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**The influence of a fencing training  
program on youth population diagnosed  
with ADHD  
(SUMMARY)**

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### List of Abbreviations

<b>ADHD</b>	-	Attention Deficit Hyperactivity Disorder
<b>ADHD RS IV</b>		ADHD Rating Scale 4 evaluation questionnaire
<b>APA</b>	-	American Psychological Association
<b>BMI</b>	-	Body Mass Index = weight (kg)/height <sup>2</sup> (m <sup>2</sup> )
<b>DF</b>	-	Degrees of Freedom
<b>DSM IV</b>	-	Diagnostic and Statistical Manual of Mental Disorders
<b>DQ</b>	-	Developmental Quotient = (maturity age /chronological age)*100
<b>F</b>	-	Ratio of two sample Variances
<b>FIE</b>	-	Fédération Internationale d'Escrime
<b>ICD 10</b>	-	International Statistical Classification of Diseases and Related Health Problems
<b>HKD</b>	-	Hyperkinetic Disorder (former terminology for ADHD)
<b>LSQ</b>	-	Learning Style Questionnaire
<b>MBTI</b>	-	Myers-Briggs Type Indicator
<b>MI</b>	-	Multiple Intelligences
<b>MS</b>	-	Mean of Squares
<b>NLP</b>	-	Neuro-Linguistic-Programming



<b>OG</b>	-	Olympic Games
<b>P</b>	-	Formal Test of Significance
<b>PA</b>	-	Physical Activity
<b>PE</b>	-	Physical Education
<b>RBC</b>	-	Red Blood Cell
<b>RM</b>	-	Repetition Maximum (in weight training is the maximum amount of force that can be generated in defined maximal contraction)
<b>SS</b>	-	Sum of Squares
<b>TSC</b>	-	Tuberous Sclerosis Complex
<b>VAK</b>	-	Visual, Auditory and Kinesthetic
<b>VARK</b>	-	Visual, Auditory, Reading and Kinesthetic
<b>WHO</b>	-	World Health Organization

## Introduction

According to Diagnostic and Statistical Manual of Mental Disorders 5 (DSM 5) most widely used in USA "ADHD is a neurodevelopmental disorder defined by impairing levels of inattention, disorganization, and/or hyperactivity-impulsivity.". The term used by the International Classification of Mental and Behavioral Disorders 10<sup>th</sup> revision (ICD10) widely used in Europe is hyperkinetic disorder (HKD). Common population surveys affirmed that ADHD occurs in most cultures in about 5% of children and about 2.5% of adults, being about 3 times more common in boys than in girls.

Our personal knowledge and experience with ADHD children extend for more than a quarter of century as physical education teacher of special education children. During numerous observations throughout the years and based on academic researchers in the field we recognized the connection between Physical Activity (PA) and ameliorating ADHD symptoms. At this time, we tried to enroll other field of my expertise – fencing as an Olympic athlete and as a trainer.

Fencing is a combat type PA involving along the obvious physical skills also mental skills and behavioral restrains derived from the need to obey game rules. Physical demands required of athlete organism are affected by the speed, endurance, orientation, fast decision, timing etc.

The reasons for choosing this topic emanated from the will to combine our lifework in the fields – physical education, sport, ADHD and fencing – seeking whether the benefits of fencing can be extracted in favor of the special children that their voice is hush, that the story of their life lies in the hands of us, hoping to write a better chapter that will change the course of their life.

**Research Rational:** Numerous researches over various age groups at different intensities during long and short-term programs have shown that PA has positive effects on ameliorating different aspects of ADHD symptoms such as memory, spatial perception, executive functions self-perception and attention. Few researches were conducted also on the benefit of more complex forms of PA like Martial Arts finding high correlation between the activities to the outcome. Fencing being also a form of Martial Art activity is expected to be a positive factor in ameliorating ADHD symptoms.

**Gap in knowledge:** Although there are few researches correlating between Martial Arts to ADHD, there is almost no knowledge relating to fencing. This research focuses on the possible benefit of fencing training program on ameliorating ADHD symptoms.

**Research Objectives:** The goal of the proposed research is to emanate an effective fencing training program proven to be effective in ameliorating ADHD symptoms to the group age under research and hopefully the program will be adopted by learning institutions like the Israeli Ministry of Education.

**Research hypothesis:** Related research by Gapin, J. I., Labban, J. D., Etnier, J. L. (2011) shows that PA has positive effects on moderating ADHD symptoms, and evidence that exercise may have positive effects on children with ADHD was found by Berwid, O. G. (2012). Also, perfectly normal children benefit from PA as reported by Erin K.H (2012), emphasizing on academic achievements.

As sport activity, fencing is regarded as a way for developing self-perceptions, of competence in several areas of ability and function, physical conditioning, self-confidence, and emotional balance. Fencing is a sport activity related to combat skills requiring full attention to the adversary thus improving the attention competence of children. Fencing activity being subject to codes of discipline requires the ability to master the hyperactivity and impulsivity levels of children.

Therefore, three hypotheses may be concluded:

1. Fencing is a sport activity related to combat skills requiring full attention to the adversary herein it is to assume that fencing program will improve the attention competence of children diagnosed as having ADHD disorder.

2. Fencing activity being subject to codes of discipline requiring the ability to master self-restrain, it is to assume that fencing program will attenuate the hyperactivity and impulsivity levels of children diagnosed as having ADHD disorder through fencing training program.

3. Fencing being a sport activity that requires mental abilities and self-control more than general PA it is to assume that Fencing program will have extra value over general PE program in improving attention levels of children diagnosed as having ADHD disorder.

**The importance of this research:** Childhood is the most important period in our development as human beings and the social cognitive skills acquired in this period will affect all adulthood period; therefore, it is very important to provide all possible means to minimize the gaps in the population and help those with a certain degree of ADHD to mingle in the society and give them a fair chance to normal life.

**Research design:** first step was to evaluate the research tools chosen – RS4 Questionnaire and Eurofit Fitness Test Battery.

Tools evaluation was accomplished by a Pilot test. The research population was  $n=8$  elementary 4th grade pupils, diagnosed with ADHD divided randomly into two groups  $n=4$  each: fencing group (2 boys and 2 girls) undergoing a fencing intervention program and control group (2 boys and 2 girls) undergoing PA intervention program. The time period of the pilot test was accelerated to one month, 90 – min twice a week experiment. The fencing experimental groups applied fencing intervention program while the control groups applied PA intervention program. The data was evaluated using SigmaPlot and IBM SSPS software and found to coherent.

The next step was running the actual research. The research population was  $n=40$  elementary 4th grade students divided into two groups (20 fencing training experimental group: 10 girls and 10 boys; 20 physical training control group 10 girls and 10 boys) all diagnosed as ADHD. The research took place after-school activity program in Misgav elementary school and fencing clubs in Akko city, Maalot city and Kiryat Ata.

The study group underwent a twice a week fencing training program, 90 minutes each, the control group received physical education lessons by the same amount of time and sessions as the study group but emphasized on general physical fitness. The time limit of the research training program was ten months.

The research tools previously confirmed – RS4 Questionnaire and Eurofit Fitness Test Battery – were evaluated at the beginning and at the end of the research using SigmaPlot and IBM SSPS software.

**Results:** Inattention characteristics were evaluated using RS4 questionnaire. At the end of the research, both fencing and control groups achieved lower values than at the beginning, indicating of decisive improvement of both fencing and control activities while fencing activity achieved distinctively lower value (154) than the control group (283) indicating the superiority of fencing program over the PA control program. Hyperactivity Impulsivity characteristics were also evaluated using RS4 questionnaire. At the end of the research, both fencing and control groups achieved lower values than at the beginning, indicating of decisive improvement of both fencing and control activities while the internal difference between the fencing (158) to the control (151) is nearly null and can't decisively indicate about a preferred activity.

The physical performance was evaluated using the Eurofit Fitness Test Battery and except the controversial *Flamingo Balance* test that can-not be quantitatively analyzed and

the *Arm bent* test which is definitely not one of the necessary fencing requirements, all other test show distinct superiority of fencing program over PA program.

**Conclusions:** Based on this research's results, it is to establish that the specific fencing training program can assist in ameliorating ADHD symptoms: *Attention; Concentration* and the *Interaction* among them and channel the *hyperactivity\impulsivity*, at the same time the subjects will gain an extra physical condition value.

## Part I – Literature Review

### Chapter 1 – Characterization of children aged 10-12 years

#### 1.1 Developmental Age Characteristics of children 10 to 12 years

##### 1.1.1 General

Developmental age will indicate where a child is socially, emotionally, physically, and intellectually on this path of development, as compared to typical behaviors and characteristics of that age. It is important to be aware that faster is not necessarily “better” and slower is not bad. The simple fact is that children develop at different rates. Each child is unique, bringing his own individual differences to the growth process. Developmental Quotient ( $DQ = (\text{maturity age} / \text{chronological age}) * 100$ ) should be assigned to each of the four major developmental fields as proposed by Watson, Ernest H. (1958) – motor, adaptive, language and social.

##### 1.1.2 Somatic

Body Mass Index ( $BMI = \text{weight (kg)} / \text{height}^2$ ) is a useful tool to approximate a healthy body weight based on height.

##### 1.1.3 Motoric

Based on Harvey W. J. (2007) and Pitcher T. M. (2003) motor development refers to changes in children’s ability to control their body’s movements. Motor Skills can be divided into two categories: first are the basic skills necessary for everyday life and secondly, the recreational skills such as skills for employment or certain specialties based on interest.

##### 1.1.4 Physiological

The physiological aspects of growth and development as detailed by Malina Robert M. et al (2004) are crucial in matching the proper activity to the subject and assist in identifying the potential benefits as long the potential hazards than can outcome from the activity. Physical training has a key role in increasing cardiovascular fitness, stronger muscles and bones as well as decreasing cardiovascular disease risks and obesity.

##### 1.1.5 Psychological

Piaget's Theory and Operational Thought as described by Inhelder B., Piaget J. (1958) believes that preschool children are preoperational thinking. Preoperational thinking involves the formation of concepts that remain, mental reasoning and the formation of supernatural belief systems. Thinking during the preschool years is not yet perfect and not well organized.

Operational concrete thinking appears usually only after the age of 7 years. In general, the definition of critical thinking is to understand the deeper meaning of the problem. Creativity development is ability to think of something new ways and unusual and gave birth to a unique solution to the problems. Cognitive developmental uses logical thinking but with a very limited ability to extend logic to abstract.

## **Chapter 2 – Theoretical Background of Attention Deficit Hyperactivity Disorder**

### **2.1 Attention Deficit Hyperactivity Disorder**

According DSM 5 denotes that conservative ranges of ADHD exist in 3 to 7% of the population. ADHD is more commonly diagnosed in boys than girls as girls are being diagnosed at latter ages due to their lack of aggressive and disruptive behavior. DSM5 identifies three subtypes of ADHD which are characterized by specific behaviors. The subtypes include (a) inattentive type; (b) hyperactive-impulsive type, and (c) combined type. An expansive comparison of the subtypes was given by Chhabildas N. et. al (2001).

### **2.2 Main Attention Deficit Hyperactivity Disorder Theories**

The common used definition of ADHD evolved from the theories developed throughout the years, some even challenge the question about the true nature of the disorder.

#### **Evolutional - Hunter vs. Farmer**

The hypothesis proposed by Thom Hartmann in his book *Attention Deficit Disorder - A Different Perception*, notes that most or all humans were for hundreds of thousands of years nomadic hunter-gatherers, but that this standard gradually changed as agriculture developed, and more people worldwide became farmers. Over many years, most humans adapted to farming cultures, but people whom retained some of the older hunter characteristics found themselves in a minority group diagnosed with ADHD.

#### **Left Brain/Right Brain Theory**

As explained by Ami L. K. and Castellanos F. X. (2006) the two brain hemispheres communicate information to each other.

The left hemisphere is analytical, cognitive, linear, concrete, detail-oriented, practical, organized, structured and firmly based in reality. It manages numbers, language, math, science and facts. It is in responsible for logical functions and precise mathematical calculations

The right hemisphere is exactly the opposite. It is intuitive, non-linear and creative and it presents possibilities by using feelings, symbols and images as a means to interpret the world. Hence, the right hemisphere is the playground of philosophy, fantasy and imagination.

Practically everyone has one side dominant of the brain that ~~is as~~ can be seen from MRI scans (Seidman L. J. et al 2005); people with ADHD tend to have right hemisphere dominance.

#### **Neurodiversity Theory**

The theory described by Armstrong, T. (2010) frames ADHD as a natural human variation that has the legitimate right to preserve rather than being forced to adopt uncritically accepted ideas of normalcy. ADHD is no more than a diverse neurological condition that appears as an outcome of normal modifications in the human genome.

#### **Social Construct Theory**

The theory argues that ADHD is not necessarily an actual pathology, but a social constructed explanation to describe behaviors that simply do not meet prescribed social norms.

### **Neurological Theory**

The theory is based on the original assumption that ADHD is a disorder. This interpretation is based almost exclusively on the unproven assumption that the patterns seen in the brain are the cause of the attention deficit as reviewed by Riccio C. A. et al (1993) and Ballard S. et al (1997).

### **Dopamine Theory**

Though the connection between ADHD to Dopamine was long time discussed by many others Madras B. K. et. al (2002), Madras B. K. et. al (2005), Li D. et. al (2006), the origins of the theory were formulated upon a study by US researchers at the Brookhaven National Laboratory, published by Volkow et. al (2009). This theory was formed as a result of drug use as cocaine and amphetamines, which caused an increase in dopamine levels in the reward pathway of the brain.

### **Gene Theory**

ADHD often is described as genetic neurological disorder.

### **Environmental Factors Theory**

The theory is most likely related to the Chaos theory and Butterfly Effect. According to this theory many environmental factors can be responsible for ADHD like symptoms.

### **Creativity Theory**

Creative thinking is the ability by which one perceives something new and original which other miss. The theory, supported by some researches in the field like Pontifex, M. B., et. al (2013) sees in ADHD a true gift. Most children categorized by the society as ADHD actually don't have attention problems, on the contrary their attention to stimulating activity that gain their interest is intense at hyper-focus level.

## **2.3 Interventions for Attention Deficit Hyperactivity Disorder**

The use of drugs became in a way the easiest method preferred to be administered because of the fast outcome however their influence fades within few hours and leave many unwanted side effects, therefore alternative methods of treatment are constantly being seek out.

### **Psychological Intervention**

The psychological treatment requires on going attention on regular basis. Moreover, since classrooms and any other normal environment are homogenous it is very hard for the tutor in charge to apply individual attitude to every group member.

### **Educational Intervention**

The task is to identify the learning style the subject respond to best, and build the learning task accordingly. Actually in a classroom of 30 and more children, to remember constantly what is the preferred learning style for each one and duplicate each task as the number of requested learning styles is an impossible mission.

### **Behavioral Intervention**

Behavioral therapy is a structured discipline strategy based on rewards and consequences that aim to teach children preferred ways of behaving. It is action based recognizing the behavior itself as the problem, and the goal is to teach children new behaviors to minimize or eliminate the issue.

### **Neuro-therapy Interventions**

Is a relatively new habilitative approach treatment of ADHD developed by, Barabasz M., Barabasz A. (2000). The goal is to achieve permanent normalization without dependence on drugs or continuous behavioral management therapy. Limitations of neuro-therapy include large number of sessions - up to 80 throughout 6 to 8 months.

### **Massage Therapy Interventions**

There are several studies conducted both on children and adults that support the benefit of massage therapy, the ability to cope in stressful situations, more restful sleep and an improvement in social functioning as well in focusing at school and doing homework – Field T. M. (1998), Maddigan B. et. al (2003).

### **Physical Activity Interventions**

Improvement in behavior and cognitive functions in children with ADHD were reported by Verret C. et. al (2012) following a ten-week training program in school at moderate to high-intensity, and a broad list of other researches confirmed the findings.

## **Chapter 3 – Physical activity and sport in children aged 10-12 years**

### **3.1 Physical Activity**

Sport differentiates humankind from other species by the simple fact that while animals are driven by instincts and necessities, humans have also rational governing their actions. While a person can decide to jog for 15 minutes in order to increase his physical condition or to lose fat, there is no fish in the pond that wakes up one morning and decides to cross the ocean just for fun or to break a record.

#### **Benefits of Sport**

Physical exercise is good for mind, body and spirit as reported by various works like Neely K. C. (2014). Sports require memorization, repetition and learning - skillsets that are directly relevant to classwork. Sports will improve fitness and weight goals, they also support healthy decisions such as not drinking or smoking .

#### **Physical effects of Sport**

Physical activity cuts the risk of developing heart disease. It also significantly lowers the risk of dying from Cardio Vascular Disease and stroke Haskell, W. L. et. al (2007). Physical activity can help to prevent about one-third of cancer cases Michaud, D. S. et. al (2001). Higher levels of physical activity earlier in life may reduce risk for Alzheimer Disease in later life (Pope, et. al 2003).

#### **Social Effects of Sport**

According to WHO and Pate, R. R. et. al, (2000) there is clear evidence that youths taking part in competitive sports programs have more chances to be of lower weight, eat more healthily, be less likely to smoke cigarettes, or engage in sexual activity.

#### **Psychological Effects of Sport**

Body mass and appearance along with sport achievements contribute to enhance personal resilience and esteem. Self-esteem rising by promoting the feelings of accomplishment followed by sport activity was recorded by Chen, W. I. et. al (2012). Engaging in sports activity can promote stress relief and help relieve stress-related illnesses such as anxiety and insomnia.

### **3.2 Fencing**

Fencing is like the fire itself – unleashed it is fatal, control it and you may benefit from a warm supper. Then as the wind carries the fire to distance and spreading it, so fencing spread to armies becoming lethal, spilling blood throughout the world in endless battles creating a new way of life by code of honor “live by the sword – die by the sword”.

Modern fencing as practiced today is an organized sport involving three different weapons: Foil (Floret); Sabre and Epee. Each brand has a different set of rules and different body target areas using the weapon for attack and defense according to set movements and rules.

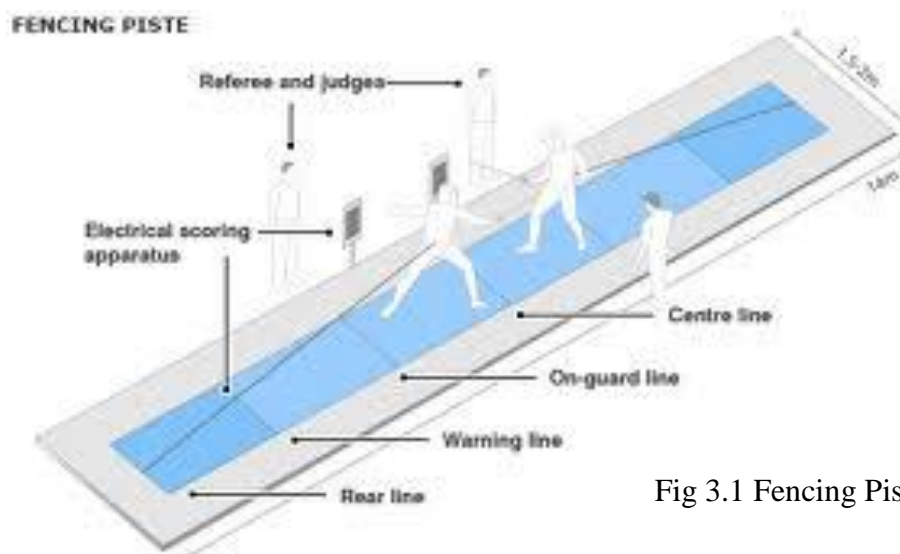


Fig 3.1 Fencing Piste

An overview of fencing piste as reflected on Fig.3.1 taken from the BBC site. The weapons and rules of modern fencing developed from combat weapons. As of today, boys and girls participate in all three weapons; fencers wear a full face mask, a protective jacket that also covers the neck, and a glove to protect the fencing hand.

#### **Benefits of Fencing**

Fencing is a sport discipline requiring participation of the complex athlete organism affected by the speed, endurance, orientation, fast decision, timing etc. The activity puts to test the strong will of the child as long his creativity, imagination, coping with stress situation of the competition, frustration, social skills and cognitive thinking. Fencing activity being subject to codes of discipline requires the ability to master and attenuate hyperactivity and impulsivity levels.

Study by Evangelos Vetropoulos et. al (2010) concluded that fencers are superior in rule detection, comparing to swimmers thanks to training fencing program.

### **Chapter 4 – Main Learning Styles Models**

#### **4.1 Overview**

There are several theories suggesting systematic differences in individuals' natural or habitual motif of acquiring and processing information in learning situations. Learning style as defined by Loo R. (2002) is “the consistent way in which a learner responds to or interacts with stimuli in the learning context” and Coffield, Moseley, Hall and Ecclestone (2004) identified 71 learning styles models, 13 of them were regarded as major contributions.

#### **4.2 Honey-Mumford Method**

There are four learning styles, although they are not fixed traits that an individual will always display but more like a tendency that may differ in different context. The learning styles are:

**Activist** – will prefer to learn by doing rather by reading or listening.

**Reflectors** – will stand back and observe, collecting as much information as possible before making any decision, being slow to make up their mind.



**Theorists** – have tidy and well-organized minds taking a logical one-step-at-a-time approach in problem solving, being uncomfortable with anything subjective or ambiguous.

**Pragmatist** – look for the practical implication of any new idea or theory before making a judgment on their value from the stand point that if something works, all is well but if it doesn't work there is no point in spending time on the analysis of its failure.

#### 4.3 VAK\VARK Method

The model is concerned with how we communicate and how this affects our learning. The model yield over the years three particular learning styles – visual, auditory and kinesthetic (VAK) that were concluded in Kim M. Jeral's (2010) work.

#### 4.4 Myers-Briggs Type Indicator (MBTI) Method

The system was largely covered by Murray, J. B. (1990), Carlyn, M. (1977) and Denham Thomas (2002) as a means of establishing individual's personality profile based on Jung's theory of types. According to the model, learners' characteristics are:

**Extrovert** learners – work in groups; try something first and think about it later.

**Introvert** learners – study alone; think about something first and try it later; make observations on their surroundings and yield best results when they can find a quiet place and have enough time to express, redraft and improve their work.

**Sensing** learners – desire clear goals; pay attention to details; taking one step at a time; have a good memory for facts.

**Intuitive** learners – apply to ADHD inattentive type characteristic. Highly use their imagination; looking at the overall picture without getting down to details; prefer jumping on to new projects than finishing existing ones.

**Thinking** learners – need clear and logical directions; use clear thinking to solve-out problems; perform best when they are stressed with time.

**Feeling** learners – need warm and supportive environment; they are emotional and the learning capabilities depend on social interactivity with the surroundings.

**Judging** learners – are the antagonists of intuitive learners. They have to get a defined plan; finish their task before jumping on to another; perform best on short term goals when they are able to make a plan of action.

**Perceiving** learners – have some common traits with feeling learners. They perform best if work is fun; open minded to different experiences, and opposite to judging learners they prefer long term goals or even better without any time limit.

#### 4.5 Kolb Method

Kolb's 1984 was reviewed by Manolis C. et. al (2013), and criticized by several researchers like Bergsteiner, H. et al (2010), Garner I. (2000) and Metallidou, P., and Maria P. (2008). The model determines four general learning types as described in Fig. 4.1.

**Diverger** type – are imaginative and sensitive and

prefer to learn by observations, brainstorming and gathering information.

**Assimilator** type – put information in concise logical order using reflective observations and responds well to information presented in organized way.

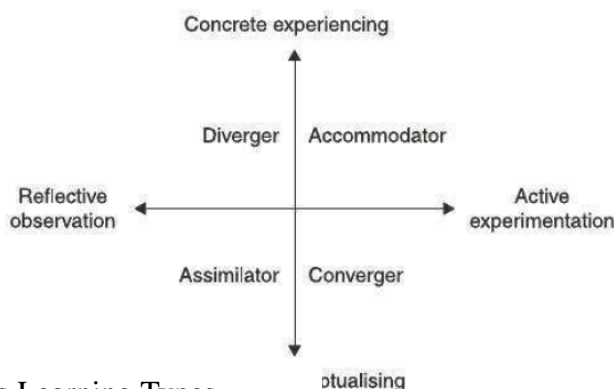


Fig. 4.1 Kolb's Learning Types

**Converger type** – similar to VAK kinesthetic learners, they prefer to learn by solving problems and doing technical tasks, finding practical uses for their ideas. They learn by trial and error in an environment that allows them the commodity of fail safe.

**Accommodator type** – similar to MBTI perceiving learners, they rely on feelings rather than logic and respond well applying new material in problem solving situations.

#### **4.6 Gardner & Hatch's Method**

According to Gardner & Hatch's Theory of Multiple Intelligences (MI) 1989 that was validated by Bordelon, D. E., Banbury M. M. (2005), each human being is able to perform according to seven relatively independent forms of information processing.

## **Part II –Pilot Research**

### **Chapter 5 –Evaluation of children with Attention Deficit Hyperactivity Disorder using Rating-Scale IV and test batteries Eurofit**

#### **5.1 Methods and Tools**

The research population was n=8 elementary 4<sup>th</sup> grade pupils, diagnosed with ADHD divided randomly into two groups n=4 each: fencing group (2 boys and 2 girls) undergoing a fencing intervention program and control group (2 boys and 2 girls) undergoing PE intervention program. The time period of the pilot test was accelerated to one month, 90 – min twice a week experiment. The fencing experimental groups applied fencing intervention program while the control groups applied PA intervention program.

The tools used in the research were: **Eurofit Physical Fitness Test Battery** and **ADHD RS IV questionnaire**.

**The Eurofit Physical Fitness Test Battery** was an inductive for the contribution of a fencing training program on ADHD diagnosed children physical fitness.

The questionnaires were filled out by the teachers twice. The first time before the start of the intervention program pilot and the second time applied at the end of the experiment. The same was performed with the **Eurofit Physical Fitness Test Battery**.

Since it is difficult to analysis variance when the population of each group is n=2, the T-test (used to determine if two sets of data are significantly different from each other) for each factor was run using either Fencing Vs Control or Boys vs Girl as it allowed to increase the n to 4.

#### **5.2 Evaluation of Questionnaire Results**

The data were run Two Way ANOVA with the variables Group and Time

- Group – Fencing Girls, Fencing Boys, Control Girls, Control Boys
- Time – Preliminary (at the beginning of the research), Final (at the end of the research)

The statistical parameters analyzed are: Degrees of Freedom (DF); Sum of Squares (SS) known also as Variation; Mean of the Squares (MS) known also as Variance; Test Statistics (F) and P value.

**Table 5.1.**

Mean and standard deviation of the answers to ADHD RS IV Questionnaire

Question number	Experimental group		Control group	
	Pre-test N=4 (M±STD)	Post-test N=4 (M±STD)	Pre-test N=4 (M±STD)	Post-test N=4 (M±STD)
Q1	2 ± 0	1.25 ± 0.5	2.25 ± 0.5	1.25 ± 0.5
Q2	2.25 ± 0.957	1.5 ± 0.577	2.5 ± 1	1.75 ± 0.5
Q3	2 ± 0.816	1 ± 0.816	2.25 ± 0.957	1.75 ± 0.5
Q4	1.75 ± 1.258	1.25 ± 0.957	2.75 ± 0.5	1.75 ± 0.5
Q5	1.75 ± 0.957	1.25 ± 0.5	3 ± 0	2.5 ± 0.577
Q6	2 ± 1.414	1.25 ± 0.957	2 ± 0.816	1.25 ± 0.5
Q7	1.5 ± 0.577	1 ± 0	2 ± 1.154	1.5 ± 1.291
Q8	2.25 ± 0.957	1.25 ± 0.957	2.5 ± 0.577	1.5 ± 0.577
Q9	1.5 ± 1.291	1 ± 0.816	1.25 ± 0.5	1.25 ± 0.5
Q10	2.25 ± 0.957	1.25 ± 0.957	2.25 ± 0.957	1.5 ± 0.577
Q11	1.5 ± 1.291	1 ± 0.816	1.75 ± 0.957	1.75 ± 0.957
Q12	1.5 ± 0.577	1.5 ± 0.577	1.25 ± 0.5	1.25 ± 0.5
Q13	1.75 ± 0.957	1.75 ± 0.957	1.25 ± 0.5	1.25 ± 0.5
Q14	2 ± 0.816	1.75 ± 0.5	2 ± 0	1 ± 0
Q15	2.5 ± 0.577	1.5 ± 0.577	2.5 ± 0.577	1.75 ± 0.5
Q16	1.75 ± 0.5	1 ± 0.816	1.75 ± 0.5	1.5 ± 0.577
Q17	1.25 ± 1.258	1.25 ± 1.258	1.5 ± 0.577	1.5 ± 0.577
Q18	1.5 ± 0.577	1.5 ± 0.577	1.75 ± 0.957	1.5 ± 0.577

The data were run Two Way ANOVA with the variables Group and Time:

- Group – Fencing Girls, Fencing Boys, Control Girls, Control Boys;
- Time – Preliminary (at the beginning of the research), Final (at the end of the research).

The statistical parameters analyzed are: Degrees of Freedom (DF); Sum of Squares (SS) known also as Variation; Mean of the Squares (MS) known also as Variance; Test Statistics (F) and P value.

**Table 5.2**

Two Way ANOVA – P value for all questions

Q	Group	P	
		Time	Group x Time
Q1	0.363	0.004	0.802
Q2	0.596	0.122	0.951
Q3	0.649	0.147	0.961
Q4	0.410	0.172	0.967
Q5	0.039	0.195	1.000
Q6	0.802	0.217	0.976
Q7	0.848	0.397	1.000
Q8	0.046	0.011	1.000
Q9	0.916	0.631	0.967
Q10	0.883	0.128	0.980

<b>Q11</b>	0.468	0.667	0.976
<b>Q12</b>	0.011	1.000	1.000
<b>Q13</b>	0.009	1.000	1.000
<b>Q14</b>	0.095	<b>0.020</b>	0.363
<b>Q15</b>	0.931	<b>0.029</b>	0.931
<b>Q16</b>	0.330	0.141	0.728
<b>Q17</b>	0.065	1.000	1.000
<b>Q18</b>	0.963	0.771	0.963
<b>IA</b>	0.396	<b>0.037</b>	0.968
<b>HI</b>	0.678	0.058	0.997
<b>Total</b>	0.388	<b>0.012</b>	0.997

There is a statistically significant difference between pre and post (**P = 0.004**) for Q1, (**P = 0.011**) for Q8, (**P = 0.020**) for Q14, (**P = 0.029**) for Q15, for IA (**P = 0.037**) and (**P = 0.012**) for Total - but no difference at all between groups. To isolate which group(s) differ from the others there is to use a multiple comparison procedure.

### 5.3 Eurofit Physical Fitness Test Battery

After processing the Eurofit Physical Fitness Test Battery data thru Two Way ANOVA, pre and post intervention program, we found the next results:

**Table 5.3**

Two Way ANOVA – P value for all Fitness Test

Test	Group	P	
		Time	Group x Time
Flamingo	0.488	0.167	0.493
Plate Tapping	0.464	0.697	0.991
Sit and Reach	0.969	0.837	0.999
Standing Broad Jump	0.587	0.650	<b>0.006</b>
Hand Grip Left	0.348	0.412	0.824
Hand Grip Right	0.379	0.424	0.860
Sit Ups	0.017	0.237	<b>0.011</b>
Bent Arm	0.620	0.892	0.269
10x5 meters	0.128	0.873	<b>0.018</b>
20 m endurance	0.082	0.670	0.349

There is a statistically significant difference between pre and post (**P = 0.006**) for Standing Broad Jump, (**P = 0.011**) for Sit Ups, and (**P = 0.018**) for 10x5 meters, - but no difference at all between groups. To isolate which group(s) differ from the others there is to use a multiple comparison procedure.

### 5.4 Conclusions

The pilot research used to conduct preliminary analysis for the functionality of the tools, equipment and the applying program before performing the full research using the tools:

- ADHD RS IV evaluation questionnaire used in order to determine the changes within the symptoms of ADHD.

- Eurofit Physical Fitness Test Battery used to assess the changes in the physical condition of the subjects.  
The pilot research allowed us to formulate the following conclusions:
- ADHD RS IV questionnaire found to be suitable and therefore it can be used as depicted evaluation research tool.
- Eurofit Physical Fitness Test Battery found to be suitable to assess the changes in the physical condition of the subjects.
- A larger scale research based on wider population, increased frequency and duration of training period is surely desired for more comprehensive interpretation of the results.

## **Part III – Personal research regarding the effect of practicing fencing on children with Attention Deficit Hyperactivity**

### **Chapter 6 – The influence of a fencing training program on youth population diagnosed with Attention Deficit Hyperactivity Disorder**

#### **6.1 Research Paradigm**

There are two quantitative research methods: experimental and non-experimental, according to Johnson, B., Christensen, L. (2008) and the actual research is "quantitative experimental research" is to determine cause-and-effect relationships by manipulating the independent variable and observing the effects on a dependent variable" – in the actual research the independent variable is a fencing program applied to a group and the change caused on the dependent variable being the ADHD manifestations will be monitored. Moreover, the research includes a control group undergoing a physical training program being the independent variable and for that group the dependent variable will be the changes in ADHD manifestation as evaluated by ADHD RS-IV and Euro-fitness Battery Test.

#### **6.2 Research Aims**

The scope of the research is to explore the influence of fencing training program on ameliorating ADHD symptoms. Especially, that specific fencing physical activity assist in ameliorating attention, concentration and the interaction among them and at the same time the subjects will learn to control their hyperactivity and channel the impulsivity bursts into controlled objectives, developing self-discipline and focus on target.

#### **6.3 Research Questions**

More specifically, the research questions were investigated:

1. Is it feasible to improve the attention competence of children diagnosed as having ADHD disorder through fencing training program?
2. Is it feasible to attenuate hyperactivity and impulsivity levels of children diagnosed as having ADHD disorder through fencing training program?
3. Is there any extra value to fencing training program over general physical program in improving attention and attenuating hyperactivity and impulsivity levels of children diagnosed as having ADHD?

#### **6.4 Research Hypothesis**

Related research shows that physical activity has positive effects on moderating ADHD symptoms. A first source for literature review on the subject could be found in Gapin, J. I., Labban, J. D., Etnier, J. L. (2011) work. Berwid, O. G. (2012), in her paper reviews evidence for a direct impact of exercise on neural functioning and preliminary evidence that

exercise may have positive effects on children with ADHD. Given the above, we formulated the following hypotheses:

1. Fencing is a sport activity related to combat skills requiring full attention to the adversary herein it is to assume that fencing program will improve the attention competence of children diagnosed as having ADHD disorder.

2. Fencing activity being subject to codes of discipline requiring the ability to master self-restrain, it is to assume that fencing program will attenuate the hyperactivity and impulsivity levels of children diagnosed as having ADHD disorder through fencing training program.

3. Fencing being a sport activity that requires mental abilities and self-control more than general PA it is to assume that Fencing program will have extra value over general PE program in improving attention levels of children diagnosed as having ADHD disorder.

## Chapter 7 – Subjects and Methods

### 7.1 Research Methods and Tools

The research population was no=40 elementary 4<sup>th</sup> grade students divided into two groups (20 fencing training experimental group: 10 girls and 10 boys; 20 physical training control group 10 girls and 10 boys) all diagnosed as ADHD. Age, BMI, Weight and Height were found to be similar for all groups ( $p>0.05$ ).

The research took place after-school activity program in Misgav elementary school and fencing clubs in Akko city, Maalot city and Kiryat Ata

. All research population was divided randomly and had no previous expertise in fencing and mastered the skills according the research program - similar research by Kang K.D (2011).

#### 7.1.2 Research Design

The study group underwent a twice a week fencing training program, 90 minutes each and the control group that did not get any supplementary program outside physical education. The time limit of the research training program lasted ten months.

The control group received physical education lessons by the same amount of time and sessions as the study group but emphasized on general physical fitness.

After formulating the hypothesis, next step is getting into program's details and elaborate the proper methods for achieving the predicted outcomes was to:

1. Create parental approval form.
2. Create evaluation forms for first group's elimination - used for the staff team.
3. Analyzing the forms and finalizing the research group's population.
4. Create the test form that will be used in the initial and final phases.
5. Global Design – "three stages"
6. Originate detail design program for each training session
7. Applying the program.
  - a. Performing the planed test during the initial phase.

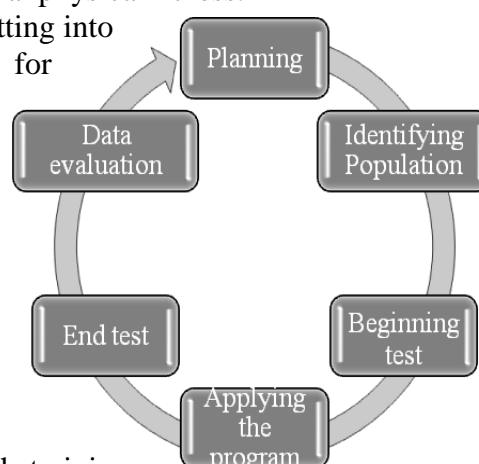


Fig. 7.1 Research Design

- b. Recording the data and store it ready for use utilizing statistical methods.
  - c. Applying the program according the design.
  - d. Performing the planed test during the final phase.
  - e. Recording the data.
8. Analyzing the data, maximize internal and external validity
  9. Extracting conclusions from the data

### **7.1.3 Evaluation Questionnaire**

The evaluation questionnaire was adapted from DSM IV, for evaluation of the results.

For inattention (IA) subscale raw score - Add the odd-numbered items

For hyperactivity-impulsivity (HI) subscale raw score - Add the even-numbered items

To obtain the total raw score - Add the IA and Hi subscale raw scores.

Convert the raw scores to percentile scores by using the appropriate scoring profile provided on the back of the rating scale.

### **7.1.4 Eurofit Physical Fitness Test Battery**

The applied test for the research was adapted from the Testing Physical Fitness: Eurofit: Experimental Battery: Provisional Handbook (1983) which is a set of nine physical fitness tests including speed, flexibility, endurance and strength. The standardized test battery was created by the Council of Europe, for children of school age and has been used in many European schools since 1988. The test is designed so that it can be performed within 35 to 40 minutes, using very simple equipment.

The following 9 tests are the standard tests recommended by the Council of Europe for testing school age children:

1. Flamingo Balance - single leg balance test;
2. Plate Tapping - tests speed of limb movement;
3. Sit and Reach - flexibility test;
4. Standing Broad Jump - measures explosive leg power.
5. Handgrip - measures static arm strength;
6. Sit-ups (30 seconds) - measures trunk strength;
7. Bent Arm Hang - muscular endurance/functional strength;
8. 10x5 Shuttle Run - measures running speed and agility;
9. 20-meter Course Naveté Endurance - cardiorespiratory endurance.

### **7.1.5 Attentive assignments and data evaluation**

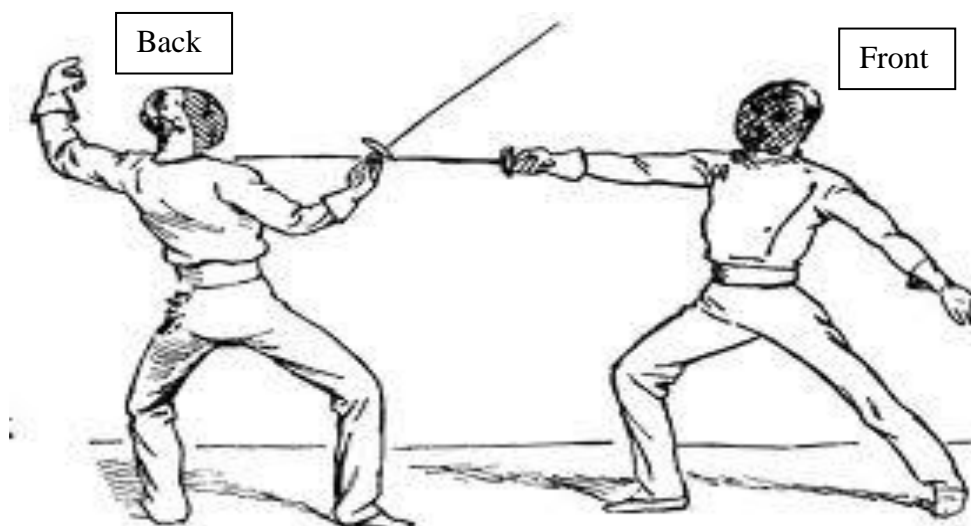
#### **Activity aim:**

1. Through controlled and focused observation tasks, to teach the participant to gradually develop the attention and concentration, the ability to focus, the ability to listen, the ability to understand the mission, the ability to complete the task while being able to ignore external effects and not relevant irritations to the specific task.
2. Through the observation process, the participant will learn to understand better the fencing and his opponents.

#### **Activity method:**

Group initiated: all fencers are seated in front of the fencing piste.

- a. Two fencers are positioned on the piste for combat or combat simulation according coach's instructions.
- b. Combat analysis videotaped of the fencers.



Fencer no 1 name \_\_\_\_\_

Fencer no 2 name \_\_\_\_\_

Fig. 7.2 Observation Paper

Every participant has an observation paper with a drawing of two fencers according to Fig. 7.2 along with a task from the task list – during first stages; the task is identical to all participants and varies throughout the program.

## 7.2 Research Intervention Design

The applied Intervention fencing program included three stages:

- Stage one – November 2014 - January 2015 basic fencing skills and general physical condition.
- Stage two – February - May 2015 tactical fencing skills and physical condition particular to fencing.
- Stage three – June - October 2015 competitive fencing skills.
- The control group applied Intervention physical education lessons by the same amount of time and duration as the fencing experimental group, emphasized on general physical fitness training.

### 7.2.1 Intervention program - Specific Physical fitness training for Fencing

The fencing intervention program emphasizes development of: specific physical fitness muscles; technical domination and tactics by using the following exercises:

**Exercise no. 1:** launch and sit.

**Exercise no. 2:** target hit with straight hand

**Exercise no. 3:** target hitting with one step forward and lunge.

**Exercise no. 4:** advance with steps forward and backwards, fencing between two lines

**Exercise no. 5:** forward jumping from static position

**Exercise no. 6:** backward jumping from static position.



### 7.3 Ethical Consideration

At the beginning of the research each participant parent had to read and agree by signing a letter of consent specifying he is aware of the whole research process and can redraw his consent and participation at any time. Moreover, the identity of the subjects was hidden and replaced by codes.

## Chapter 8 - Results and Conclusions

### 8.1 ADHD RS IV TEST

The ADHD RS IV questionnaire was analyzed at the beginning of the research and at the end.

#### 8.1.1 Inattention characteristic

**Table 8.1**

Inattention characteristic test as reflected from RS IV questionnaire

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

The data on **Table 8.1** summarize the Inattention characteristics of the research. The results show that at the beginning of the research the preliminary values of both fencing and control groups were high and nearly identical (347, 335) indicating of homogeneity between the two groups. At the end of the research, both fencing and control groups achieved lower values than at the beginning, indicating of decisive improvement of both fencing and control activities while fencing activity achieved distinctively lower value (154) than the control group (283) indicating a better improvement of the fencing program over the PA control program.

#### 8.1.2 Hyperactivity Characteristic

**Table 8.2**

Hyperactivity Impulsivity characteristic data as reflected from RS IV questionnaire

Group	Test	ADHD RS IV Question									
		Q2	Q4	Q6	Q8	Q10	Q12	Q14	Q16	Q18	Total
Fencing	Preliminary	45	34	28	40	37	41	38	40	35	338
	Final	27	16	8	9	12	26	22	15	23	158
Control	Preliminary	45	35	32	41	41	31	34	26	28	313
	Final	25	16	13	17	18	21	15	14	12	151

The data on **Table 8.2** summarize the Hyperactivity Impulsivity characteristics of the research. The values show that at the beginning of the research the preliminary values of both fencing and control groups were high and nearly identical (338, 313) indicating of

homogeneity between the two groups. At the end of the research, both fencing and control groups achieved lower values than at the beginning, indicating of decisive improvement of both fencing and control activities while the internal difference between the fencing (158) to the control (151) is nearly null and can't decisively indicate about a preferred activity.

### 8.1.3 Conclusions - Evaluation Questionnaire

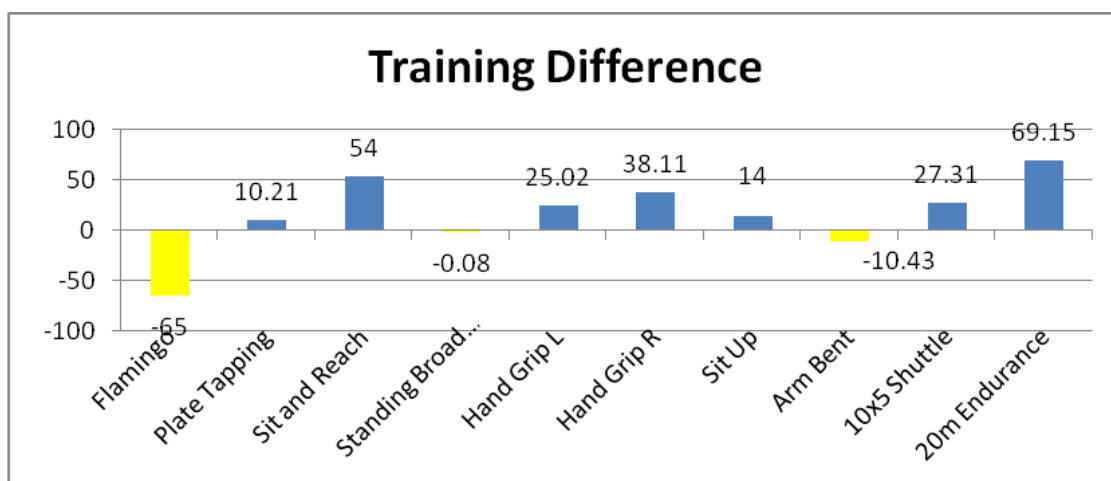
- Gender presents baseline differences which prevents the analysis of the effect of Fencing with larger samples size (cannot combine boys and girls)
- For the Inattention, the results demonstrate that it was more accurate to show significant differences over time due to the Fencing training, independently of the gender.
- For the Hyperactivity, the gender appears to have a greater effect than the training.

## 8.2 Eurofit Physical Fitness Test Battery

The Eurofit Test Battery was analyzed at the beginning of the research with the initial data and at the end with the combined data of both initial and final data.

First, we used 4 basic parameters to determine if the population was normally distributed. Age, BMI, Weight and Height were found to be similar for all for 4 groups ( $p>0.05$ ), meaning it was possible to combine them together. Secondly, and in order to remove a gender effect, we ran interactions analysis with a 2-way Anova followed by a Bonferroni post-hoc. As the population was low, it was better to have a more conservative post hoc test which would give more power to the analysis. Significance was set at 0.05. Independently of the gender, fencing training had no significant effect on *Flamingo Balance*, *Plate Tapping*, *Sit and Reach* and *Jump* ( $p>0.05$ ).

### 8.2.1 Training Difference



**Fig. 8.1 – Training Difference**

The fencing training effect relative to the control group effect is summarized in **Fig. 8.1**. The results for each test are standing alone, it can-not be compared one to each other because the different scale used for each test. The visualization provides an overall knowledge about the quality of the data - all values above the null line indicate superiority of the fencing program over the PA program. The values under the null are indicating inferiority of the fencing training program over the PA program.

- *Flamingo Balance* test- can-not be quantitatively analyzed because the scoring system by giving the null score to the best and to worst performances, therefore qualitative analyze

is required.

- Standing *broad jump* –parameter determines the muscular leg power translated by the ability to reach to a greater distance. Nevertheless, the differences between the change in performances of both fencing and control groups, are nearly identical and it seems that the effort invested in fencing footwork yield similar results as the effort invested in general PA as running, playing field games and alike.
- *Arm bent* - parameter determines the muscular upper body development- an isometric exercise- which is definitely not one of the necessary fencing requirements, therefore the inferiority of fencing training program is quite explainable.

### 8.2.2 Conclusions - Fitness Test Battery

Fencing training group undergoing Fencing training program determined higher impact on Physical Fitness compare the control group undergoing PA training program, as reflected from the Eurofit Physical Fitness Test Battery. The validity of the Eurofit Physical Fitness Test Battery data for the research is confirmed by the statistical analysis using SigmaPlot 12.5 software and running Two Way Repeated Measures ANOVA (One Factor Repetition).

The research examined the effect of a fencing training program on physical fitness in youth population diagnosed Attention Deficit Hyperactivity Disorder (ADHD) thru *Eurofit Physical Fitness Test Battery*.

*Flamingo Balance* test which found to be not measurable test, most of the values indicated superiority of the fencing training program over the PA program but one, *Arm Bent*. The *Arm Bent* test indicated superiority of the PA program over fencing training program. The *Standing Broad Jump* test seems to yield almost identical results for both fencing and control groups.

### 8.3 Final Conclusions and Recommendations

The aim of this research was to explore the influence of fencing training program on self-perception of competence in children with ADHD. The research population was n=40 elementary 4<sup>th</sup> grade pupils, diagnosed with ADHD divided randomly into two groups n=20 each: fencing group (10 boys and 10 girls) undergoing a fencing training program and control group (10 boys and 10 girls) undergoing PE training program. The research was on a whole academic year (9 months), 90 – min twice a week experiment all samples has no previous experience.

The tools used in the research were: *Eurofit Physical Fitness Test Battery* and *ADHD RS IV questionnaire*.

**The Eurofit Physical Fitness Test Battery** was an inductive for the contribution of a fencing training program on ADHD diagnosed children physical fitness. The results show distinctive superiority of the fencing training program on improving the physical fitness on the ADHD diagnosed children. Previous researchers in the field show that PA is an ameliorating factor for ADHD symptoms. **The ADHD RS IV questionnaire** was the tool according which it can be concluded the contribution of fencing training program over ameliorating ADHD symptoms.

Back to the research questions and hypothesis:

1. **The feasibility to improve the attention competence of children diagnosed as having ADHD disorder through fencing training program was proven.** Fencing training program achieved distinctively greater improvement of *Inattention* characteristic over the control group undergoing PA program.
2. **The feasibility to attenuate hyperactivity and impulsivity levels of children diagnosed as having ADHD disorder through fencing training program was proven.** Fencing training program achieved a slight advantage over the control

group undergoing PA program. Notably that both fencing training program and control PA program indicating a better improvement of the *Hyperactivity Impulsivity* characteristic.

3. **The extra value of fencing training program over General PA program was proven** in both physical parameters as reflected from the Eurofit Physical Fitness Test Battery and also in the behavioral parameters as reflected from the ADHD RS IV questionnaire.

Based on this research's results, it is to establish that the specific fencing training program can assist in ameliorating ADHD symptoms: *Attention; Concentration* and the *Interaction* among them and channel the *hyperactivity\impulsivity*, at the same time the subjects will gain an extra physical condition value.

According to research's results, it is further recommended to assimilate fencing training programs within elementary schools curriculum as an accessory to diminution of ADHD symptoms and help in the integration of ADHD population within the surroundings. It is also recommended to operate fencing training program within afterschool activities as a way of healthy life.

Further research in the field is recommended with bigger number of participants in order to avoid statistical validity concerns, but for shorter period of time – the shorter time such program can be proven too be effective it can be more flexible to be assimilated within school programs.

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