Review

Cannabis and adolescence: The current situation in Greece comparing to European and Worldwide context

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ABSTRACT

Adolescence is a period of life that makes people vulnerable and prone to illegal substances. They are more likely to commit offenses than any other age group. In recent years, there has been an increase in the use of cannabis by adolescents worldwide. Cannabis has now been described in several countries, including Greece, as the dominant illegal substance and has been more closely linked to youth culture, as the age of starting cannabis is usually younger than for other drugs. Cannabis has very low acute toxicity and a very small mortality rate compared to other drugs, but morbidity is the most important impact on public health. In many countries, medical cannabis is considered legal in certain specific quantities, but the laws vary from country to country. The use of cannabis is examined and studied on many levels mainly because it affects teenagers in many areas including cognitive, social, and psycho-emotional. Some studies around the world confirm that the earlier and more prolonged exposure to cannabis use, the greater the damage. The fact that it can lead to adverse conditions in adolescents makes it imperative to proceed to primary prevention in the school environment but also in the society of each country. This will properly shape the adolescent's perception of cannabis and help identify other problems that occupy everyday life of adolescents preventing them from starting cannabis use or stop them from continuing using it.

Key Words: *adolescence, cannabis, drug, behavioral disorders, public health*

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Introduction

Adolescence is one of the most important and interesting periods of human life [1]. It is characterized by a particularly difficult transition from childhood to adulthood and is important both for the adolescent himself and for the people in his environment. It is a period of intense biological, cognitive and psychosocial changes [2,3]. During this period, a very important element for the teenager is his peers since he is prone to the pressure of the group and simultaneously seeks autonomy from his parents [2]. At the same time, the adolescent is characterized by significant changes in his behavior and cognitive functions, where cognitive deficits in risk assessment are identified. A main reason for this refers to the slow development of the prefrontal cortex [2,4]. This is why the adolescent brain is vulnerable to environmental impulses [3]. Also, an important factor seems to be the cultural context in which the teenager moves, the family environment, his personality, and psychosynthesis [5]. Adolescents are susceptible to developmental disorders caused by exogenous substances, such as cannabis use which can lead to a wider range of problematic behaviors [6].

In Europe and around the world, there is an increasing trend in cannabis use by adolescents. Adolescence is a developmental period of great importance. Also, adolescence in combination with the special characteristics of the individual, as well as his environment are important predisposing factors. This review aims to present data and information from Europe and around the world on cannabis use by young people and to highlight the importance of preventing and informing young people.

Cannabis or Hemp

Cannabis (Cannabis sativa L.) is a plant that exists in nature in many variations and is the first illegal substance that teenagers experiment with [7,8]. Currently, all its types (fiber, seed, marijuana, hashish) are classified in the species “Cannabis sativa” with two subspecies: the Cannabis sativa L. subsp. Sativa and the Cannabis sativa L. subsp. indica with different varieties depending on the use [9]. The most common method of its use is smoking with tobacco or ingestion with food [10] (Table I).

The greatest variation between varieties of drugs is their cannabinoid content (more than 400 chemicals and about 60 alkaloids) [9]. Among these, the most well-known are D-9 tetrahydrocannabinol (THC) which is the main psychoactive substance and cannabidiol (CBD) which has an antipsychotic, sedative effect and is associated with health benefits [9,11].

The mechanism of action of Δ9-THC is the result of its binding to the receptors of the endocannabinoid system (CB1, CB2) resulting in psychoactive intoxication and other systemic effects on peripheral tissue. Cannabinoid receptors are located in the central nervous system such as in the basal ganglia, hippocampus, and cerebellum and in immune cells and spleen [12,13]

A study reports that mitochondria also have CB1 receptors. Δ9 – THC stops the mitochondrial activity and can block the basic neurodevelopmental processes which involve CB1 receptors, damaging brain communication at sensitive ages [14]. Overdose does not cause anesthesia, coma, or death because basic vital functions such as breathing are not affected [13]. According to DSM – V (Diagnostic and Statistical Manual of Mental Disorders) during chronic dosing a disorder from cannabis use may develop, as 9% of those experimenting with cannabis will become addicted [15,16].

Numerous uses in medicine are found in cannabinoids and other substances of cannabis due to their soothing and analgesic action in the prevention and treatment of nausea and /or vomiting. These symptoms can happen in the advanced stages of diseases such as cancer, in chronic diseases such as in patients with multiple sclerosis (mainly relievers) and in AIDS [9,17]. Their therapeutic uses can be seen to asthma treatment and glaucoma and are constantly proven by studies. Cannabinoids and other substances of cannabis can also be used as antidepressant, as appetite stimulant, etc. [10, 17-18].

Legislation

The Cannabis legal framework is divided into 3 categories: cultivation, medical use, and recreational use. The only countries in the world that have legalized cannabis in all three categories are Canada and Uruguay [19]. In Greece, the legalization of industrial hemp took place in 2015. In all EU Member States, possession of cannabis for personal use is an offense, but 1/3 of these countries do not enforce imprisonment and most have legalized its medical use, such as Switzerland and Norway. The legalization framework differs significantly in all these countries. In contrast, the EU does not support the legalization of recreational cannabis use, and all countries impose imprisonment for illegal supply and possession [20].

Epidemiological data

The prevalence of cannabis use is 2.5% of the world's population, approximately 147 million people, compared with 0.2% who use cocaine and 0.2% who use opiates. Higher rates are found in the US, Oceania, Europe and increasingly in Africa and Asia [17,21]. According to the World Health Organization, cannabis abuse has risen rapidly, exceeding cocaine and opiate abuse over the past decade. In the last year, 15.5% (15,8 million) of young adults (15-34 years old) in the EU used cannabis. Due to the disruption of services due to the COVID-19 pandemic, the figures for 2020 should be interpreted with caution. Also, at the ESPAD report, it is derived that although it is too early to assess the consequences from the purchase and use of drugs in the Ukrainian war, there are, however, significant consequences. [22].

Greece

The National Documentation and Information Centre on Drugs (E.K.T.P.) states that cannabis is the most popular drug among young people, both in Greece and in Europe [23]. The ESPAD survey which was conducted in 2015 among 16-year-olds in Greece, shows significant ($p < 0.05$) changes in the rate of cannabis use between 2003 and 2015. In all other European countries, the prevalence of cannabis remained at the same level during the same period [22].

The percentage of 16-year-olds who report their first trial or onset of cannabis use at a very young age (≤13 years) remains stable over the last 20 years. One in 2 (50.8%) 16-year-olds in Greece consider cannabis use or experimentation "harmless". According to the most recent panhellenic survey of EPIPSY (University Mental health Research Institute - ΕΠΙΨΥ), which was conducted in spring 2019 in a nationwide representative sample of 17,733 students aged 16-18, (of which 5,988 were 16-year-olds), 8.20% have used cannabis at least once. [23]

Europe (Table II)

According to the 2022 European Drug Report, 15.8 million young adults (15-34 years old) in Europe, represent 15.5% of the total young adult population. Marijuana (herbal cannabis) and hashish (cannabis resin) are the main species of cannabis they use [22]. In 38 countries in Europe and North America, a study was conducted on adolescents that showed that the release of cannabis and partial prohibition policies were associated with higher levels of regular cannabis use among adolescents [24]. In addition, data from a study in Norway showed differences in cannabis use between adolescents with a migrant background and adolescents with a non-immigrant background. The prevalence of cannabis use was 10.6% between the 2nd generation of European immigrants and those from the US and 3.7% among the 2nd generation of Asians. This may be due to cultural differences because cannabis is more culturally acceptable and even legal in some countries [25].

Asia (Table III)

In Hong Kong, the results of a study showed that over 90% of adolescents had never used substances or cigarettes and only 10% had used them regularly (in the last 6 months) [26]. In Southeast Asian countries, a WHO study shows the aggregated estimate for substance use to be 2.5% for the 10 countries studied. The low level of parental commitment increased the risk of substance use while the high level appears to be a protective factor against mental health and substance use problems. Bullying was also connected to mental health and substance use (Indonesia OR: 5.47 – CI 95%) and in almost all Member States of the WHO South east Asia Region, the presence of mental illness increased the chances of using [27]. In a study conducted in 5 Asian countries, the prevalence of cannabis use throughout their lives was 0.9%. Compared to America and Europe it was generally found lower, probably due to the greater release of cannabis in these countries [28].

Oceania (Table IV)

In New Zealand, a significant association between cannabis and cognitive function (attention, learning, and memory tests) was found in adolescents aged 13-18 who were regular users (use more than once a week). Also, it was found that 52% of the general population had tried cannabis, with 70% of it, being adolescents (in age range up to 21) [29]. It was also found, in a sample of adolescent cannabis users, that a weakening in the ability to collect data and evaluate information before making a decision was observed, and especially, the earlier and more prolonged the exposure, the greater the harm was. [30]. A prospective study showed that the daily use by young women was associated with more than five times an increase in the chances of developing depression and anxiety [OR: 5.6, CI 95%: 2.6-12, P=0.003] [31]. In Victoria, Australia, it was shown that those who use cannabis at least weekly in adolescence had higher risks for subsequent illegal drug use and were less likely to complete tertiary education than non-users [32].

Africa (Table V)

Table I: Main hemp products

<table>
<tr><th>Marijuana</th><th>Hashish</th><th>Hashish oil</th><th>Industrial Hemp</th></tr>
<tr><td>Greenish mixture prepared from dried leaves and cannabis flowers</td><td>Dark-colored dried cannabis prepared from the dried resin of the plant (compressed under heat)</td><td rowspan="2">A concentrated extract from hashish and sticky material produced from cannabis leaves after special treatments (abundant in cannabinoids)</td><td rowspan="2">It is used in the diet (seeds, oil), in colors and dyes, cosmetics, fabrics (fibers), construction material, and for pharmaceutical use</td></tr>
<tr><td>Contains 0.2-5% D9 – THC</td><td>Contains 5-12% D9 - THC</td></tr>
<tr><td colspan="4">- When smoked (alone or within a mixture with tobacco): the action of cannabinoids begins within a few minutes and lasts 2-3 hours
- Oral intake: the action begins after 30-40 minutes and lasts 5-12 hours</td></tr>
<tr><td colspan="4">*Synthetic cannabinoids (K2/spice): they are human-made chemicals that are usually sprayed on dried plants. They are sometimes deceptively called "synthetic marijuana" because they act on the same brain cell receptors as THC. They are unsafe, have unpredictable effects, and are life-threatening (they can induce vomiting, violent behavior, suicidal thoughts, etc.)</td></tr>
</table>

Based on national population surveys, cannabis use ranges from 2% to 9% among South African adolescents. Studies report that the younger the age of one's first cannabis exposure and the more frequent the use, the greater the negative effects on mental health and the risk of developing psychosis later in vulnerable people, are. [33]. In addition, frequent cannabis use (several times a week) was associated with an increased rate of transition to suicidal ideation for young men aged 10-24 years but there is no evidence that suicidal ideation led to cannabis use in this population [34]. Research in South Africa found a high prevalence of cannabis use in adolescent patients with the first episode of psychosis [35].

America (Table VI)

From a large survey, the US National Drug Addiction Agency (NIDA) reported increased rates of marijuana use in middle and high school (grades 6 to 12) and an increase in the daily use of marijuana in the younger grades. These results represent the 2nd highest annual increase ever measured in a similar survey [36]. In North Carolina, cannabis use was associated with cognitive and behavioral disorders, such as decreased attentional performance, short-term memory, etc. [37] In Chicago, it appeared that the systematic use of marijuana before the age of 17 was associated with unemployment among men, children out of wedlock for men and women, and finally the abandonment of high school ($p>0,004$) [38]. In Victoria, British Columbia, and Canada, cannabis use was associated with psychotic symptoms (<22 years) and depressive symptoms between the ages of 16-19 and after 25 years of age [39]. In Mexico, it was shown that marijuana is the most used drug, with a prevalence of 3.2% of lifetime use, in comparison to all illegal drug users, who represented 5.2%. Drug use among Mexican adolescents is lower than among adolescents from other developed countries, while its increasing prevalence requires consistent public health actions, especially prevention strategies [40].

Table II: Studies in Europe

RESEARCH DATA		RESULTS	
Oslo – Norway (2014)	A cross-sectional study in high school based on 10,937 adolescents aged 14-17 years (questionnaires)	Prevalence of cannabis use→10.6% among 2nd generation of European immigrants and those from the U.S. & 3.7% among 2nd generation Asians.	Differences in cannabis use between adolescents with or without a migrant background may be due to cultural differences as cannabis is more culturally accepted and even legal in some countries [25] Asian 2nd generation → OR (95% CI): 0,34 (0,24-0,47) p<0.001
In 38 European and North American countries (2015)	A cross-national study examines the associations between types of cannabis control policies at a country level and the prevalence of adolescent cannabis use among 172,894 adolescents aged 15 years.	Teenagers were more likely to use cannabis (OR = 1.10, p = .001), use last year (OR = 1.09, p = .007) and systematic use (OR = 1.26, p = .004) (With boys more than girls) in relation to the differences in protection policies applied to various countries.	Cannabis release and partial prohibition policies were associated with higher levels of regular cannabis use among adolescents. The correlation between cannabis legalization and regular use was significant only in cases where the policy had been in place for more than 5 years [24]

Table III: Studies in Asia

RESEARCH DATA		RESULTS	
Southeast Asia (2014-2017)	A cross-sectional survey of students aged 13-17 examined the relationship between drugs & mental health in 10 countries.	The pooled estimate is 2.5% across the 10 countries that were studied. Substance use remains high in Bhutan (12%), Maldives (4.4%), Thailand (5.3%), and Timor-Leste (4.6%). Low levels in Indonesia (1%) and Buckland (1.3%)	The low level of parental engagement in most countries increased the risk of suicide attempts, feelings of loneliness, anxiety disorder, and substance use. In contrast, high levels of parental engagement appear to be a protective factor against mental health problems and substance abuse. Bullying has also been connected to mental health and substance use, and the presence of mental illness has increased the chances of using it [27]
5 Asian countries: Iraq, Malaysia, Mongolia, Kuwait, Vietnam (2017)	A cross-sectional study to assess the prevalence of cannabis and amphetamine use and to investigate factors related to substance use among adolescents in 38,941 adolescents (average age of 15.4 years)	The prevalence of lifetime cannabis use was 0.9% of participants. Strong relationships with peers or colleagues can help protect against illicit substances.	Prevalence of cannabis use was generally lower than reported in the Americas and Europe (due to higher cannabis release) [28]
China- Hong Kong (2009)	A replication study with 44 schools through questionnaires with 7,151 Chinese Secondary 2 (Grade 8) students (3,707 boys and 3,014 girls)	Problematic behavior and its association with substance use and alcohol were investigated.	90% had never used drugs or cigarettes in the previous 6 months and 10% had regular use. Life satisfaction was negatively correlated with substance abuse and crime (p <0.01) [26]

Table IV: Studies in Oceania

RESEARCH DATA		RESULTS	
Australia (2012)	Questionnaires and structured interviews for obtaining psychiatric, medical, and neurological history in 175 adolescents (mean age 18.3, range 16.5-20; 55% female). 48 cannabis users, 65 alcohol users, and 62 non-substance-using controls-recruited from a longitudinal cohort.	The age of the first cannabis trial was 15 years (p <0.001). Greater damage after early-onset and prolonged exposure to cannabis use.	The results show increased risky and impulsive decision-making in adolescents who are exposed to cannabis. The young cannabis users did show sensitivity to losses, suggesting that greater impulsivity early in their drug-using career is more evident when there is a lack of negative consequences [30]
Victoria, Australia (2010)	10-year follow-up for the results of occasional cannabis use in adolescence with a representative sample of 1943 secondary school adolescents.	From 1992 to 2003, a total of 10 series of teenagers with different average ages (from 14.9 to 24.1 years)	Occasional adolescent cannabis users who continued to use occasionally as young adults were at higher risk for illicit drug use in adulthood and less likely to complete higher education than non-users [32]
New Zealand (2007)	Questionnaire on alcohol and drug use, depression and other psychiatric disorders or ADHD and interviews (2 hours) with 70 adolescents 13-18 years old who do not have a confirmed mental disorder.	52% of the general population have tried cannabis and 70% of adolescents by the age of about 21. 68.5% had used cannabis in the last 28 days (p <0.01).	A significant relationship between cannabis and cognitive function in adolescents 13-18 years and using more than once a week (regular users). They performed worse on attention, learning and memory tests [29]
Victoria, Australia (2002)	A prospective study lasting 6 years with the participation of 44 secondary schools with 1601 students aged 14-15 years. Clinical interviews weighted for anxiety and depression.	60% of participants had used cannabis by the age of 20 & 7% were daily users.	Daily use of young women has been associated with a more than fivefold increase in the chances of reporting a state of depression and anxiety. [OR (95% CI): 5.6 (2.6-12) P = 0.003] Frequent cannabis use in adolescents predicted about twice the risk of developing later depression and anxiety (OR: 1.9, 1.1-3.3) [31]

Table V: Studies in Africa

RESEARCH DATA		RESULTS	
South Africa (2014)	Review of mental illness in adolescents from cannabis use.	Based on national population surveys, cannabis use varies between 2-9% in South African adolescents. 61.8% of adolescents (10-18 years old) who admitted to psychotic symptoms, reported cannabis use throughout their lives.	The negative effects on mental health seem to be greater when first exposure to cannabis occurs at a younger age and when use is more frequent. There is a correlation between early cannabis use and an increased risk of developing psychosis later in vulnerable individuals [33] Intensive cannabis use (several times a week has been associated with an increased rate of suicidal ideation in young men aged 10-24 years. There is no evidence that suicidal ideation has led to cannabis use in this population [34]
Durban, Kwazulu-Natal, South Africa (2013)	Psychiatric records of patients in 45 adolescents aged 12-18 years who had been admitted to a psychiatric clinic for at least 2 years	31 people (68.8%) reported a history of cannabis use throughout their lives.	There was a high prevalence of cannabis use in adolescent patients with FEP (first episode of psychosis) and there was an association between early presentation age and longer duration of symptoms and diagnosis of psychosis or schizophrenia. However, there was no link between cannabis use and a family history of mental illness [35]

Table VI: Studies in America

RESEARCH DATA		RESULTS	
USA (2019)	42,000 students from 400 public and private Gymnasiums and Lyceums (13-18 years old) of 8th, 10th and 12th grade by the National Organization for Drug Addiction (NIDA) **Middle (Grades 6–8) and high (Grades 9–12)*	Declining trends compared to previous years in smoking, alcohol and drug use, excluding marijuana. High school marijuana increase is the 2nd largest annual increase ever measured in a similar survey. 2,6 → 3,9% (8^{n}) 7 → 12,6% (10^{n}) 7,5 → 14% (12^{n})	60.9% use it to experiment. In 2019 daily marijuana rates increased significantly in the small classes with 1.3% (0.7 -2018), 4.8% (3.4 -2018) and 6.4% respectively for 8th, 10^{th}, and 12th grade. Marijuana smoking in the 12th grade →7,5% (2018) at 14% (2019) monthly usage [36]
Victoria, Colombia, Canada (2018)	Self-report measures for diagnostic symptoms, DSM V (CU = cannabis use. CUD = cannabis use disorder with psychotic, depressive, and anxiety symptoms) in 662 adolescents 12-18 years old random sample over 10 years (2003-2013)	The correlations between cannabis use, and cannabis use disorder with psychosis, depression, and anxiety symptoms in adolescents and adults were examined.	The use of cannabis (CU) was associated with psychotic symptoms after the age of 22 and with depressive symptoms between the ages of 16-19 and after 25 years. It was not associated with anxiety symptoms. CUD was associated with psychotic symptoms after the age of 23. - Depressive symptoms in the ages of 19-20 and after the age of 25. - Anxiety symptoms only in the ages of 26-27 years [39]
North Carolina, USA (2012)	Telephone and in-person interviews in combination with structured questionnaires [Drug History Questionnaire (DHQ)] for adolescents aged 14-17 years & classification based on marijuana use history. Users with at least 4 days/week for at least 6 months and non-users.	Cannabis use is associated with cognitive and behavioral disorders such as impaired attention, short-term memory, decision making, impulse control and intelligence.	These signs may be related to the increased risk of these individuals for a future psychiatric condition, including psychotic and emotional disorders as more serious substance use disorders [37]
Mexico (2007)	Of the country's 1,834,661 teens, 3,005 (71% agreed to take part in the survey) were 12-17-year-olds living in Mexico City.	-5.2% have tried illegal drugs -2.9% have tried it in the last 12 months -3.2% systematic use of cannabis -1.9% of cannabis use in the last 12 months - Marijuana is the most commonly used drug with 14 beng the average age of first time use	While drug use among adolescents in Mexico is lower than among adolescents in other developed countries, their growing prevalence requires sustained public health actions, and particularly prevention strategies [40]
Chicago, USA (2006)	A prospective study (ages 6 to 32-33) of young African Americans in Chicago. The social and behavioral effects of early and heavy cannabis use (on employment, marriage, etc.) were examined.	Marijuana use before age 17 was associated with adult unemployment in men and high school dropout ($p = 0.004$)	Early cannabis use in adolescence shows a marginal correlation in women & was negatively correlated in men and women in terms of marriage. There was no correlation between adolescent paternity or motherhood, but it was associated with extramarital parenting for both genders [38]

Treatment and prevention

According to NIDA and a plethora of studies, the systematic implementation of prevention programs in the school community prevents young people from using psychoactive substances.41 Statistics in Greece (2015) show a significant increase in the number of health education programs by the Ministry of Culture, Education and Religious Affairs in primary education, as well as in the number of students who participated in them. On the contrary, the corresponding interventions in secondary education have been reduced. An example of a program is the «I know what I want» (Ξέρω τι Ζητάω) implemented and evaluated in the framework of a multicenter study in seven European countries (Austria, Belgium, Germany, Greece, Spain, Italy, and Sweden). The first results of the program demonstrated that the students who participated showed a decrease in the use of alcohol, tobacco, and cannabis [20,41]

O.KA.NA (Organization against Drugs), through the action "pilot programs, alternatives to imprisonment" based on the program "Fred goes Net" (FreD) (early intervention program for young substance users implemented in European countries including Cyprus) organizes and operates the user support service, which aims at the prevention, treatment and reintegration of users [2].

A recent EMCDDA survey identified more than 60 drug-related mobile applications, almost half of them coming from Europe. This is due to the transition to the new digital generation, where adolescents appear to be quite active. Most applications have provided information on drugs, combined with some form of intervention [11,22]. At the same time, through the internet and social networks, adolescents can be informed, for example from the Adolescent Health Unit of the University of Athens, the "We know how" page, the Foundation "A World Without Drugs" etc.

Finally, in Greece, prevention and treatment programs are provided by recognized bodies. Indicatively they include KETHEA (Therapy Center for dependent individuals), Rehabilitation Unit 18 ANO, the Psychiatric Clinic of the National and Kapodistrian University of Athens, the General Public Hospitals, the independent association THESEAS within the framework of the Municipality of Kallithea and the Greek Center forMental Hygiene and Research. Non-governmental bodies are also included (eg Hellenic Centre for Intercultural Psychiatry and Care and the Hellenic Red Cross). The basic types of treatment provided by the above-mentioned bodies are divided into four different types of intervention:

1. Treatment of pharmaceutical treatment of dependence
2. Psychosocial therapeutic interventions (internal adult residence, adult outpatient, adolescent external stay)
3. Psychosocial therapeutic interventions within the criminal/penitentiary system and
4. Physical detoxification services [2,20].
   In addition, interventions in the community can be done with the help of parental groups, and media information campaigns.

Conclusions

In conclusion, cannabis has now become a part of the daily routine of teenagers worldwide, raising concerns for the scientific community and public health. The maturing and continued development of the endocannabinoid system during adolescence suggests that early, systematic, and heavy cannabis use makes them vulnerable, creating cognitive, behavioral, social, and even psycho-emotional problems throughout their lives. In Greece, the utilization rate is increasing, but compared globally, it remains at low levels, with the first places being held by North America, Oceania, and Europe according to the existing data. Perhaps the harsh legislative framework of some countries in Asia and Africa is the cause of their low prevalence, but this does not mean the rates of usage in these countries are not significant and that they will not increase as well over time. The fact that it is a "cheap" and more easily accessible drug for adolescents makes it more attractive because its long-term effects are unknown and increases the chances of their involvement with other illegal substances. Prevention plays an important role in the fight against cannabis and by extension to all drugs, and it ensures a better future for tomorrow's adults.

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