

REVIEW

Can a Person with Attention Deficit Hyperactivity Disorder be an Athlete?

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Attention-deficit-hyperactivity disorder (ADHD) is a common neuropsychiatric disorder that impairs academic, social and occupational functioning in children, adolescents and adults. It is characterized by excessive activity, restlessness, and nervousness. The disease occurs in general at children before the age of 7 and usually is not easy to be detected, due to various symptoms. When the diagnosis is established the physician can prescribe two types of drugs, stimulants: amphetamine, dexamphetamine, lisdexamphetamine, methylphenidate, and non-stimulants such as: guanfacine, atomoxetine, and clonidine. So what can be done for a person who has ADHD, and wants to be an elite athlete? Due to the rules established by the World Anti-Doping Agency the stimulant drugs are prohibited in competition and if traces of a prohibited substance are detected in the sample of blood of the athlete his access to competition can be blocked from 2-4 years, from that date of the incident. Fortunately for some athletes the disease was acute in childhood but as they grew up the symptoms were reminiscent and they could concentrate at the sporting task that was supposed to be achieved. What about those athletes that still have the symptoms? Well, they can be treated with the non-stimulant drugs, but their doctor must monthly verify if the list of prohibited drugs has been changed. In conclusion we can say that ADHD can be an impediment, but with the help of parents, teachers, and physicians the athlete can achieve very good performances.

Keywords: attention-deficit-hyperactivity disorder, athlete, sports, doping

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Introduction

Attention deficit hyperactivity disorder (ADHD) is a syndrome of neurodevelopmental type characterized by excessive activity, restlessness, nervousness and problems in paying attention. Usually these symptoms appear before the age of 7 and can create problems in different social settings such as school, home or recreational activities. Children affected by ADHD have trouble staying focused; are distracted easily or get bored when working on a certain task, appear not to listen when spoken to, have difficulty in remembering things and following instructions; do not pay attention to details, have trouble finishing projects and staying organized, frequently losing or misplacing homework, books, toys, or other items. The most obvious sign of ADHD is hyperactivity; while many children are quite active naturally, children with ADHD are always moving, trying to do several things at once, bouncing around from one activity to the next. The impulsivity of children with ADHD can also cause problems with self-control, as they have the tendency to interrupt conversations, invade other people's intimate space, ask irrelevant questions in class and make tactless observations [1,2].

ADHD can be classified in 3 subtypes by symptoms [3]:

- 1 A symptoms only: ADHD, Predominantly Hyperactive Type
- 1 B symptoms only: ADHD, Predominantly Inattentive Type
- Both 1 A and 1 B symptoms: ADHD, Combined Type

The fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV), classifies ADHD based on the presence of particular symptoms. Each symptom is classified as being either from the "Inattention" (1A) or "Hyperactivity - Impulsiveness" (1B) group [3]. Symptoms are listed by group in Table I.

Children with ADHD are at greater risk than other children for substance abuse and juvenile delinquency; however, early diagnosis and treatment with psycho-education as well as drug therapy may decrease the negative outcomes of ADHD, including the rate of adult antisocial personality and of conduct disorders [4].

Is important to discover the disease as soon as possible, because children with undiagnosed ADHD remain untreated, and the feedback from the people that are close to them, parents, teachers is important, because they need the help from the people with whom they are in contact with [5,6].

Children with ADHD when feel criticized, they tend to control less their symptoms [7, 8].

Studies have shown that children with ADHD who cannot control their behavior are exposed to the probability of persistence of the behavior [9-11].

The exact cause of ADHD isn't known, but it seems that heredity is the most common cause of ADHD, as there are genetic characteristics that seem to be passed on. However, like many other illnesses, ADHD probably results from a combination of factors, as possible environmental factors,

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Table I. Symptoms used in the DSM-IV diagnostic criteria for classifying ADHD diagnoses by group [3]

Inattention (1A)	Hyperactivity (1B)	Impulsiveness (1B)
1. Has trouble keeping attention on certain tasks. 2. Doesn't give enough attention to details and makes careless mistakes in schoolwork and other activities. 3. Doesn't follow instructions and fails to finish certain tasks. 4. Doesn't seem to listen when spoken to. 5. Avoids, dislikes, or doesn't want to do things that take a lot of mental effort for a long period of time. 6. Has trouble in organizing daily activities. 7. Loses things for tasks or other activities. 8. Is easily distracted by external stimuli during activities. 9. Forgets daily activities.	1. Leaves seat in classroom or in other situations in which remaining seated is expected. 2. Runs and climbs excessively in situations in which it is inappropriate. 3. Plays with hands or feet or squirms in seat. 4. Has trouble playing or enjoying leisure activities quietly. 5. Is always "on the go" or often acts as if "driven by a motor." 6. Talks excessively.	1. Answers to questions before questions have been finished. 2. Interrupts or intrudes on others. 3. Has trouble waiting one's turn.

brain injuries, nutrition and the social environment might contribute to ADHD [12].

Beside medical treatment, Cognitive Behavioral treatment (CBT) has outcomes in adolescents and also in adults. If we are talking about adults there are results which are showing that CBT has great effects on the symptoms of ADHD, with the reduction of anxiety and depression. It has been observed that the ADHD symptoms tend to be reduced after CBT, while anxiety and depression, may have an impact in decreasing the ADHD symptoms, lowering the effect of CBT [13].

In children, CBT is a protocol which can be used to individuals who do not respond to stimulant medication, or the stimulant medication cannot be tolerated by them; it is also a protocol which validated at adults could help adolescents with ADHD. The CBT protocol may also decrease the doses of medications prescribed for the children in need [14]. Psychosocial management includes the following interventions: behavioral parent training (BPT), adolescent-parent training in solving problems, training teachers to manage kids with ADHD and also all the three interventions mentioned above combined [15]. CBT may be also used for treating: anxiety [16], autism [17], and for children exposed to violence [18].

Diagnosis

Clinical interview with the parents, the child or adolescent and any significant family members is essential to establish a diagnosis of ADHD by verifying the functionally impairing symptoms of inattention, impulsivity and hyperactivity. There are also other tools that can be used to help the physician in establishing this diagnosis, such as: Connor Questionnaire, NICQH Vanderbilt Assessment Tool, DM5- criteria, SNAP IV and Pelham Scale [19].

We consider adhering to DSM IV diagnosis is important because it can be established which component is the most pointed out and by establishing this component, a better diagnosis can be achieved, the physician knowing which component is the most sweeping and needs more attention in the treatment of the person with ADHD. DSM-5 and DSM IV are both used in diagnosis of mental diseases.

Management of ADHD

There are a few factors that are important before establishing the way the patient will be treated, as treatment

depends on the: age, gender, the way the patient acts at home, work, school. Medication and also non medication treatments are available, but studies show that medication has superior results [20].

ADHD can be treated using medication or therapy, but a combination of both is often the best choice. There are five types of medication licensed for the treatment of ADHD: methylphenidate, dexamphetamine, lisdexamphetamine, atomoxetine and guanfacine [21]. The chemical structures of the drugs are presented in Figure 1.

Amphetamine was the first medicine that was used for treating ADHD; it has been introduced on the pharmaceutical market 50 years ago, but nowadays is no longer used because of serious addiction risks [1].

Methylphenidate (methyl phenyl (piperidin-2-yl) acetate) is the most commonly used medication for ADHD; it is a central stimulant of phenethylamine and piperidine classes. Its mechanism of action involves the inhibition of catecholamine reuptake, primarily inhibiting the dopamine reuptake, leading to increased concentrations of neurotransmitters within the synaptic cleft. The medication can be taken as either immediate-release tablets (small doses taken two to three times a day), or as modified-release tablets (taken once a day in the morning, and they release the dose throughout the day). The ADHD patient may also have other co-morbidities such as depression, in

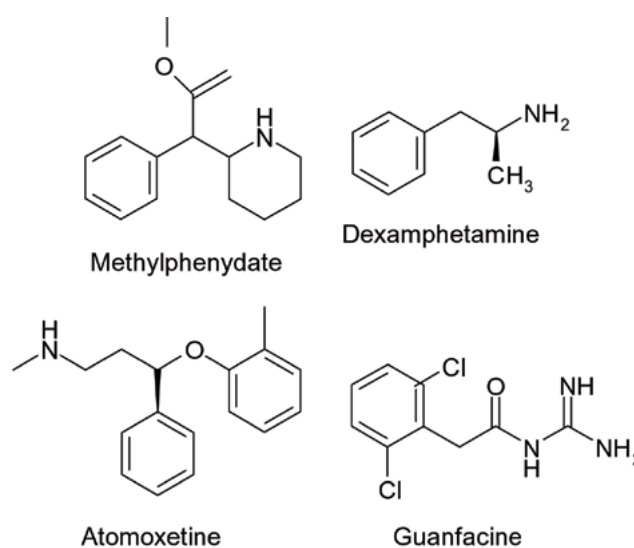


Fig. 1. Chemical characteristics of the drugs currently used in therapy in the treatment of ADHD

some studies it has been observed that methylphenidate has a good effect if the patient has depression and ADHD [1, 21].

Dexamphetamine ((2*S*)-1-phenylpropan-2-amine) is the dextrorotatory enantiomer of amphetamine, its mechanism of action is related to the activation of a trace amine receptor, increasing monoamine and excitatory neurotransmitter activity in the brain, with the most pronounced effects of catecholamine neurotransmitters like norepinephrine and dopamine [22].

Lisdexamphetamine ((2*S*)-2,6-diamino-*N*-[(2*S*)-1-phenylpropan-2-yl]hexanamide) is a very similar medication to dexamphetamine and has the same mechanism of action, its chemical structure consists of dextroamphetamine coupled with an essential amino acid L-lysine; lisdexamphetamine is the prodrug of dextroamphetamine as *in vivo* suffers the cleavage of the lysine portion of the molecule [23].

Atomoxetine ((3*R*)-*N*-Methyl-3-(2-methylphenoxy)-3-phenylpropan-1-amine) works differently to other ADHD medications; it is known as a selective noradrenaline reuptake inhibitor (SNRI). Its primary advantage over the standard stimulant treatments for ADHD is that its abuse potential is low. Atomoxetine has the advantage of dosage, because the patient has to take only one pill daily. It has been proven that atomoxetine is noninferior to immediately release methylphenidate but if we compare it with extended release methylphenidate it has been concluded that it is less effective [24].

Guanfacine (*N*-(diaminomethylidene)-2-(2,6-dichlorophenyl)acetamide) is a sympathomimetic drug, being a α_{2A} -receptor agonist, very similar to clonidine. It can be used if the other treatments do not work well; it also has some advantages compared to clonidine, because guanfacine has a longer half life, and some side effects such as sedation and changing the blood pressure are not as powerful like in the case of patients using clonidine [25].

ADHD in Sport

An athlete with ADHD faces certain unique challenges. The scientific literature has traditionally focused on the cognitive and psychological aspects of ADHD, and only a few studies comment on sport performance.

So the question is can a person with ADHD be an athlete?

Well, it depends on the medicine he is using, for example some athletes used amphetamines and they were banned from competition; but if they demonstrated that they had ADHD and they were using those medicine for treating their condition their suspension was lifted; but in the Code it is mentioned that if a athlete is suffering from a disease and needs to use a medicine which is forbidden to be taken, he may use it but only to help him treat his disease. As it was mentioned before there are two classes of substances that can be used in ADHD: those which are stimulants and the others that have not any stimulant effects. So why are the athletes using the stimulant ones when they could

use the other class? The representative of the stimulant class are all banned and can be found on the prohibited list at the section prohibited substances, section S6 Stimulants, which are prohibited only in competition, so if a person has ADHD and uses amphetamine he can use it but only when he is not competing, when he competes he may use substances from the class of non-stimulants: atomoxetine, clonidine, guanfacine.

There are other methods used for treating ADHD that do not have the same usefulness as the medication, but they may help the patient, such as: diet, using the herbal treatments (Ginkgo Biloba, Panax quinquefolius), yoga and homeopathy [26].

Team physicians should understand the effects of the medications commonly prescribed for ADHD on athletes during daily life and also while the athletes are engaged in athletic activities. Unfortunately, there are some people that are using the rules in their advantage, and they use medicine for ADHD, and are also participating at Olympic Competitions, as the stimulating drugs may induce advantages comparing over other competitors.

Recent studies have shown that an 80 dB noise (white noise) may improve the attention of the ADHD patient, it has been observed that if the patients were asked to repeat a word even if they had or not ADHD the results were the same, in both cases it has been observed the improvement of the capacity of remembering a word for both categories [26].

Studies regarding the influence of physical activity in the ADHD symptoms, showed that aerobic exercise seem to decrease hyperactivity, inattention, and impulsivity, among other symptoms. Another physical therapy includes yoga, which could improve behavioral symptoms, and psychological function. Physical exercise is good for children with ADHD because the release of dopamine which can decrease inattention symptoms. Practicing more sports seems to improve the anxiety and depression symptoms which may occur in children with ADHD [27].

In the list of athletes serving a period of ineligibility as a result of a rule violation we found that only a few were caught using amphetamine (4 athletes out of 296), and no positive results were detected for methylphenidate [28].

Athletes that proved that ADHD is not a barrier for performances

In some studies it has been shown that the lack of physical activity relates with the depressed affect. Physical activity can conduct to improvement of the ADHD, while the lack of physical activity (sedentarism) did not have a good outcome [29].

The study of Gapin et al shows that physical activity is related to ADHD; they measured the total move score (TMS), total execution time (TET), and the results showed an improvement to those parameters, in children which made physical activity [30].

Due to the issues that ADHD includes, children who want to be part of the other children activities present

low performance in doing them and some children with ADHD choose to have their own physical activity. Unfortunately some of them do not understand the purpose of the physical activity. For having better results the children with ADHD they should be helped by the physical education teachers, and also they should discuss with adults (teachers, parents) about the leisure counseling [31].

Michael Phelps was diagnosed with ADHD at the age of nine when his mother decided to take him to a pediatrician because he was more active than the kids at his age, and he couldn't concentrate to the activities in school. His mother, also a teacher, has received notification from the teachers that her son had a problem. When the athlete was diagnosed with ADHD, he also received pills that were making him concentrate to the tasks he was receiving, and with the help of his mother, his results at the school improved. At the age of 12 he stopped taking medicine for his disease, and at the same age the good results in sport appeared. Being energetic was an advantage, and he was doing remarkably well at swimming. His mother used his love for swimming to help him learn things: if the pool has 500 meters and the swimmer's speed is 3 m/second, in what time will he arrive at the finish line? [32].

Michael Phelps is now no longer using medicine for ADHD, but since the age of 15 he had incredible results at all the swimming competitions that he participated in, winning many gold medals and he is the youngest world record holder. His results are incredible, he participated at 4 Olympic Games and won at every Olympic Game at least one gold medal (since 2004 Athens) [32]. He is one of the ADHD athletes that can help us say that having ADHD is not stopping us from achieving our purposes in life.

Another example can be Michael Jordan who excelled at basketball since he was in high school, but due to his height he could not reach the high school basket team. After a summer of hard working, beneath the skills that he got, he also reached the height of 190 cm. The height and the skills brought him a place in the team. He channeled all his energy into playing basketball and achieved the goals that he wanted, becoming one of the greatest basketball players of all time, with records that were not beaten still. He is also one of the athletes that struggled with ADHD during his childhood [33].

Justin Gatlin, an American sprinter, was the co-holder of the world record at 100 meters. He declared that competing is important to him, because beneath the competitors he has to struggle against ADD, and every competition in which he attended is a victory against ADHD, a disease with which he fought during all his life [34]. Unfortunately Justin was tested positive in 2004 and he was banned to compete for two years. The banning came due to the medication he took for his disease, which is not permitted in competitions. [34]

Cammi Granato was a Canadian hockey player who won the gold medal at the Olympics in Nagano 1998, and silver in Salt Lake City in 2002; she discovered her dis-

ease only in 2003, and concluded that the disease she had helped her in the sport she practiced because she didn't need too much thinking, she only needed to react at what happened on the ice. At first she thought that she was lazy and that was the issue that prevented her from doing her daily tasks, but after discovering the disease she concentrated more on the problem that she had and put her life in order [34].

Chris Kaman was a great basketball player who also had to handle with the ADHD symptoms. As a kid he had issues in staying focused, and had bad grades in school, but after growing up and taking his medication, things became better for him and he managed to play for the Los Angeles Clippers, doing the best thing he was good at: play basketball [34].

Conclusions

There are several options in treating ADHD, but using methylphenidate, amphetamine or lisdexamphetamine may create an advantage for the athlete using them. Many athletes are willing to take forbidden substances, but the athletes should be careful in using the substances, because their future and their career may be affected in a bad way by breaking the rules. The question remains if the athlete can use these substances out of the competition, knowing that they present a great risk of addiction.

The decision to use medications during sporting activities should be made on an individual basis. All athletes with ADHD are likely to benefit from general behavioral skills oriented treatments, which include time management, stress management, organizational skills and problem solving skills training.

If we are talking about athletes that may experience ADHD at an adult age and also practicing sport, why not use other medication that does not affect the sportsman reputation and can be taken, in and out of competition, without any risk that the athlete might be excluded of the competition. We do not say that the person who is suffering from ADHD and it is also practicing sports should not take their medicine, we stand for using the right medicine for them, the one that does not affect in a cheating way their results, but also helps them fighting with the disease.

The majority of athletes which were diagnosed with ADHD also have great performances in the sport they practice. Sport performance is a therapy for some kids, because they use their energy into something that they like and enjoy and they are also rewarded; their self-esteem is growing, helping them getting over some of the symptoms of ADHD and concentrate on sport. Studies have shown that practicing more sports can help the children with ADHD, while practicing high level sport is also a solution for the ADHD kids, who can use their energy in making something good for them, for their self-esteem and for their parents.

There are quite a few athletes that already succeeded in sport while also having ADHD, so the answer to the ques-

tion that was put at the beginning of the study is yes, an ADHD person may be a great athlete.

We must also say that becoming a great athlete and having ADHD is not always an advantage; it depends on the symptoms that the ADHD child has and also how severe is the disease. Physical activity may improve the ADHD symptoms but it will not cure it.

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