoids tasks that require sustained mental effort"* (e.g. schoolwork or homework; for older adolescents and adults, preparing reports, completing forms, reviewing lengthy papers). There is a difference between initial and final time point ($p<0.001$) and it depends on the training factor ($p=0.009$). While there was no difference between the groups at initial time point ($p=0.604$), there was one at the final time point ($p<0.001$). A difference between the girls and the boys is also present ($p=0.002$) but independently of the time or the training ($p=0.625$ for both).

- Q13: *"Looses things necessary for task or activities"* (e.g., school materials, pencils, books, tools, wallets, keys, paperwork, eyeglasses, mobile telephones). A time difference exists ($p=0.012$) but it is independent of the groups ($p=0.099$) and the gender ($p=0.052$).

- Q15: *"Is easily distracted"* (e.g., for older adolescents and adults may include unrelated thoughts). There is significant difference overtime ($p<0.001$) and this is due to the Training Regimen ($p=0.001$), independently of the gender ($p=0.450$). While there was no difference between the Boys and the Girls ($p=0.705$), the groups were different at the initial time point ($p<0.001$) but not at the final time point ($p=0.423$). Both Groups also were found different from their initial value ($p<0.001$).

- Q17: *"Is forgetful in daily activities"* (e.g., doing chores, running errands; for older adolescents and adults, returning calls, paying bills, keeping appointments). No time effect was found ($p=0.235$). The differences observed between the groups ($p<0.001$) is related to the gender ($p=0.005$) and while the boys and the girls were not different within the Fencing group ($p=1.000$) a difference was found within the Control group ($p<0.001$).

Conclusions

Supporting evidence that exercise may have positive effects on children with ADHD as found by Berwid O. G. (2012) is consolidated. From the results it can be evidently seen that both fencing and PA training of the control group contribute to ameliorating IA symptoms of ADHD by decisive lowering the value data of the subjects being tested during the elapsed time between the beginning to the end period of the program, however it is not vividly seen which one of the programs has greater benefit. The answer to the latest showing a much lower value at the final stage for the fencing group (154) than for the control group (283).

In order to conceive an undoubted decision regarding the contribution of a fencing training program on all aspects of ADHD symptoms it is required to investigate also the influence on the hyperactivity-impulsivity factors of ADHD.

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