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Review Article

Use of Alcohol and Impulsivity during Adolescence: A Systematic Review

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Abstract

Objectives: This systematic review aimed to identify empirical studies that have been done to explore: the instruments that were used to assess impulsivity; the characteristics of the studies, such as origin, cultural aspects, binge drinking; and to verify if greater impulsivity is thought to increase the risk for alcohol use.

Method: PRISMA systematic review search was conducted in the following five databases: PubMed, Embase, Lilacs, Scopus, and Psycnet. Some inclusion and exclusion criteria were used to select the studies, and 14 were analyzed independently.

Results: The results showed that the most used instrument to assess impulsivity was Barratt Impulsiveness Scale (BIS). Some studies have been developed in Brazil and the United States of America, and some have explored other variables, such as family, hopelessness, binge drinking, aggressiveness, and other addictive substances.

Conclusion: In brief, considering impulsive adolescents, it is necessary to have more studies to understand how alcohol consumption can increase behaviors indicative of possible aggression, delinquency or impulsive risk, and hopelessness. In the analyzed studies, it was concluded that for measures of impulsivity, the Barratt Scale (BIS) was the most used and trustable instrument in different countries.

Keywords: Alcohol; Impulsiveness; Binge drinking; Teenagers; Risk taking

Introduction

Increases in alcohol and other drug consumption among adolescents have been reported in different studies worldwide [1-3]. A high consumption pattern featured as drinking more than five alcoholic drinks on one occasion is known as Binge Drinking (BD). It has become a public health issue in several countries due to its high prevalence and consequences, especially in the youngest population [4,5].

Several consequences are related to this excessive consumption, including alcohol and drug addiction. Due to the neurobiological plasticity, and emotional, social, and behavioral changes, adolescents bring out high vulnerability to dependencies once they frequently seek risk taking behaviors to develop their identity and the need for belonging in groups [6,7].

Actually, the nature of impulsivity is heterogeneous [8] and is characterized by deficits in delaying gratification, urge control and impulse, decision making, and maladaptive behaviors [9]. Some studies associate lack of impulse control with high alcohol consumption and polysubstance use [10,11]. Furthermore, it was observed that high levels of impulsivity are associated with higher aggressiveness and stressful life events [10-13]. Another variable that appears to be linked to alcohol consumption and impulsivity is the family history of violence and drug consumption [14,15].

Impulsivity is a multifaceted construct [16] that consists of at least two different but connected dimensions: “impulsive action” and “impulsive choice” [17]. Impulsive action involves difficulty inhibiting or controlling behavior, whereas impulsive choice refers to the tendency to prefer smaller, immediate rewards to larger, delayed ones. Both of these components have been shown to predict different aspects of drug abuse, and acute or chronic use of a drug can alter both types of behavior [18]. This use helps them deal with situations perceived as harmful or stressful, or when faced with difficult or unknown emotions [19]. Thus, the current literature suggests the Urgency Premeditation Persever-

ance Sensation Seeking Positive Urgency (UPPS-P) impulsive behavior scale, which indicates five specific facets of impulsivity [20]. These dimensions are sensation seeking (tendency to pursue novel and thrilling experiences), absence of premeditation (tendency to not take into account the consequences of actions), lack of perseverance (tendency to have difficulty staying focused on a task that can be long), tedious or hard, negative urgency (the tendency to act rashly while in an intense negative mood), and positive urgency (the tendency to act precipitously while in an intense positive mood) [8].

Several studies have observed associations between the different dimensions of UPPS-P and distinct psychopathologies and problematic behaviors (e.g., substance abuse/dependence, aggressive and suicidal conduct). In fact, Lack of Premeditation has been shown to be associated with substance misuse, for example, risk taking propensity was associated with alcohol use in early adolescent and young adult samples [21,22]. Likewise, adolescent impulsivity was associated with early alcohol initiation [23].

Apart from the high impulsivity levels and incomplete brain maturation in adolescence, it is known that social isolation boosts symptoms of stress and anxiety among the population, and these symptoms cause a relatively higher shift in the harmful consumption of addictive substances [24,25]. Based on the topics previously presented, the current study aimed to identify empirical studies that have been done to explore instruments that were used to assess impulsivity and verify what variables are related in adolescents, including impulsivity.

Our hypothesis for the present study was: ‘’Greater impulsivity is thought to increase the risk for drug abuse, and conversely, drugs of abuse produce acute and chronic changes in impulsivity behavioral’’.

Materials and Methods

A systematic literature review was conducted, following the premises proposed by PRISMA [26,27]. The Systematic Review was carried out according to the following steps:

1. Formulation of the research question
2. Production and registration of the investigation protocol
3. Definition of inclusion and exclusion criteria
4. Developing of the research strategy and conducting the reference search
5. Screening of studies based on inclusion and exclusion criteria
6. Evaluation of the quality of studies
7. Data extraction
8. Data synthesis and evaluation of the quality of the studies [28].

Systematic reviews have been used increasingly in health services research during the past few years [29]. This paper is based on the five stage methodological framework developed:

Stage 1: Identifying the research question

The central questions guiding this systematic review were:

1. Can alcohol use increase impulsivity in adolescents?

2. What instruments are most used for impulsivity in the eligibility articles?

Stage 2: Identifying relevant studies

After the initial search in EMBASE and PsycNet, five electronic databases were searched: EMBASE, PubMed, PsycNet, Scopus, and Lilacs, with the last searches performed on September 09, 2022. Date limits were set for 10 years. The search strategy included using descriptors: Alcohol’ AND (‘Impulsivity’) AND (Adolescence’), with necessary adaptations to the specifications of each database (Table 1). Searches between August 22 2022, and September 09, 2022, 2054 materials were identified.

Table 1: Search strategies used for EMBASE, PsychNet, PubMed, Scopus, AND Lilacs

Database		Search Strategy	
EMBASE		‘Alcohol' AND (‘Impulsivity’) AND (Adolescence’)	
PsychNet		(Any Field: “Impulsivity”) AND (Any Field: “Alcohol”) AND (Any Field: Adolescence)	
PubMed	#1	Mesh Terms Alcohol“	
	#2	Mesh Terms Impulsivity“	
	#3	Mesh Terms Adolescence“	
Scopus		All=((‘Alcohol’*) AND (‘Impulsivity*’) AND (Adolescence*’))	
Lilacs		#1	ALL=Alcohol*”
		#2	ALL=(Impulsivity* OR “Impulsiveness*”)
		#3	ALL=(Adolescent* OR Adolescents)
		#4	#1 AND #2 AND #3

Stage 3: Study selection

Quantitative and qualitative peer-reviewed, original, full length research papers were included. The reviewers were previously trained for the task according to the following exclusion criteria:

(a) Reviews and meta-analyses

(b) Theses, dissertations, abstracts, and publications in congresses

(c) Studies that are not in English, Spanish or Portuguese

(d) Animal model research

(e) Sample with subjects under 10 or over 20 years old.

Participants

The participants were adolescents. The population may have been investigated in schools, hospitals, or socio-demographic surveys.

Concept

The key concept that was reviewed was alcohol use during adolescence, including variables where at least social/relational domains occur. Studies with a very narrow focus on Post Traumatic Stress e.g., suicide, were excluded. Elaboration of the PICO strategy, according to the study's eligibility criteria, which was as follows: P (population) adolescents; I (intervention) impulsive behavior; C (compare) adolescents with a low level of impulsivity or intra-group; O (outcome) Alcohol and drugs use in adolescence.

Context

The context of the participants in the various studies was the present use of instruments for impulsivity behavior. Substance use was characterized or described as problematic. The context may or may not include a treatment situation.

Search strategy

When performing the search strategy in the five different databases, a total of 2054 records were identified. These records were exported into Rayyan Software [30-48]. Duplicate records were then removed, resulting in 1345 records for screening the title and abstract. The screening was performed by two authors (FRTA and MGM), who independently compared the titles and abstracts of each record with the inclusion criteria. FRTA and MGM finally agreed to include 14 records as relevant studies for full-text screening. The records considered eligible for full-text screening were then distributed among one other author, RMMA, in addition to FRTA and MGM, who independently screened the full-text studies to assess eligibility for inclusion in the review.

The research tool Rayyan Software [48] was used to combine all materials, remove duplicates (n=1345), and for the independent reviewers (FRTA and MGM) to screen the 2054 unique titles and abstracts simultaneously. FRTA and MGM had a concordance rate of 96.7%, and a third reviewer (RMMA) assessed divergences. With those steps complete, 21 articles were selected for the second round of assessments, this time analyzing full text, according to the same criteria previously stated.

Based on the analysis of the complete texts, 21 articles were selected for the data extraction phase. After this second exclusion phase, data extraction began, considering as inclusion criteria in the study:

(a) Articles that had impulsivity in their title

(b) Studies that evaluated the effect of impulsivity and alcohol used

(c) Researches that made comparisons between groups or intragroup, at this stage seven articles were excluded.

Stage 4: Charting the data

Use of Alcohol and Impulsivity during Adolescence was analyzed by three authors (FRTA, MGM, and RMMA), including three main phases: preparation, organizing, and writing. One author (FRTA) extracted study characteristics, which were also reviewed by MGM and then included in an agreement between RMMA. As this was a systematic review, study quality (e.g., risks of bias, study strength) was considered, but not for a meta-analysis. Tables 2 and 3 show the systematization and categorization of relevant topics from the results of the studies included in this review, reflecting the review questions.

Stage 5: Collating, summarizing, and reporting the results

The main characteristics of the fourteen included studies are presented in Table 2. The studies were grouped by year of publication. Studies published in the same year were grouped in alphabetical order of first authors' surnames. The extracted data were:

Table 2: Summary of the information and characteristics of each study (n=14)

Authors (year)	Country	Method	Instruments	Sample	Findings
Wilhelm, AR, et al. (2020)	Brazil	Longitudinal	Questionnaire to Assess Early Alcohol and Drug Use; Barratt Impulsiveness Scale Youth (BIS); The State-Trait Anger Expression Inventory for Children and Adolescents (STAXI-CA).	115/0 (M/F) between14 a 17 years	Significant differences in: impulsivity due to lack of planning, total impulsivity, internalized anger; young people with a history of drug use have higher scores. Rage internalized and externalized was lower among athletic students compared with other groups.
Bernhardt et al. (2019)	Germany	Prospective Longitudinal	The German short versions of the Barratt Impulsiveness Scale (BIS-15); Substance Use Risk Profile Scale (SURPS); Alcohol Use Disorders Identification Test (AUDIT); Obsessive Compulsive Drinking Scale (OCDS-G); Brief Alcohol Expectancy Questionnaire (AEQ-G); Drinking Motives Questionnaire (DMQ-R); Value-based decision-making (VBDM): DD, (2) PDG, (3) PDL and (4) loss aversion.	N=54 male Between 18-19 years	Alcohol intoxication did not significantly affect the behavior of choice (by time and by monetary rewards/punishments); this contrasts with the study's hypothesis that alcohol increases impulsivity in general; Greater impulsiveness in the face of decisions about "delay discounting" is associated with higher expectations about the effects of alcohol. Greater risk aversion (to gains and losses) is positively associated with real-life alcohol consumption and family history of abuse. Time to ponder and decide was significantly shorter for choices involving losses.

Pérez-Fuentes M, et al. (2019)	Spain	Cross-sectionl	Sociodemographic scale; Adapted version Aggression Questionnaire (AQ); State Impulsivity Scale (SIS);	Sample of n=822 high school students aged 13-18, mean age of 14.84 (SD=0.87). 51.8%(n=426) were men and 48.2% (n=396) were women with mean ages of 14.85 (SD=0.87) and 14.82 years (DT= 0.86), respectively.	29,8% of the students reported use of tobacco; 66,8% reported use of alcohol; Group of alcohol and tobacco users (Cluster 2) have higher means for all AQ items scores; Cluster 2 (with violence scores over the mean of the total sample) had a significantly higher score (M=14.77) than the rest of the groups.
Wilhelm AR, et al. (2019)	Brazil	Cross-sectional	Strengths and Difficulties Questionnaire (SDQ); adaptation of the instrument proposed by the World Health Organization and developed by the Research and Reporting Project on the Epidemiology of Drug Dependence; Socioeconomic Survey; Adapted Barratt Impulsiveness Scale (BIS) for youth; Adapted of Go/No-go task; Five Digits Test (FDT); Reduced version of WAIS.	Sample of early and pre adolescents from private and public schools aged 10-16 (n=190), 58,9% participants were females.	60% of adolescents surveyed had used alcohol and 17% had used illegal drugs. Almost 15% of adolescents aged 10–12 years reported having tried alcoholic beverages. Association between age and first use of alcohol was highly significant, p=.58, p <.001. Early alcohol consumption was not influenced by type of school, which raises the question of whether there is a more pervasive cultural process. There were school differences in total BIS score (U=2874, p<. 05) and non-planning BIS score (U=2564.5, p<.001), reflecting better performance by students in private schools.
Hamilton KR, et al. (2019)	U.S.A	Cross -sectional study	Demographic characteristics were assessed (including sex, race/ethnicity); Youth Risk Behavior Surveillance System (modified); Eysenck 1-7	N=246 135/111 (M/F) -Between 11 and 15 yo (M=13.06)	Trait impulsivity assessed during early adolescence predicted the steepness of alcohol use escalation during adolescence, a variable with significant prognostic value for long-term AUDs and behavioral problems. This research underscores the importance of understanding trait impulsivity during early adolescence, and suggests that early trait impulsivity may have predictive value with respect to later alcohol use disorder and behavioral problems.
Seo S, et al. (2019)	Germany	Longitudinal, cross-sectionl study	Life Events Questionnaire (LEQ); 60-item NEO Five-Factor Inventory; Novelty-Seeking scale of the revised Temperament and Character inventory (TCI-R); Substance Use Risk Profile Scale (SURPS); European School Survey Project on Alcohol and Other Drugs (ESPAD); Timeline Follow Back Questionnaire (TLFB).	N=1000 Between 14 and 19 years (M=14.4 years)	Heavy drinking was associated with lower gray matter volume in bilateral ACC, MPFC, thalamus, middle, medial and superior OFC as well as left amygdala and anterior insula and right inferior OFC. This effect was stronger in females than in males. In both genders, they observed that impulsivity and facets of novelty seeking at the age of 14 and 19, as well as hopelessness at the age of 14 are risk factors for heavy. drinking at the age of 19.Stressful life events with internal (but not external) locus of control were associated with heavy drinking only at the age of 19. Personality and stress assessment in adolescents may help to better target counseling and prevention programs. This might reduce heavy drinking in adolescents and hence reduce the risk of early brain atrophy, especially in females. This could additionally reduce the risk of developing alcohol use disorders later in adulthood.
Eseed R, Khoury-KassabriM. (2018)	Israel	Cross-sectional	Monitoring the Future (MTF), survey for drug use; My Exposure to Violence Scale (MYETV); Adolescent Fam- ily Process (AFP) Scale; Adapted version of the Social Network Assessment Questionnaire, for peer delinquency; impulsivity was measured using four items from the Teen Conflict Survey; Sociodemographic Scale.	Sample of n=2,948 Arab Muslim students from Israel, 59.6% girls, ages 12–18 (M 14.81, SD 1.41), with 49.7% in secondary schools	9.6% of the students reported having drunk alcohol during the previous year; 49.2% of the students had experienced violence victimization; experience of violence has significant and positive correlation with alcohol use; affiliation with delinquent peers increased alcohol use; parent– adolescent communication has negative correlation with adolescent use of alcohol.

Pilatti A, et al. (2017)	Argentina	Longitudinal	Adapted version of Impulsivity Scale (UPPS-P); Local Alcohol consumption Questionnaire (Pilatti et al); Balloon Analogue Risk Task (BART); Go-Stop Impulsivity Paradigm (Go- Stop); Single Key Impulsivity Paradigm (SKIP);	Sample. 161 adolescents (50.3% female) aged 15-18 (Mean age=15.83±.85) enrolled in four high-schools of Cordoba, 72% of public schools.	Highest correlations between risk-taking and impulsivity traits were found between the two dimensions of urgency (. 64) and between lack of premeditation and lack of perseverance (.47). Positive urgency was positively and significantly correlated with usual frequency of consumption (.17, * p≤ .05 and.20, p≤ .05), with high episodic consumption (0.19, p≤ .05), and with the amount of alcohol consumption (0.19, p≤ .05).
Wilhelm, AR, et al. (2017)	Brazil	Longitudinal	Questionnaire about drug usage start o Barratt Impulsiveness Scale (BIS – age adapted); Go/NoGo Task; Five DigitsTests;	112 adolescents (gender differences weren't assessed) Between 13 and 16 yo (M=14,84 years)	There were significant differences in impulsivity among all scales of BIS; there were no differences among inhibitory control variables. Impulsive behavior in adolescents occurs due to lack of maturation in the prefrontal region and that may be associated with alcohol consumption.
Dougherty et al. (2015)	U.S.A	Longitudinal	Immediate Memory Task; GoStop Impulsivity Paradigm; Balloon Analogue Risk Task- Youth; Family History were assessed;	N=386 FH+ 35/46 (M/F) → Mean age: 11.62 FH- 152/153 (M/F) → Mean age: 11.52	The groups had similar age and racial demographics, although the FH+ group had lower socioeconomic status and a slightly higher frequency of Hispanic participants. FH+ adolescents also had lower IQs, although the mean of both groups was in the average range (i.e., 90 to 110). A minority of FH+ adolescents (34%) met the criteria for one or more DSM-IV-TR disorders. Study attrition during the prospective longitudinal assessment period was low (10.8% for FH+ and 7.4% for FH youths) and was unrelated
Lopez-Nunez et al. (2015)	Spain	Longitudinal	Spanish version of the Rutgers Alcohol Problem Index (RAPI); Mann-Whitney U tests were conducted to determine whether delay discounting rates (using the area under the curve, AUC) differ as a function of both binge drinking within the last month and RAPI scores.	494 adolescents (55.7% male) who were randomly recruited from ten secondary schools in the Principality of Asturias (northern Spain). Mean age was 13.97 years (SD=0.526)	Also, participants who reported problems related to alcohol use had significantly higher delay discounting rates (Md=0.05, n=22) compared to those who did not (Md=0.18, n=472), U=3839, p=.039,=.37.
Hamilton KR. et al. (2014)	USA	Longitudinal	Data from Sociodemographic scale; Eysenck Impulsiveness Scale; Balloon Analogue Risk Task e Youth (BART-Y); modified version of the Youth Risk Behavior Surveillance System.	Sample of early adolescents (n=277), was 44.4% female, with 48.8% identifying as White, 35.5% Black, and 15.7% Other.	Higher levels of risk-taking in White adolescents (M=42.13, 95% CI [39.12, 45.15]) than Black adolescents (M=33.60, 95% CI [29.92, 37.29]). Johnson-Neyman technique suggests that the association of impulsivity with drinking initiation becomes increasingly stronger at lower levels of risk-taking propensity.
Malmberg et al. (2013)	Netherlands	cross-sectional	Substance Use Risk Profile Scale (SURPS)	The age of the participants ranged from 11 to 14 years (M=12.92, SD=.43) at T0 and 97% were of Dutch ethnic origin. N=1068 (507/561) (M/F)	Tobacco use was predictive of anxiety sensitivity. Anxiety sensitivity does not predict alcohol and tobacco use in adolescence. Positive relationship between tobacco use and"hopelessness"; negative relationship with alcohol use. Students who used more alcohol often reported higher levels of impulsivity.
Pilatti A. et al. (2013)	Argentina	Cross-sectionl	Measures of Alcohol (4 item scale), Tobacco and drug use was coded with a 1 or 0 for Drinking Onset (DO); Scales (13 item each) from the Spanish-adapted version of the Big Five Questionnaire for Adolescents; Adapted 18-item Barratt Impulsiveness Scale for Adolescents (BIS-11-A); Ten items from two argentinian scales for aggressive behavior; The Alcohol Expectancy Scale for Argentinean Adolescents.	n=583 adolescents aged 13– 18 years (M=15.01 years; SD=1.5 years; 59.5% female) from the city of Cordoba, Argentina.	Heavy drinkers (HD) and risky polysubstance users (RPSU) were characterized by a lack of impulse control and greater disinhibition; Aggression was significantly higher in RPSU than in the other users; Substance Use Naive (SUN) and Light drinkers (LD) anticipated more risk and aggression effects from drink- ing alcohol; Early drinkers (EDs) were more likely to to report drunkenness episodes and drug use.

1. Authors (years)
2. Country
3. Method
4. Instruments
5. Sample
6. Findings.

Findings

The findings of the review are presented according to the review questions. Table 2 reports the general information and major findings of the reviewed publications.

Results

The review included 14 articles (Figure 1), which assessed the instruments used in each study aiming to measure impulsivity and verified the correlations between impulsivity. It was found that in total (n=5), studies have used Barratt Impulsiveness Scale (BIS) adapted from each country, and consequently has been the most used instrument to measure impulsivity. An overview of the studies that investigated impulsivity and other variables, such as first-age use of alcohol, hopelessness, and family perspectives. Most of the studies were developed in Brazil and the United States.

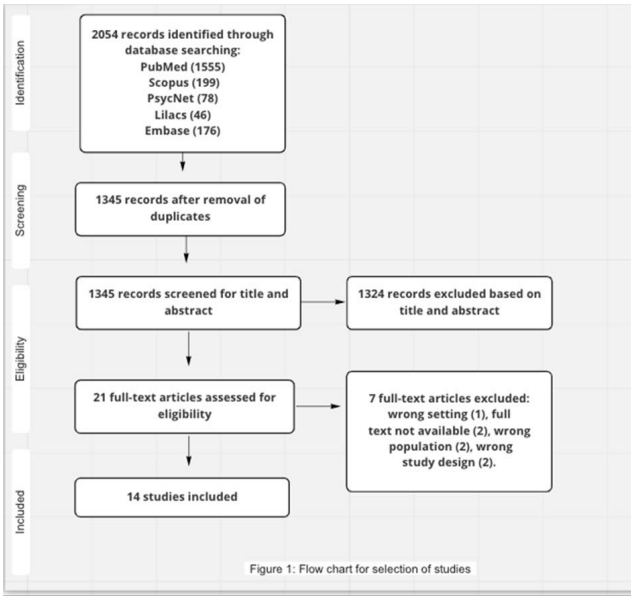

Figure 1: Flow chart of steps performed during the systematic review

The use of impulsivity testing was an inclusion criterion for this review; thus, all studies performed at least one behavioral task or socio-demographic. Despite the diversity of tasks used, some seemed to be consistently used to assess certain behaviors. Risk-taking was assessed by 53.2% of the studies, while sensation-seeking behavior was assessed by 37.3% and Impulsiveness by 55%.

The decline in impulsivity and increase in alcohol use across adolescence observed in the North American study [31,36] are consistent with the findings of the Australian study [49-56]. Although the slopes of alcohol use and impulsivity were not significantly correlated the findings may highlight the predictive nature of early trait impulsivity as it relates to alcohol use escalation. Studies present that a high initial level of trait impulsivity predicted a more rapid rate of alcohol use escalation; initial levels of impulsivity and alcohol use escalation were not associated in the Australian study [55,56].

Concerning drinking and personality change, it may thus be the case that youth drinking operates as a marker for a wide range of maladaptive adjustment behaviors that might influence negative personality change [50].

The importance of understanding trait impulsivity during early adolescence suggests that early trait impulsivity may have predictive value for later alcohol use disorder and behavioral problems. Early drinkers were more likely to report drunkenness episodes and drug use.

The studies included in this review were published between 2013 and 2020, Table 2 with 64% (n=9) published in the last five years. Most studies (n=12) had a mixed sample (male and female adolescents) while two only included boys and none with girls, but not all of them distinguished the result by sex because they considered that the difference was not statistically significant. The samples ranged from 54 to 2,948 participants in the study with a smaller group and a larger group, respectively, and when considering all studies, a total of 8,456 adolescents (mean 134.7; standard deviation 162.8) with a high standard deviation.

Regarding age, the samples followed the threshold considered eligible, with a total range of 10 to 19 years and averages between 10.83 and 19.3. The age range was presented in 14 of the studies, and in 11, only the mean appeared, the most recurrent being 13 and 14 years old, each representing 25.1% (n=5) of the total. Victimization and aggression statuses were equally divided into 14 articles for both, and only one article was aimed at investigating peer aggression among victimized adolescents in their families. Externalization behaviors were considered aggressive, whether or not they involved violence, and adolescents who witnessed some type of aggression or were directly attacked in some way were classified as victims [30,31].

In order to assess the impulsivity of these adolescents, impulsivity questionnaires were applied and interviews, socio-demographic questionnaires, and questionnaires to assess life events were used. Among the impulsivity questionnaires, the ones that appeared the most were the BIS (Barratt Scale Youth), and the socio-demographic ones were mentioned only in 4 studies, while others used only structured or semi-structured interviews and the Substance Use Risk Profile Scale (SURPS).

It is noteworthy that in all articles, the use of the consent and permission form was mentioned, some signed by parents and adolescents and others only by adolescents, depending on the age and choice of research subjects. It was also left free withdrawal at any point in the process. In some studies, the researchers chose to give participants a bonus or offer a subsidy.

Seven countries are present in the 14 eligible articles, including Argentina, Brazil, Germany, Israel, Netherlands, Spain, and The United States of America (Figure 2A). Several instruments were used for data collection and analysis, and they were not homogeneous. Some instruments appeared more being Barratt Impulsiveness Scale Youth (BIS), Substance Use Risk Profile Scale (SURPS), Balloon Analogue Risk Task (BART), and Sociodemographic Scale distributed in the seven countries present and repre-

sented in (Figures 2B and 2C).

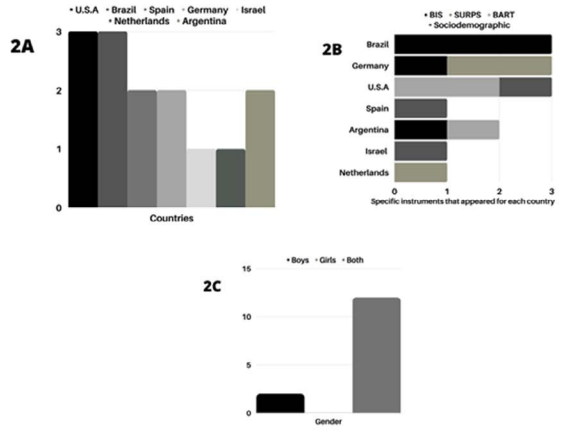

Figure 2: (A) Countries in which the studies were carried out and the number of study by country; (B) The most used instruments in each country and the ones that appeared the most in the 14 eligible studies. Being Barratt Impulsiveness Scale Youth (BIS), Substance Use Risk Profile Scale (SURPS), Balloon Analogue Risk Task (BART), and Sociodemographic Scale. (C) Comparison between the proportion of samples with a female, male, and both, the latter being the most frequent.

Cultural aspects: studies that included races, ethnicities, or the cultural relevance of that country in the alcohol context were considered cultural aspects.

Binge drinking: Adolescents who reported in the questionnaires or in the history of drinking in sequence and compulsively.

Personality traits: Personality traits were considered in studies in which these traits were evaluated through specific instruments to measure these findings, such as the: ''Personality profiles and substance use''.

Table 3 presents information that may bias the research results since not all analyzed articles followed the same protocol. Some studies have used biological samples or neuroimaging of brain regions for more detail and physiological assessment [12,14]. Another data presented as a possible bias is related to cultural aspects, such as the application of questionnaires and evaluations in different countries, and cultural aspects such as drinking with family members, socio-demographic data, and even religion were evaluated in some cases. In a few cases, the questionnaire's psychological and behavioral questions were answered not only by the research subject, but the adolescents' data were complemented with the information provided by parents, caregivers, or teachers.

Table 3: Possible biases

Author (year))	Biological Samples/ Neuroimaging	Cultural Aspects	Binge Drinking	Used Placebo	Personality Traits
Wilhelm AR, et al. (2020)	Not	Yes	Yes	Not	Not
Bernhardt, et al. (2019)	Yes - Baseline blood phosphatidyl ethanol (PEth) levels were used as biomarkers to quantify alcohol consumption	Yes	Yes	Yes	Yes Anxiety sensitivity Hopelessness, Impulsivity, Sensation seeking
Perez-Fuentes M. et al. (2019)	Not	Not related	Not related	Not	Yes- Anger and hostility
Wilhelm A. R, et al. (2019)	Not	Yes	Yes	Not	Not
Hamilton R. K. et al.(2019)	Not	Yes	Yes	Not	Not related
Seo S. et al. (2018)	Yes - Neuroimaging using Statistical Parametric Mapping 8(SPM8) software package and the toolbox oxel-Based Morphometry 8 (VBM8)	Yes	Yes	Not	Yes neuroticism, extraversio, openness, agreeableness and conscientiousness
R.Khoury-Kassabri, M. (2017)	Not	Yes	Yes	Not	Not
Pilatti A, et al. (2017)	Not	Yes	Yes	Not	Not
Wilhelm AR, et al. (2017)	Not	Not related	Yes	Not	Not
Dougherty, et al. (2015)	Not	Yes	Not related	Not	Generalized anxiety Disorder Separation, Anxiety Disorder and Specific phobia

Lopez-Nunez, et al. (2015)	Not	Not	Yes	Not	Not
Hamilton K. R, et al. (2014)	Not	Yes	Yes	Not	Not Related
Malmberg, et al. (2013)	Not	Yes	Yes	Not	Yes personality profiles (i.e., anxiety, sensitivity, hopelessness, sensation seeking, and impulsivity)
Pilatti A, et al. (2013)	Not	Yes	Yes	Not	Yes - Personality Traits Extroversion Conscientiousness Impulsiveness

Only in one study [14] was it seen that biological samples and the use of placebo were used, being the only study that suggests that adolescents generally do not show more remarkably impulsive choice behavior when under the influence of alcohol. Considering that studies were carried out with men and women in adolescence, a significant bias was also seen and presented in Table 3. The binge drinking (BG) behaviors were mentioned in 11 articles as having been taken into account at the time of screening the participants and measuring the data, despite the fact that some of them answered the questionnaires on the consumption of alcohol and other drugs.

The results also indicated bias because they were not presented in all articles through numerical measures, and the way in which they were presented was very different, with some with the general final result others divided by social factors, by questionnaire, by group, by sex and with different types of instruments. Personality traits which were shown in some studies, proved to be an essential bias factor in several applied instruments and their application form. Six studies had differences in the findings. To investigate the two-way relationships between personality and substance use, several personality profiles were tested separately, e.g. (anxiety sensitivity, hopelessness, sensation seeking, and impulsivity), and the three substance use outcomes (i.e., alcohol use, excessive alcohol consumption, and tobacco use) [37].

Discussion

This systematic review aimed to identify empirical studies that have been done to explore instruments that were used to assess impulsivity and verify what variables are related in adolescents, including impulsivity. Apart from that, the aim was to appraise the association between impulsivity and alcohol consumption. So as to obtain a better understanding of the impulsivity variable, the scales and tests used in the studies were observed. The Barratt Impulsiveness Scale (BIS) was found to be the most used instrument due to its current conceptualization of impulsiveness as a construct and its impact on a broad range of domains, including mental health, business, criminal justice, and education.

In this study, almost all papers compare impulsivity and the use of alcohol or the relationship between both. Some studies also mentioned that several side effects might arise from excessive use of alcohol or substance use profiles, including violence, isolation, mental distress, and the severity of behavioral problems [3,32,39]. Alcohol consumption can also increase consequent behaviors such as aggression, delinquency, or impulsive risk, as well as hopelessness [30,34,36,37]. In the analyzed studies, early drinkers were more likely to report drunkenness episodes and drug use and the consequences might harm psychological, social, and functional aspects of adolescents' lives.

Some behavioral differences are present between boys and girls who are more likely to report internalizing symptoms, and boys are more likely to report externalizing symptoms [40,41] which means that the effects of early alcohol use on other risk behaviors may vary for girls and boys. In addition to alcohol disorders later in life, early drinking also predicted risky sexual behaviors in adolescent girls [42].

Although there is a body of research focusing on internalizing pathways to substance abuse among youth, [43-45] the role of gender and race/ethnicity differences in these processes is not fully understood. In our review, this difference was not noticeable, although, in a German study [12] it was found that personality traits such as impulsivity, extraversion, and extravagance at age 14 and age 19 are associated with a higher likelihood of heavy drinking at age 19 in both genders and stressful life events at age 19 but not at age 14 are positively associated to heavy drinking in both genders at age 19 [12]. Regarding race/ethnicity, differences were reported in an American context, indicating that white participants reported more alcohol use than non-white youth, even though, sex was not significantly cross-sectionally related to either alcohol use or impulsivity [36].

An important reason for concern is related to adolescents' perceptions of risks associated with alcohol. Factors such as school, friends, and family environment are variables for adolescents' awareness when dealing with alcohol use and risky behavior. These findings are also seen in a study developed consistent with previous research, [3,46,47] where self-derogation was associated with peers' pro-alcohol norms, which was linked to lower risk perceptions, such as impulsivity, lower personal disapproval of use, and increased drinking. The findings demonstrated the interplay between factors and highlighted parental involvement as an important first step in a path linked to either alcohol

abstinence or use through factors relating to adolescents' proneness to drink.

The school and the family have, therefore, a fundamental role in the social construction of these young people. Addressing the risk of alcohol use by adolescents cannot be seen as a taboo but as a reality that must be discussed by public policies aiming to help these young people in this discovery process. In this case, it was found that family functions significantly impact adolescents' behavioral problems [31].

This topic was assessed by a cross-sectional study from Israel which used a large representative sample to investigate Arab Muslim adolescents' use of alcohol. The findings showed that adolescents who indicated greater exposure to community violence victimization also indicated an increase in the risk for adolescent affiliation with delinquent peers, elevating the use of alcohol and impulsivity levels [30].

A few lines of evidence suggest that impulsivity is a unique vulnerability factor for alcohol drinking, which further predisposes to increased alcohol use. Longitudinal studies indicate that poor ability to delay gratification at a young age is associated with a greater likelihood of substance use and dependence in adulthood [49-51].

Binge drinking and alcohol abuse are associated with increased impulsivity understood both as an impulsive personality trait as well as behavioral impulsivity. While heightened impulsivity predisposes to frequent alcohol use, acute alcohol intoxication independently diminishes inhibitory control resources, which may lead to even heavier drinking episodes. Likewise, repeated episodes of heavy drinking followed by withdrawal periods and subsequent relapse lead to structural modifications in the brain regions associated with emotion processing and higher cognitive functioning, resulting in poorer self-control and impulsive behavior, further promoting drinking [52,55].

The notion that specific individuals may be more reactive to intense emotional states is getting increased attention and is referred to as urgency. Some individuals may tend towards impulsive behaviors more when experiencing negative emotions, while others when experiencing positive ones. These features are referred to as negative and positive urgency, respectively [51,52].

Experiencing emotional distress guides people to engage in impulsive behaviors to improve their mood. Research also suggests that indulging in impulsive drinking may be used by individuals with high trait urgency to regulate their mood. For example, a recent study on university students has shown that individuals displaying high levels of negative urgency may consume alcohol to ameliorate their emotional distress due to strong desires to grow positive and decrease negative experiences. Cumulative stress is related to increase hazardous drinking among individuals reporting high levels of trait impulsivity [54]. Similarly, studies reported that the relationship between daily anxiety and alcohol intoxication was more robust for individuals with greater negative urgency. Together, these results suggest that managing emotional distress may motivate drinking in impulsive individuals [53,54].

In addition, more studies can be developed to investigate the relationship between the first time they consumed alcohol and other drugs, the cultural and family relationships in the context of the development of this individual, and the differences between girls and boys could be a promising line of future investigations.

Conclusion

Behavioral differences are present between boys and girls who are more likely to report internalizing symptoms, and boys are more likely to report externalizing symptoms. In order to have more reliable data, it is suggested that further studies can be carried out, associating alcohol/drug consumption and impulsivity in adolescents. In these promissory studies, the Barratt Impulsiveness Scale (BIS) is considered to be a suitable instrument to assess impulsivity. However, these results should be accounted for carefully considering the changeability of instruments used in the reviewed studies.

The data collected covered several significant biases to be considered, however, considering impulsive adolescents, it is essential to have more studies to understand that alcohol consumption might increase impulsive behaviors, which can be seen through aggression, delinquency, or impulsive risk and hopelessness behaviors. As adolescence is a phase of significant biological and social changes, it is crucial to be aware of these aspects, primarily when related to social support, for a greater possibility of dealing with conflicting situations. The family and school are the two places where adolescents spend most of their time, and this relationship with family members and peers can affect the subject's life, mainly because it is the moment of group identity formation.

Limitations of the study

There are some limitations of this systematic review and first of all, caution is warranted when generalizing our results to other populations. We have seven countries involved in this study, many countries in which laws and norms regarding substance use are more liberal and actual substance use in adolescence is high compared to most other countries.

It seems plausible that the norms regarding substance use are more liberal in some countries and might have influenced the study's outcomes. In line with this point, many factors influence personality development or substance use trajectories (e.g., life events, family, peers, and socio-demographics). As much as the ages were within the proposed inclusion criteria, the amplitude was also diverse. The division between the sexes for each group was not equal, and only in some studies did the control group have the same n as the experimental group. The interventions carried out also had their differences, having an interpersonal relationship that was measured by questionnaires, personality variables, and family factors. Another signif-

icant limitation was the way of presenting the data, which in some cases was more detailed, in others in clusters, and there was still a lack of information between groups.

Second, more boys report substance use than girls, and boys generally report more excessive use. We do not have female-only studies in this review. Many studies try to control sex and education. It is still unclear if other factors could explain additional variance in the personality or substance use variables or if the model paths might vary by sex and education. Future research on the interrelations between personality profiles and substance use should address these issues.

Third, many studies may have been limited by using a community sample of adolescents rather than a clinical sample, which could have allowed us to observe higher levels of impulsivity and alcohol use. Future developmental research should examine the relationship of behaviorally-assessed impulsivity to multiple aspects of alcohol use. In conclusion, these findings underscore the value of early-age trait impulsivity in predicting the escalation of alcohol use across adolescence and support the rationale for personality-based alcohol misuse prevention efforts.

Conflict of Interest

The authors declare that there are no conflicts of interest.

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