THE TURKISH JOURNAL ON ADDICTIONS
www.addicta.com.tr

REVIEW

Alcohol Misuse and Alcohol Use Disorder in Adolescents

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Main Points

- Adolescent alcohol consumption is a significant public health concern that has various negative long-term consequences.
- Adolescents have been shown to be less sensitive to the negative effects of alcohol while being more responsive to its positive rewarding effects.
- Research has shown that genetic factors, as well as shared and non-shared environmental factors, play a significant role in the initiation and escalation of alcohol use during adolescence.
- Effective screening involves evaluating family dynamics, while treatment emphasizes psychotherapy and family therapy, along with medications when indicated in specific cases.
- Comprehensive prevention strategies that promote social skills and community awareness are essential for reducing underage drinking.

Abstract

Adolescence is a distinct developmental stage marked by increased levels of novelty-seeking, reward sensitivity, and risk-taking behaviors, which often heighten the risk for alcohol use. The adolescent brain reacts to alcohol differently than that of adults, exhibiting less sensitivity to negative effects and greater sensitivity to positive effects. However, vulnerability to neurotoxicity may lead to higher alcohol consumption among adolescents, as it can impair their cognitive abilities and behavioral control. Alcohol use often starts and escalates during adolescence, heightening the risk of developing alcohol use disorder in adulthood, particularly for those who begin drinking before the age of 13. Although recent reports indicate a declining trend in alcohol consumption, the overall prevalence of alcohol use among adolescents remains around 25%. Research has consistently indicated that genetic factors, along with both shared and non-shared environmental influences, contribute to alcohol use in adolescence. Identifying familial dynamics is crucial for early intervention, as a supportive family can reduce the risk of alcohol misuse. Treatment primarily focuses on psychotherapy, with approaches like brief motivational interviewing and cognitive behavioral therapy demonstrating significant progress. Family therapy, particularly multidimensional family therapy, has proven to be highly effective. While pharmacological options exist, such as disulfiram and naltrexone, their use is limited and requires careful monitoring due to potential risks. Preventive measures are crucial and should emphasize early education and creating supportive environments. Comprehensive strategies that address both psychological and environmental factors are essential for preventing alcohol use disorder in adolescents by integrating education, family support, and targeted treatments.

Keywords: Addiction, adolescence, alcohol use disorder, public health, underage drinking

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Received: August 29, 2024
Revision Requested: November 3, 2024
Last Revision Received: December 2, 2024
Accepted: December 11, 2024
Publication Date: December 27, 2024

Introduction

Adolescence is a critical stage characterized by intense and rapid changes across multiple areas, including physical, cognitive, emotional, social, and behavioral domains. Along with physical growth, the adolescent brain undergoes various developmental processes that significantly impact behavior, cognition, and emotional regulation (Salmanzadeh et al., 2020).

Cite this article as: Süzer Gamlı, İ., & Erata, M.C. (2024). Alcohol misuse and alcohol use disorder in adolescents. *Addicta: The Turkish Journal on Addictions*, 11(3), 421-429.

During adolescence, increased neuronal processing, remodeling of synaptic connections, increased myelination in prefrontal regions, and maturation of subcortical regions occur, which are particularly involved in inhibitory control, reasoning, and emotional regulation (Spear, 2013). Growing literature indicates that these alterations have an impact on decision-making, reward sensitivity, reaction to uncertainty, and assessing risks and rewards, which makes adolescents more prone to engaging in risky behaviors (Salmanzadeh et al., 2020).

Tobacco, alcohol, illicit drug use, aggressiveness, violence, injury, self-harm, suicide attempts, and risky sexual activities are some of the common behaviors associated with risk during adolescence (Bozzini et al., 2021). Among these, alcohol is one of the most used substances during adolescence owing to its easily accessible nature. It primarily targets the brain, particularly the prefrontal cortex (PFC), hippocampus, cerebellum, white matter, and glial cells. In adolescence, these substances can influence the development of the PFC and mesolimbic dopamine pathways, affecting the brain's reward systems, social-emotional processing, and cognitive abilities, including attention, learning, working memory, and visuospatial skills (Salmanzadeh et al., 2020; Tetteh-Quarshie & Risher, 2023). Prolonged exposure to alcohol during these crucial stages can interfere with brain plasticity, maturation, and frontolimbic connectivity, potentially leading to permanent cognitive and behavioral deficits (Guerri & Pascual, 2010).

Adolescence is a critical period marked by significant brain changes and development, which also increases susceptibility to risky behaviors such as alcohol use. Alcohol consumption during this stage can disrupt brain maturation and lead to long-term cognitive, emotional, and behavioral challenges. While alcohol use is common among adolescents, it is also associated with various risks, which makes it an important area of study and intervention. Therefore, it is aimed to examine the effect of alcohol use during adolescence in light of existing literature.

Effect of Alcohol on Adolescence

Studies suggest that the adolescent brain may react to alcohol differently compared to the adult brain. Adolescents have been consistently shown to be less sensitive to the negative effects of alcohol. Intoxication-related reactions (such as motor impairment, reduced anxiety, social dysfunction, and sedation) and/or post-intoxication effects (like hangovers), which typically limit alcohol use, have been shown to be less pronounced in adolescents compared to adults (Spear, 2014). Additionally, adolescents have been found to be more responsive to the positive rewarding effects of alcohol, such as enhanced social relaxation and interaction, which can reinforce its use (Varlinskaya & Spear, 2015).

Another explanation is that the pharmacodynamic and pharmacokinetic responses of adolescents to alcohol may differ from those of adults. Adolescents need to consume more alcohol to achieve a blood alcohol concentration comparable to that of an adult which may contribute to adolescent regular use and/or binge drinking (Crews et al., 2016).

Although adolescents may exhibit lower sensitivity to certain adverse effects of alcohol, they are more prone to memory impairments caused by alcohol intoxication and are at increased risk for alcohol-induced neurodegeneration (Nixon et al., 2010; Spear, 2014). In the literature, several neuroimaging studies have clearly demonstrated the negative effects of alcohol, showing damage to both white and gray matter. Among these, adolescent binge drinking has been associated with white matter tracts throughout the brain, specifically affecting the primary fiber pathways that originate in the hippocampus and connect to the prefrontal cortices (Zhao et al., 2021). Moreover, adolescents with binge drinking patterns have been shown to exhibit a thinner and reduced volume in PFC and cerebellar regions, along with diminished white matter. Additionally, increased activity during tasks involving working memory, verbal learning, and inhibitory control has been revealed in fronto-parietal regions. Neuroimaging studies investigating the impact of alcohol on the gray matter have consistently demonstrated heightened neural activity in mesocorticolimbic areas, including the striatum, anterior cingulate cortex (ACC), hippocampus, and amygdala when exposed to alcohol compared to control subjects (Tetteh-Quarshie & Risher, 2023).

Besides the harmful impact on both gray and white matter, chronic alcohol use is also known to hinder the development of neural stem cells, especially in the hippocampus- a brain region critical in learning, memory, mood regulation, and behavioral control. In adolescents with alcohol use disorder (AUD), the hippocampus has been stated to be especially vulnerable to alcohol's neurodegenerative effects compared to adults. Hence, it has been shown that alcohol has an additional adverse effect on newborn cell survival in the same region (Wooden et al., 2021). Since adolescents have a higher rate of neurogenesis, a greater number of newly formed cells are lost following alcohol consumption compared to adults (Nixon et al., 2010).

Epidemiology

Alcohol is one of the most used substances among young people, and it is associated with an increased risk of developing AUD in adulthood. In the national survey results on drug use 2018 overview on adolescent drug use, 59% of high-school students have ever consumed alcohol and 24% of them have tried before eighth grade. According to this report, the 30-day prevalence rates of alcohol use for eighth, tenth, and 12th graders were 8%, 19%, and 30%, respectively. Binge drinking in the previous 2 weeks showed a decline among tenth- and 12th-graders to 9% and 14%, respectively, while it remained at 4% for eighth-graders (Johnston et al., n.d.). A recent population-based study revealed that 25.0% of adolescents had consumed at least one drink in the past 30 days, 17.9% had been drunk at least once in their lifetime, and 10.6% experienced drinking-related problems. Moreover, boys and adolescents aged 14 – 15 compared to those aged 12 – 13 were reported to be at higher risk for alcohol consumption (Ma et al., 2018). Another study has demonstrated that the overall prevalence of alcohol consumption among adolescents was 25.2%, with rates of 28.3% in boys and 22.4% in girls (Farnia et al., 2024). A cross-sectional study using data from a school-based survey conducted by Wang et al. (2018) reported that 22.8% of students had consumed alcohol in the past 30 days, and 9.2% (95% CI: 8.5 – 10.0) of students reported binge drinking. Despite relatively low prevalence in early adolescence, alcohol use significantly rises in the later stages of adolescence.

Although the majority of adolescents do not develop AUD in later life, reports suggest that 15% of individuals with AUD receive a diagnosis by the age of 18 (Glantz et al., 2020). Moreover, adults with AUD typically began drinking during adolescence or even earlier. According to the National Longitudinal Alcohol Epidemiologic Study, children and adolescents who began using alcohol at age 12 or younger had a 40.6% prevalence of lifetime alcohol dependence (Ryan et al., 2019). The age at which alcohol consumption begins has been shown to significantly impact the prevalence of AUD. For individuals who started drinking at age 18, the prevalence of AUD was 16.6%, while for those who began at age 21, it was 10.6%. Similarly, the prevalence of lifetime alcohol abuse was 8.3% for those who initiated alcohol use at 12 years or younger, 7.8% for those who started at 18, and 4.8% for those who began drinking at 21 (Grant & Dawson, 1997).

Etiology

Alcohol use and its associated problems impose significant costs worldwide, highlighting the need for a deeper understanding of the causes and developmental processes as well as risk and protective factors. In the literature, research has shown that genetic factors, as well as shared and non-shared environmental factors, play a significant role in the initiation and escalation of alcohol use during adolescence to certain degrees. The etiology of adolescent alcohol use involves a complex interplay of various factors, including, biological, psychological, social, and environmental domains. Research suggests that genetic risk factors contribute 50% of the alcohol use variance. The strongest relationship between adolescent alcohol consumption and genotypes involves DRD4, 5-HTTLPR, DRD2, and OPRM1 genes. It has been suggested that the way genotypes interact with environmental influences could affect drinking behavior during adolescence. Genetic influences have been claimed to have a greater impact on the initiation of alcohol use; while environmental influences become more significant in the development of habitual alcohol consumption (Friedel et al., 2021). In addition, genetic factors are demonstrated to play a substantial role in the stability of adolescent alcohol use, while non-shared environmental factors are more responsible for changes or fluctuations in alcohol consumption during adolescence (Zheng et al., 2019). These factors can cause differences in drinking behavior, even among individuals who share similar genetic backgrounds.

Environmental factors play a crucial role in shaping alcohol use during adolescence, especially in determining how and when adolescents engage in drinking. These factors may be analyzed in terms of psychological, familial, and social/peer domain factors. Literature suggests that parameters such as parental and peer approval, and adolescent delinquency, contribute to the prediction of future alcohol misuse (Donovan et al., 2004). Social environments, access to alcohol, and cultural norms also impact the development of drinking habits during this critical period. Parental substance or alcohol use, positive family attitudes toward drinking, family conflicts, unstable family dynamics, weak family bonds, and inconsistent discipline are among the family factors linked to an increased likelihood of alcohol use in adolescents. Legal regulations surrounding alcohol use, the availability of alcohol, social environments, and cultural factors can also play a role in adolescents' decisions to try alcohol (Evren et al., 2012). Research has shown that childhood socioeconomic status (SES) can elevate the risk of alcohol consumption in late adolescence; while low SES is linked to AUD in adulthood, especially among males and those diagnosed with externalizing disorders. Consequently, SES may have an impact on alcohol misuse differently based on the underlying individual genetic risk factors (Barr et al., 2018).

Individual factors include traits such as a desire for excitement, impulsivity, sensation-seeking, and tendencies toward risk-taking. Children with difficult temperament traits, difficulties adapting to new stimuli, and emotion regulation problems are considered to be at a higher risk of experimenting with alcohol and drugs. Research indicates that male adolescents are at greater risk for alcohol use than females due to several factors. These include a lower response to alcohol, increased sensitivity to its rewarding effects, delayed development of brain structures and executive function skills, a propensity for risky behaviors, higher perceptions of peer alcohol consumption, and socialization into traditional gender roles that may promote alcohol use (Evren et al., 2012; Schulte et al., 2009).

Moreover, adolescents diagnosed with externalizing disorders including attention deficit hyperactivity disorder (ADHD), oppositional defiant disorder (ODD), and conduct disorder (CD) have been associated with an increased risk for both early onset and addiction to alcohol (Evren et al., 2012). Attention deficit hyperactivity disorder and AUD have been shown to share a genetic overlap and common traits, such as a tendency for risky behavior, impulsivity, and a maladaptive reward system. Research suggests that up to 43% of individuals with ADHD may develop AUD. Moreover, it has been reported that individuals especially with comorbid ODD and/or CD are stated to be at a higher risk for developing AUD in later life (Luderer et al., 2021). A recent meta-analysis has shown that externalizing symptoms raise the risk of AUD by 62%, while internalizing symptoms also increase the risk of AUDs in young adults by 21% (Meque et al., 2019). Academic failure, weak connections with school, excessive screen time, loneliness, sleep problems, adverse life events, being bullied and exposure to neglect and abuse are additional psychosocial risk factors for alcohol and substance use in adolescents (Evren et al., 2012; Wang et al., 2018).

Additionally, peer influence significantly impacts adolescent alcohol use. Social norms, peer pressure, and the need for acceptance and validation from peers can shape adolescents' attitudes and behaviors regarding drinking. The growing use of social media among adolescents further influences their perspectives on alcohol through peer comparisons, social approval, and the content shared in social media posts. Misleading information on social media can contribute to a lack of awareness about the risks of underage drinking, which may increase the likelihood of alcohol use among adolescents (Evren et al., 2012; Zheng et al., 2019). Research has shown that social media plays a distinct role in shaping peer influence related to alcohol use. Specifically, exposure to friends' alcohol-related content on social media has been linked to adolescents' initiation of drinking (Nesi et al., 2017).

Clinical Features

Alcohol misuse and AUD are vastly undermined and ignored subjects that have become more problematic in recent years (Brown

et al., 2008). Underage drinking is one of the leading public health problems in both developing and developed countries (Hingson et al., 2004). Upon literature review, in contrast to adult literature, it is seen that there are sparse number of research articles regarding alcohol use in children and adolescents (Winters et al., 2011). Although the clinical phenomenology and end results of alcohol use in adults and adolescents may appear similar, there are important differences in the patterns of alcohol consumption between these age groups. Additionally, prolonged alcohol exposure during adolescence can lead to a range of associated risks, including cognitive impairments, increased susceptibility to substance addiction, and potential developmental issues (Adger & Saha, 2013).

Alcohol Misuse and Alcohol Use Disorder In Adolescents

According to the literature, underage drinkers consume, on average, four to five drinks per occasion about six times per month, whereas adults aged 26 and older consume, on average, two to three drinks per occasion approximately nine times per month. Individuals who start drinking before the age of 13 are nine times more likely to binge drink frequently during high school compared to those who begin drinking later. Moreover, it is clearly stated that many children and adolescents tend to engage in excessive drinking (binge drinking) at a young age, resulting in problems for themselves, those around them, and society as a whole (Brown et al., 2008; Grunbaum et al., 2004; Tripodi et al., 2010).

Problematic drinking is characterized by an inability to control alcohol consumption (such as drinking more than intended or in unsuitable situations) and experiencing negative outcomes from drinking (including issues like impaired driving, risky sexual behavior, physical altercations, and health problems). Addiction often develops from repeated heavy drinking, which may result from a persistent effort to relieve the pleasurable effects of alcohol and intoxication. Consistent heavy drinking can also lead to physiological dependence, primarily characterized by increased tolerance to alcohol and withdrawal symptoms occurring between periods of heavy drinking. Although less frequently reported among adolescents than among adults, heavy drinking also can lead to alcohol withdrawal symptoms between drinking episodes (Adger & Saha, 2013).

A problematic pattern of alcohol use leading to clinically significant impairment or distress, as manifested by at least two of the following, occurring within a 12-month period (APA, 2013):

Similar to the criteria used for adults, the Diagnostic and Statistical Manual of Mental Disorders (DSM) by the American Psychiatric Association provides specific guidelines for diagnosing alcohol abuse and dependence (American Psychiatric Association, 2013). To be diagnosed with alcohol abuse, an individual must meet at least one of the four specified criteria. For a diagnosis of alcohol dependence, the individual must meet at least three of the seven listed criteria (Table 1).

The severity of alcohol use disorder is determined as follows:

- *Mild: Two to three criteria met.*
- *Moderate: Four to five criteria met.*
- *Severe: Six or more criteria met.*

Potential Risks of Alcohol Use in Adolescence

Adolescence is a time of increased risk-taking, and for many young people, this includes the use of alcohol. Although adolescents are among the healthiest groups in terms of organic disease, they face relatively high rates of mortality and morbidity due to behaviors such as alcohol consumption (Adger & Saha, 2013).

Research shows that the earlier children and adolescents start drinking, the more likely they are to engage in harmful behaviors (Committee on Developing a Strategy to Reduce and Prevent Underage Drinking, 2004). Furthermore, early alcohol use and increased drinking during adolescence are associated with a higher risk of developing alcohol-related problems in adulthood. In fact, individuals who start drinking before age 15 are four times more likely to develop alcohol dependence and twice as likely to experience alcohol abuse compared to those who begin drinking after age 21 (Grant, 2000).

As mentioned, for some adolescents, increased social pressure can lead to heightened anxiety, raising the risk of alcohol use (Nesi et al., 2017; Zheng et al., 2019). As a result, alcohol use often becomes intertwined with the normal developmental processes of adolescence and may become problematic. Besides the psychological and social consequences of alcohol abuse, there are also significant physiological outcomes. Heavy drinking can impact several aspects of adolescent physiology, including:

1. Neurocognitive and aneurodevelopmental effects: lcohol consumption can disrupt the developing brain, affecting cognitive functions and brain development (Guerri & Pascual, 2010).
2. Liver effects: repeated heavy drinking can lead to elevated liver enzymes, particularly in overweight or obese individuals (Adger & Saha, 2013).
3. Growth and endocrine effects: alcohol abuse can interfere with normal growth and endocrine function (Adger & Saha, 2013).

These effects highlight the broad impact of alcohol abuse on adolescent health.

Screening the Adolescent and the Family

Early identification of families with alcohol or drug-related issues is crucial for preventing problematic drinking and AUDs in adolescents. As mentioned, clear and well-defined conduct norms established by parents are an important protective factor (Barr et al., 2018). Adolescents who are least likely to engage in alcohol or substance use typically have a strong emotional connection with their parents, receive guidance and advice, follow clear and reasonable rules, and have siblings who disapprove of drug use. Parents of non-users often provide praise and encouragement, foster a sense of trust, and are sensitive to their children's emotional needs (Barr et al., 2018; Evren et al., 2012).

Conversely, adolescents are at higher risk of problematic alcohol use if their families experience marital conflicts, financial difficulties, social isolation, or disruptions in family routines. They are also more vulnerable if their parents are either overly permissive

Table 1.
Criteria for Alcohol Use Disorder According to the DSM-5

Consuming more alcohol than intended	1.	Taking in larger amounts or over a longer period than intended.
Desire to cut down on alcohol use	2.	Persistent desire or unsuccessful efforts to cut down or control alcohol use.
Increasing amount of time spent to obtain alcohol use	3.	A great deal of time is spent in activities to obtain alcohol, use it, or recover from its effects.
Cravings	4.	Strong cravings or urges to use alcohol.
Failure to fulfill obligations	5.	Failing to fulfill major role obligations at work, school, or home due to alcohol use.
Social problems	6.	Continued use despite having social or interpersonal problems caused or worsened by alcohol.
Reduction of activities	7.	Giving up or reducing important social, occupational, or recreational activities due to alcohol use.
Hazardous alcohol use	8.	Using alcohol in situations where it is physically hazardous.
Tolerance	9.	Needing increased amounts of alcohol to achieve the desired effect or a diminished effect with continued use of the same amount.
Withdrawal	10.	Experiencing withdrawal symptoms or using alcohol to avoid withdrawal.

or excessively strict, or if they offer minimal encouragement and show consistent neglect (Barr et al., 2018; Evren et al., 2012).

To effectively screen for alcohol and drug use problems within families, a detailed psychosocial history is essential. Understanding the family structure, dynamics, and interpersonal issues among parents, children, and adolescents helps identify the need for further screening. Families affected by alcohol or substance use disorders often exhibit signs such as behavioral problems, academic struggles, parenting difficulties, family conflicts, and changes in the home environment (Barr et al., 2018; Evren et al., 2012).

Screening Tools for Alcohol Use Disorder

In clinical practice, tools such as the Cut, Annoyed, Guilty and Eye (CAGE) questionnaire and the Alcohol Use Disorders Identification Test (AUDIT) are commonly used to screen for alcohol use problems (Rumpf et al., 2013). The CAGE questionnaire is a concise, four-item tool that effectively detects AUD by asking about feelings of guilt, annoyance from others, the need to cut down on drinking, and the use of alcohol as an "eye-opener" in the morning. However, the CAGE is primarily designed to detect alcohol dependence and may not capture the full spectrum of unhealthy drinking behaviors. The AUDIT, on the other hand, is more comprehensive and screens for a broader range of alcohol-related problems, including drinking frequency, quantity, binge drinking, and the negative consequences of alcohol use (Adger & Saha, 2013).

In addition to these standard tools, the family CAGE has been developed as a modified version of the CAGE questionnaire to expand the screening process to include family members' alcohol use. This tool is particularly useful for providing indirect information about alcohol misuse within families, especially when working with adolescents who may not be using alcohol themselves but are concerned about a family member's drinking (Adger & Saha, 2013). For example, an adolescent could be asked whether they believe a parent needs to cut down on drinking or whether a parent ever uses alcohol in the morning. Positive responses to these questions can indicate a higher risk for AUD within the family and suggest the need for a more thorough evaluation. While the Family CAGE does not diagnose AUD, it is effective in identifying families at increased risk for alcohol-related issues, enabling healthcare professionals to intervene early. The family CAGE has demonstrated high specificity (96%) and a positive predictive value (90%), making it a reliable tool for screening families at risk (Adger & Saha, 2013). Furthermore, by incorporating drug use into the family CAGE questions, it can also be used to identify issues with substances other than alcohol, increasing its applicability and usefulness in various settings (Adger & Saha, 2013).

There is no universally recommended screening tool for adolescents, but the Car, Relax, Alone, Forget, Friends, Trouble (CRAFFT) questionnaire is validated for this age group and is widely used due to its simplicity. Additionally, some practitioners find the AUDIT helpful for adolescents, as it includes questions about drinking frequency, quantity, binge drinking behavior, and the consequences of alcohol use (Harris et al., 2014).

Treatment Methods Used In Adolescents

In literature, psychotherapy is often preferred over psychopharmacological interventions for treating adolescent alcohol misuse and AUD, considering its safer profile and medium to larger effect size (Riper et al., 2014).

Brief Motivational Interviewing

Brief motivational interviewing (BMI) is particularly effective in brief, direct intervention settings, such as primary care or emergency care environments. Although its use is limited in severe substance use disorders, BMI has shown the strongest evidence of success among youth. It promotes effectiveness through empathy and nonjudgmental support, encouraging change and engaging the patient's motivation while emphasizing the need for follow-up, which is crucial for the treatment of AUD. Its focus on harm reduction is especially beneficial in addressing issues

related to drunk driving, high-risk drinking behaviors, and self harm (Bukstein & Kaminer, 2015; Harris et al., 2014).

Cognitive Behavioral Therapy

Cognitive-behavioral therapy (CBT) uses principles of operant and classical conditioning to address triggers for use, misuse, and relapse. It promotes skill-based learning through homeworks and modeling, using social learning principles to facilitate behavior change. Although its effectiveness relies on self-efficacy, CBT alone has not yet demonstrated substantial success among adolescents. When integrated with other supplemental modalities, such as motivational interviewing, CBT helps achieve treatment goals (Riper et al., 2014; Tripodi et al., 2010).

Family Therapy

Family-based therapy is widely recognized as the most validated approach for addressing substance use in youth. Its effectiveness comes from its ecological perspective, which focuses on improving the parent – child relationship, enhancing discipline, and addressing parental substance use disorders. Multidimensional family therapy is highly regarded for its effectiveness in treating AUD among youth, with parenting skills serving as a key mediator in its impact. Another effective approach is brief strategic family therapy, which emphasizes reducing negative behaviors and is particularly tailored for Hispanic youth. This underscores the importance of using culturally appropriate family therapy strategies (Henderson et al., 2009; Liddle et al., 2008). Brief strategic family therapy has also proven effective for individuals from disadvantaged backgrounds and those with severe alcohol/substance misuse issues (Bukstein & Kaminer, 2015).

Twelve Step Programs

Twelve-step programs, based on alcoholics anonymous principles, effectively help youth achieve and maintain abstinence from alcohol. These programs benefit from their cost-effectiveness, strong social support, and spiritual focus, including 24/7 access to the sponsors. However, challenges include the limited availability of groups specifically for young people, the informal nature of the community-based approach, and the considerable time commitment needed to sustain the programs. Despite these issues, Twelve-step programs remain a valuable tool for supporting long-term sobriety (Bukstein & Kaminer, 2015; Kelly et al., 2010, 2011).

Pharmacological Interventions for Adolescent Alcohol Use Disorder

Although pharmacotherapy for alcohol withdrawal is appropriate when necessary, it is often not used for adolescents (Simkin & Grenoble, 2010). Pharmacological interventions for adolescent AUD can target several key areas, including alcohol withdrawal, cravings, and comorbid mental health disorders (Margret & Ries, 2016). While robust empirical evidence supporting specific pharmacotherapy for adolescents with AUD is lacking, approaches similar to those used in adults may be beneficial, especially given the limited effectiveness of psychosocial interventions in some cases. Medications may focus on reducing relapse risk by altering alcohol metabolism or decreasing cravings, thereby shifting the balance between the reinforcing and aversive effects of alcohol. Additionally, addressing comorbid mental disorders through pharmacotherapy can also be a valuable treatment option (Margret & Ries, 2016).

Among adolescents with AUD, withdrawal symptoms occur in about 5 – 10% of cases, with only a small subset requiring pharmacotherapy (Clark, 2012; Margret & Ries, 2016). Due to the limited number of systematic studies on the pharmacological management of alcohol withdrawal in adolescents and the rarity of severe withdrawal that necessitates treatment, it is believed that outcomes would be similar to those observed in adults, with pharmacotherapy approaches generally aligning with those used for adult patients (Clark, 2012). Due to the abuse potential of benzodiazepines and the potentially lethal effects of combining alcohol and benzodiazepines, this treatment should be conducted only in supervised settings, such as inpatient services (Clark, 2012).

Disulfiram has shown promise in reducing relapse rates among adolescents with AUD, demonstrating longer periods of abstinence compared to naltrexone (De Sousa et al., 2008). However, its use requires highly motivated individuals, close medical supervision, and parental support due to potential hepatotoxicity and the severe risks associated with alcohol consumption while on disulfiram (Clark, 2012).

Several pharmacotherapy approaches for AUD focus on reducing alcohol craving and preventing relapse. Naltrexone is Food and Drug Administration-approved for individuals aged 12 and older, while acamprosate is approved for patients aged 18 and older, with both medications indicated for the treatment of AUD (Garbutt, 2010). Acamprosate, a glutamate antagonist, has demonstrated an increased rate of abstinence among adults, though research in adolescents is limited (Rösner et al., 2010). Other medications, such as topiramate, ondansetron, and baclofen, have also shown potential in reducing alcohol consumption, but their efficacy in adolescents has not been extensively studied (Clark, 2012). Ondansetron, in particular, has shown promise in an open-label study with adolescents, significantly reducing alcohol use and cravings (Dawes et al., 2005). While these medications may be beneficial, further research is needed to establish their effectiveness and safety for adolescents with AUD. In the literature, quetiapine, topiramate, and baclofen have been noted to help address cravings in patients with AUD (Chang & Steinberg, 2001; Ray et al., 2010; Rolland et al., 2011). However, because these medications have not been extensively studied for this purpose, their effectiveness in adolescents with AUD is still uncertain.

Overall, the pharmacological options for treating AUD in adolescents are still developing, and more research is needed to fully understand their effectiveness and safety for this age group.

Treatment of Comorbid Psychiatric Conditions

Adolescents with AUD often have comorbid mental health disorders, such as ADHD, CD, and MDD, along with common and significant issues related to traumatic experiences, such as post-traumatic stress disorder (Thatcher & Clark, 2006). These mental disorders may require targeted interventions and can influence AUD treatment outcomes. To address and effectively manage

AUD, treatment plans may need to be adjusted to include antidepressants, stimulants, and other medications such as quetiapine (Clark, 2012).

Prevention of Alcohol Use Disorder

Addressing underage drinking is critical and requires early prevention and proactive treatment. Environmental factors significantly influence the onset of adolescent alcohol use, making prevention strategies essential in combating this issue (Clark, 2012). Successful school-based programs that emphasize social skills and moral values show promise for wider implementation (Benningfield et al., 2015). In contrast, non-school universal interventions have demonstrated limited effectiveness (Gates et al., 2006). Public policies, such as campaigns against drunk driving and raising the minimum drinking age, have increased awareness of the risks associated with alcohol consumption (Nunez-Smith et al., 2010). Overall, universal prevention efforts focused on environmental factors appear promising, while selective prevention approaches vary in their impact.

Conclusion

In conclusion, as mentioned earlier, adolescence is a critical period marked by significant brain changes and development, which increases susceptibility to risky behaviors such as alcohol use, potentially disrupting brain maturation and leading to long-term cognitive, emotional, and behavioral challenges. Given the limited research on alcohol use during this sensitive developmental phase, our goal is to provide a review that gathers the existing literature to date and further examine the effects of alcohol use in adolescence.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – I.S.G., M.C.E.; Design – I.S.G., M.C.E.; Supervision – I.S.G., M.C.E.; Resources – I.S.G., M.C.E.; Materials – I.S.G., M.C.E.; Data Collection and/or Processing – I.S.G., M.C.E.; Analysis and/or Interpretation – I.S.G.; Literature Search – I.S.G., M.C.E.; Writing – I.S.G., M.C.E.; Critical Review – I.S.G.

Declaration of Interests: The authors have no conflict of interest to declare.

Funding: The authors declared that this study has received no financial support.

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