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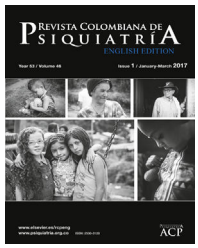

Review Article

Relationship between alcohol consumption and cognitive impairment in the adult population over 60 years of age: A systematic review

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ABSTRACT

Introduction: Alcohol is the most consumed substance in Western culture and its use is a causal factor in more than 200 diseases and disorders. Our objective was to determine the relationship between alcohol consumption and cognitive impairment in people aged ≥60, and identify which cognitive functions are most affected by prolonged alcohol consumption.
Methods: Search in MEDLINE, PsycInfo, Psicodoc, Cochrane and Web of Science databases. The search was limited to articles published from 2010 to 2020. A total of 8716 articles were obtained. Those repeated and unrelated to the topic were eliminated, leaving a total of seven articles: five longitudinal studies, covering the relationship between alcohol and cognitive impairment; and two cross-sectional studies, which helped identify which cognitive functions are more affected. This systematic review was carried out in accordance with the criteria of the PRISMA statement.
Results: Most of the studies found conclude that no or excessive alcohol consumption is associated with a higher risk of cognitive impairment, compared to moderate consumption. In addition, excessive and prolonged alcohol consumption can evolve into secondary alcoholic dementia such as Marchiafava–Bignami disease, Wernicke–Korsakoff syndrome or pellagra. In people with alcohol use disorder, the cognitive functions that are most affected are executive functions, visuospatial skills, attention and memory.

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Relación entre el consumo de alcohol y el deterioro cognitivo en población adulta mayor de 60 años: una revisión sistemática

Palabras clave:
Alcohol
Deterioro cognitivo
Demencia
Funciones cognitivas
Demencia alcohólica
Enfermedad de Marchiafava
Bignami
Encefalopatía de
Wernicke-Korsakoff
Pelagra

RESUMEN

Introducción: El alcohol es la sustancia más consumida en la cultura occidental y su consumo es un factor causal en más de 200 enfermedades y trastornos. El objetivo es conocer la relación entre el consumo de alcohol y el deterioro cognitivo en personas de edad ≥ 60 años, así como qué funciones cognitivas se ven más afectadas por un prolongado consumo de alcohol.

Métodos: Búsqueda en las bases de datos MEDLINE, PsycInfo, Psicodoc, Cochrane y Web of Science. Se acotó la búsqueda a artículos publicados entre 2010 y 2020. Se obtuvieron 8.716 artículos. Se eliminaron los repetidos y no relacionados con el tema, con lo que quedaron en total 7 artículos. De estos, 5 estudios longitudinales sirvieron para conocer la relación entre el alcohol y el deterioro cognitivo y 2 estudios transversales, para conocer qué funciones cognitivas están más afectadas. Esta revisión sistemática se ha llevado a cabo de acuerdo con los criterios de la declaración PRISMA.

Resultados: La mayoría de los estudios encontrados concluyen que el consumo de alcohol nulo o excesivo se asocia con un mayor riesgo de deterioro cognitivo que el consumo moderado. Además, un consumo de alcohol excesivo y prolongado puede evolucionar hacia una demencia secundaria alcohólica como, por ejemplo, la enfermedad de Marchiafava-Bignami, la encefalopatía de Wernicke-Korsakoff o la pelagra. Por otra parte, en personas con trastorno por consumo de alcohol las funciones cognitivas que se ven más afectadas son las funciones ejecutivas, las habilidades visuoespaciales, la atención y la memoria.

Introduction

According to the Observatorio Español de las Drogas y las Adicciones (OEDA) [Spanish Observatory of Drugs and Addictions],[1] the mean age for first alcohol use in 2017 was 16 years of age and the prevalence of alcohol use in that year was 75.2%. It is estimated that worldwide 237 million men and 46 million women suffer from alcohol use disorder (AUD).[2] The highest prevalence rates among men and women are recorded in the European Region (14.8% and 3.5%) and the Region of the Americas (11.5% and 5.1%).[2]

Cognitive impairment is defined as the decline of cognitive functions, either due to changes attributable to the physiological process of ageing (physiological deterioration is natural and results from the ageing process, and its magnitude—or at least evidence thereof—correlates negatively with the intellectual level achieved) or to a pathological deterioration (the "portion" of a measurement of deterioration that is not attributable to physiological deterioration and that is usually assumed to have an organic aetiology, which would also imply a functional deterioration, which may or may not be totally or partially reversible) due to other factors (primary, of neurodegenerative cause, or secondary, which are due to tumour-related, vascular, toxic, metabolic, deficiency-related, infectious, or trauma-related factors, among others). Depending on the degree of deficit in cognitive functions and how this affects activities of daily living, the disease is classified as mild cognitive impairment (or mild cognitive disorder) or dementia, according to the ICD-10, or as mild or major neurocognitive disorder according to the DSM-5. Having said this, when we refer, later in the text, to the clinical evolutionary stage, and/or to the intensity or severity of the cognitive impairment, we use the terms "mild cognitive impairment" or "(mild, moderate or severe) dementia"; conversely, when the intensity or severity of the clinical condition is not indicated or there is no reference to the clinical evolutionary stage, we simply say "cognitive impairment".

Long-term alcohol use can in some cases progress to mild cognitive impairment (MCI) or dementia syndrome.[3–5] More specifically, in some cases it can evolve into secondary alcohol-related dementia (of toxic and/or deficiency-related aetiology), such as Marchiafava–Bignami disease, Wernicke–Korsakoff syndrome and pellagra, which are caused by some intracerebral or extracerebral pathological process of a determined non-degenerative aetiology.[6]

Marchiafava–Bignami disease (MBD) is a demyelination of the corpus callosum in which patients may present with a change in mental status of acute, subacute or chronic onset, which ranges from lethargy to coma, seizures, eye movement disorder, memory loss, gait disorders and speech disturbances.[7] The parts of the corpus callosum most often involved in the acute form are the genu and the splenium, whilst alterations have also been seen in the corpus in the chronic form.[8] Several studies[9–12] show the symptoms presented by different patients after a long history of alcohol use. These symptoms include altered state of consciousness, malnutrition, ataxia and speech problems. Furthermore, magnetic resonance imaging (MRI) has revealed symmetrical hyperintense changes in the corpus callosum, lesions outside of the corpus callosum and, in one case, cystic necrosis

in the central layer of the genu and linear necrosis in the splenium.[12] Although no specific treatment is available for MBD, these patients were administered different vitamins, such as thiamine,[10–12] folic acid,[11] vitamin B_{12}[11] and vitamins combined with glucocorticoids.[9] Only half of the patients fully recovered from all the symptoms, and the rest had sequelae or poor outcomes (death, listless state or vegetative state).

Wernicke–Korsakoff syndrome (WKS) is a brain disorder caused by a thiamine (vitamin B_1) deficiency. The term refers to two different syndromes. Wernicke's encephalopathy is characterised by confusion, ataxia and nystagmus and Korsakoff's syndrome is a type of dementia characterised by memory loss, confabulation, and cardiac, vascular and nervous system problems.[13] Two single case studies[14,15] show the effects of prolonged alcohol abuse in two middle-aged patients. These patients presented with disorientation, altered eye movements and muscle atrophy, as well as visual hallucinations, overall cognitive impairment,[14] memory disturbances and a rash on the limbs.[15] In the latter case, the diagnosis was WKS comorbid with pellagra. Both were administered thiamine and one of them was also administered niacin.[15] In one case, the treatment was not effective, providing an example of a patient with acute WKS that became chronic.[14]

Pellagra-induced dementia is caused by a persistent lack of niacin (vitamin B_3) and is a multisystemic condition with gastrointestinal, skin and nervous system involvement. The initial symptoms are neuropsychiatric: irritability, depressed mood, decreased attention and memory impairment. Oppositional hypertonia, myoclonus and peripheral neuropathy may also subsequently manifest, which can progress to stupor and coma.[3] Two single-case studies[16,17] report on two patients with a history of alcohol use for more than 30 years. Their symptoms were seizures, loss of consciousness, faecal incontinence,[16] delirium, impaired cognitive functions (sustained attention, short- and long-term memory loss), as well as restlessness, aggressiveness and insomnia, and erythematous and scaly skin lesions.[17] Both were given niacin and one[16] also received thiamine, folic acid, vitamin B_{12} and vitamin D. The patients began to improve and were discharged within a week.

We need to highlight the lack of literature available on secondary alcoholic dementias, and the fact that the few studies are of a single case.

Objective

The main objective of this study was to carry out a systematic review with the aim of determining the relationship between alcohol use and cognitive impairment in the adult population over 60 years of age, and which cognitive functions are most affected by prolonged alcohol use.

Methods

This systematic review was conducted according to the PRISMA[18] statement criteria in the MEDLINE, PsycInfo, Psicodoc, Cochrane and Web of Science databases. We used the following descriptors/keywords: "Alcohol and cognitive impairment", "Alcohol and dementia", "Pellagra or niacin deficiency and cognitive impairment", "Pellagra or niacin deficiency and dementia", "Encephalopathy Wernicke–Korsakoff and cognitive impairment", "Encephalopathy Wernicke–Korsakoff and dementia", "Encephalopathy Marchiafava-Bignami and cognitive impairment", "Encephalopathy Marchiafava-Bignami AND dementia" AND "Alcohol-related dementia".

Initially we obtained a total of 8716 articles (MEDLINE, n = 2964; PsycInfo, n = 192; Psicodoc, n = 23; Cochrane, n = 2076; Web of Science, n = 3461). We then filtered the search by language, English and Spanish, and period, publications from 2010 to 2020. We ruled out duplicate articles (n = 693) or articles not related to the theme of the study (n = 7932), including articles in which the sample comprised animals (n = 981), that included variables such as drug use (n = 283), that referred to other types of dementia other than those in our study (n = 244) or for other reasons (n = 6040), such as: the sample comprised adolescents; the article discusses deficits in cognitive functions but that are not alcohol-related; it discusses treatments or neuropsychological tests; or they are systematic reviews. We also discarded publications in languages other than Spanish or English (n = 377). Seven studies were finally selected for this systematic review (five longitudinal and two cross-sectional); the algorithm for the article selection procedure is shown in Fig. 1.

Selection and quality criteria

We only considered complete original publications published in high-impact scientific journals (Journal Citation Reports [JCR] and/or SCImago Journal Rank [SRJ]), taking into account the position and quartile that the journal occupied in the ranking of its speciality[19,20]; methodologically rigorous studies dealing with the association between prolonged alcohol use, cognitive impairment and dementia (secondary deficiency dementias [pellagra and WKS] and toxic dementias [alcohol-related dementia and MBD])[6]; with a high validity index (studies that could be generalised), carried out using the tool for critical reading and appraisal of studies described by Berra et al.[21] to assess the quality of the selected articles (Table 1); studies that included subjects aged ≥60 years old with prolonged alcohol use: the reason for restricting it to this population is that three of the five longitudinal studies used in our study had a follow-up of >15 years and the age range of their participants covers a difference of about 15 years, so a large number of the people who make up their sample are over 60 years old. Furthermore, when these studies were completed, the age of the entire sample was >60 years due to the long study period. The other two longitudinal studies had a much shorter follow-up (between 4.5 and 6 years), but their samples at the time of starting the study were aged >55 years, and so when these studies were completed, they were also over 60 years old. In the case of the cross-sectional studies, it should be noted that they included an older age range and their participants were over 60 years old.

A statistically significant sample size was sought by selecting articles with a sufficiently large sample in each of the specified groups so that the results could all be compared

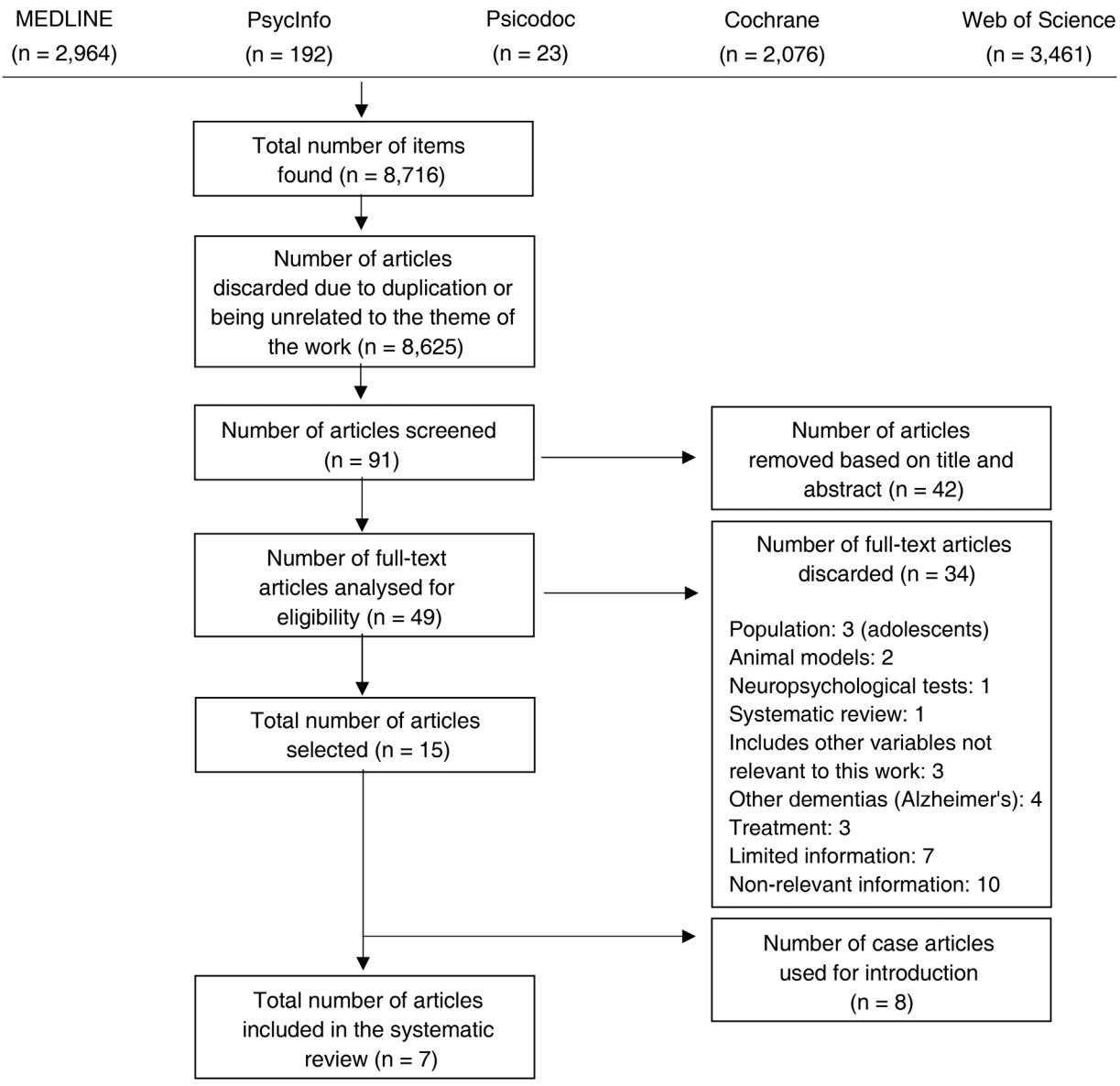

Fig. 1 – Procedure for selecting articles for the systematic review.

and it would be possible to obtain conclusions that could be generalised to the population under study.

We considered the use of psychometric tools for cognitive assessment of the subjects in the sample to determine their cognitive condition.

We considered that the argumentation of the results (both positive and negative) was coherent, and that the articles gave precise details of the results obtained by means of the methodology used. We also considered that their conclusions were in line with everything mentioned in the results, with reference made to any limitations.

Relevance of their literature references: all the articles had to base their introduction on scientific literature, with references to the DSM, the ICD, the WHO, or articles written by other authors and that are related to the object of study.

In the selection process, the five authors of this paper examined and assessed for inclusion the full text of those studies that appeared to meet the pre-specified selection criteria. Doubts and discrepancies between the authors were resolved through discussion within the research team until a consensus was reached. Once the articles had been read and analysed, data mining was carried out and the results were analysed and described in detail.

As ethical considerations, we also adhered to articles 5 (solidity of the scientific foundation) and 24 (non-discrediting of studies carried out by other professionals) of the Código Deontológico del Colegio Oficial de Psicología de Cataluña [Code of Ethics of the Official College of Psychology of Catalonia].[22]

Results

This work is divided into two sections. The aim of the first section was to provide answers on the relationship between alcohol use and cognitive impairment[23–27] (Table 2). In the

Table 1 – Quality assessment of the selected studies using the "Instrumento para la lectura crítica y la evaluación de estudios epidemiológicos transversales" [Tool for the critical appraisal of epidemiological cross-sectional studies] by Berra et al.[21]

First author (year)	A1	B2	B3	B4	B5	B6	C7	C8	C9	C10	D11	D12	D13	D14	E15	E16	E17	E18	F19	F20	F21	F22	G23	G24	G25	G26	H27	Internal validity	Overall validity
Sabia (2018)	2	2	3	3	X	4	4	4	4	2	3	2	3	3	4	3	4	3	4	4	4	3	4	4	3	0	4	3	Medium
Koch (2019)	4	4	3	4	X	2	4	4	4	3	3	3	4	4	4	4	3	X	4	4	3	4	4	4	3	0	4	3	High
Hoang (2014)	4	4	4	4	X	3	4	4	3	4	3	4	4	2	4	4	3	X	2	3	3	4	4	4	3	X	4	3	High
Kuźma (2014)	3	3	2	3	X	3	3	4	4	4	3	3	4	4	3	4	3	4	4	3	3	4	4	4	3	3	4	3	High
Lobo (2010)	4	4	3	3	X	2	3	4	4	3	3	3	4	4	4	2	4	4	3	3	3	4	4	4	3	X	4	3	High
Romero (2020)	4	4	4	1	X	3	4	4	4	4	X	4	4	4	3	4	X	2	4	4	3	4	X	X	2	2	4	3	Medium
Caneva (2020)	3	4	4	2	X	3	0	0	0	0	3	3	4	4	3	4	4	3	4	4	2	4	3	4	3	3	4	2	Medium

Scores: 1 (bad); 2 (fair); 3 (good); 4 (very good); 0 (not applicable); X (not reported).

second section,[28,29] we aimed to determine which cognitive functions are most affected by prolonged alcohol use (Table 3).

Alcohol and cognitive impairment

There are conflicting results on the association between alcohol use and cognitive impairment. The results of several prospective cohort studies indicate that this relationship follows a J-shaped or U-shaped curve, in which moderate alcohol use is associated with a lower risk of cognitive impairment, whilst abstinence and excessive alcohol use are associated with an increased risk.[23,24,26,27] Four of the five studies we came across confirm this affirmation.[23–26]

Sabia et al.[23] conducted a 23-year follow-up study and found that the group of teetotaller individuals, the group of individuals who had decreased their alcohol use over the years, and the group that consumed more than 14 units of alcohol per week had a higher risk of dementia than the control group (CG).

The study by Koch et al.[24] compared people diagnosed with MCI with people not diagnosed with MCI. They found that, in the non-MCI group, no category of alcohol use was associated with an increased risk of dementia compared to the CG. However, teetotaller participants had lower cognitive scores in the *Mini-Mental State Examination* (MMSE). Another group that also scored low in the MMSE was people with MCI who consumed more than 14 drinks a week, and they also had almost double the risk of dementia compared to the CG.

Hoang et al.[25] focused on a sample consisting only of women, and the results obtained are on a par with those of the aforementioned studies. In their study, women who increased their alcohol use over the course of 16 years were no more likely to experience cognitive impairment than the CG. In contrast, women who reduced their alcohol use (mean, 0.5 drinks a week) had a significantly higher likelihood of cognitive impairment. Furthermore, of the 40.2% women who suffered cognitive impairment, 22.7% had MCI and 17.5% had dementia.

The Kuźma et al. sample[26] was of individuals with a history of AUD, and they found that a history of AUD doubled the odds of memory impairment and was statistically significantly associated with worse memory and cognitive function.

However, none of these results were confirmed in the study by Lobo et al.,[27] which found no clear pattern of increased or decreased risk of cognitive impairment with an increase in alcohol intake. Specifically, the consumption of less than 40 g/day in the case of men and 24 g/day In the case of women was not associated with a lower risk of cognitive impairment.

The studies also took into account other variables, such as level of education, marital status, weight, height, tobacco use, blood pressure, medical history (heart disease, diabetes, hypertension),[23–25,27] ethnicity,[23–25] socioeconomic status,[23] hours of physical activity,[23,25] degree of social interaction,[24] use of medications,[25,27] depressive symptoms[23–25,27] and anxiety symptoms.[23] After adjusting the analysis based on these variables, the results varied greatly between the different studies.

Hoang et al.[25] found that the association between increased alcohol use and the risk of dementia remained non-

Table 2 – Summary of the main characteristics of studies investigating the relationship between long-term alcohol use and cognitive impairment or dementia.

Authors (year) country	N	Age, mean ± SD (range)	Sample characteristics	Follow-up (years), mean ± SD (range)	Classification of participants according to alcohol use	Psychometric tools	Statistical method and type of study	Results
Sabia et al. (2018)	9087	50.3 ± 6.0	31.63% women	23.2 ± 4.4	Abstinent	CAGE	Longitudinal	397 cases of dementia
United Kingdom		(35–55)		(0.08–25.6)	1–14 drinks a week (CG)	Medical history	Cox regression	Abstinent participants, those who had reduced alcohol use, and those who consumed more than 14 drinks a week had a higher risk of dementia than the CG
					>14 drinks a week		Competing risk model	
Koch et al. (2019)	3021	78	46.2% women	6	Non-drinkers	Comprehensive series of 10 neuropsychological tests	Longitudinal	512 cases of dementia
United States		(76–80)	473 participants with MCI	(4.9–6.5)	<1 drink a week (CG)	MMSE	Cox regression	Complete abstinence and consumption of more than 14 drinks a week were associated with lower cognitive scores on the MMSE
			GEM study participants		1–7 drinks a week 7.1–14 drinks a week >14 drinks a week	CDR ADAS-Cog	Linear mixed models	
Hoang et al. (2014)	1309	68.3 ± 2.8	Female	20	0 drinks a week	MMSE	Longitudinal	526 developed cognitive impairment (17.5% dementia and 22.7% MCI)
United States		(65–81)	WISE study participants		$0 < \times < 3$ drinks a week	CVLT	Linear regression	Increased alcohol use was not associated with a risk of cognitive impairment
			59.4% alcohol drinkers		$3 \leq \times \leq 7$ drinks a week >7 drinks a week	IQCODE	Kruskal–Wallis test Fisher's exact test χ^2 test	Decreased alcohol use was associated with increased risk of cognitive impairment

– Table 2 (*Continued*)

Authors (year) country	N	Age, mean ± SD (range)	Sample characteristics	Follow-up (years), mean ± SD (range)	Classification of participants according to alcohol use	Psychometric tools	Statistical method and type of study	Results	
Kuźma et al. (2014)	6542	≥65	57% women	16.7 ± 3	Non-drinkers	Modified CAGE (C omitted)	Longitudinal	90 participants had severe cognitive impairment	
United States			80.9% Caucasian	(3.5–19.1)	<1 drink a day	MMSE	Pearson's correlation	74 participants had severe memory impairment	
					1–2 drinks a day	Tasks involving immediate and delayed recall of 20 words	Student's t test	History of AUD doubled the likelihood of severe memory impairment	
					3–4 drinks a day	WAIS similarities subtest			
					≥5 drinks a day	TICS (modified version)			
Lobo et al. (2010)	3888	≥55	Separates the results by gender	4.5	Women:	Men:	MMSE	Longitudinal	No association was found between alcohol use and cognitive impairment
Spain			425 died and 367 dropped out		Teetotallers	Teetotallers	GMS-B	χ^2 test	Consumption <40 g a day in men and <24 g a day
			56% women		Former drinkers	Former drinkers	Lawton–Brody scale	Mann–Whitney U test	In women was not associated with a lower risk of cognitive impairment
					<12 g a day	<12 g a day	Katz index		
					12–24 g a day	12–24 g a day	EURODEM risk factors questionnaire		
					>24 g a day	24–40 g a day			
						>40 g a day			

ADAS-Cog: Alzheimer's Disease Assessment Scale – Cognitive; AUD: alcohol use disorder; CAGE: Cut-down, Annoyed, Guilty, Eye-opened; CDR: Clinical Dementia Rating; CVLT: California Verbal Learning Test; GEM: Ginkgo Evaluation of Memory; GMS-B: Geriatric Mental Scale; HCT: Halstead Category Test; IQCODE: Informant Questionnaire on Cognitive Decline in the Elderly; MCI: mild cognitive impairment; MMSE: Mini-Mental State Examination; SCWT: Stroop Color and Word Test; SILS: Shipley Institute of Living Scale; TICS: Telephone Interview for Cognitive Status; TMT: Trail Making Test; WAIS: Wechsler Adult Intelligence Scale-Revised; WCST: Wisconsin Card Sorting Test; WISE: Women Cognitive Impairment Study of Exceptional Aging.

Table 3 – Summary of the main characteristics of studies investigating the relationship between long-term alcohol use and impaired cognitive functions.

Authors (year) country	N	Age (years), mean ± SD (range)	Sample characteristics	Psychometric tools	Cognitive functions assessed	Statistical method and type of study	Results
Romero et al. (2020)	79	45.55 ± 8.99 group with AUD	Male	Interview	Intellectual capacity	Cross-sectional	The group of men with AUD but abstinent presented with deficits in abstract reasoning, processing speed, sustained attention, working memory, long-term memory (for verbal and visuospatial information), cognitive flexibility and in their capacities for inhibition and planning.
Spain		42.05 ± 11.33 CG	Group with AUD comprising people who have been abstinent without interruption for 3.2 years	DSM-5-based inventory to check for AUD	Memory	Shapiro–Wilk	
			CG alcohol use zero or <30 g/day	CANTAB; WAIS-III; d2 test; RVP; AST; CRT; Rey–Osterrieth complex figure test; WMS; FAS; Stroop; Hayling test; 5-point test; WCST; Zoo test and Key test; OTS; CGT	Attention	Mann–Whitney U test	
					Executive functions Empathy	χ^2 test	
Caneva et al. (2020)	41	52.29 ± 8.14	Patients with AUD participated in a 28-day residential rehabilitation programme	ENB-2	Attention	Cross-sectional	31.7% of patients with AUD had cognitive impairment
Italy			58.5% men 56.1% had a long-term AUD (≥10 years)	CBA-OE	Executive functions Perception Praxis skills Understanding Memory	Analysis of variance (ANOVA)	70.7% had poor performance in at least one ENB-2 test, with particular attention to executive function, visuospatial domains and memory

AST: Attentional set Shifting Task; AUD: alcohol use disorder; CANTAB: Cambridge Neuropsychological Test Automated Battery; CBA-OE: Cognitive Behavioural Assessment – Outcome Evaluation; CGT: Cambridge Gambling Task; CRT: Cognitive Reaction Test; ENB-2: Brief Neuropsychological Examination 2; FAS: verbal fluency test; IGT: Iowa Gambling Test; LNS: Letter-Number Sequencing test; MCST: Modified Card Sorting Test; OTS: One Touch Stockings of Cambridge; RFFT: Ruff Figural Fluency task; RVP: Rapid Visual Information Processing; SCWT: Stroop Color and Word test; WAIS: Wechsler Adult Intelligence Scale; WCST: Wisconsin Card Sorting Test; WMS: Wechsler Memory Scale.

significant, and that the association between decreased alcohol use and the risk of cognitive impairment reduced slightly until it was of borderline statistical significance.

Sabia et al.[23] found that alcohol abstinence was associated with an increased risk of dementia compared to the CG and they explain that part of this risk is attributed to the increased risk of cardiometabolic diseases in this group. They also found that, among people with an excessive alcohol use, an increase of seven units a week was associated with a 17% increased risk of dementia. Furthermore, the risk of dementia was three times higher in people with one or more hospital admissions for alcohol-related chronic disease. This study also found that an older age (at the start of the study), being female, education below secondary school level, and a low socioeconomic status were associated with an increased risk of dementia.

The above findings are consistent with those of Lobo et al.,[27] who found that cases of cognitive impairment were more likely to be female, elderly, widowed, with a low level of education, and taking medications at the start of the study. They were also more likely to be current or former smokers.

The results of Kuźma et al.[26] are along the same lines. In their study, people with a history of AUD were more likely to have low socioeconomic and educational levels, a history of cardiovascular disease or of having been unconscious due to a craniocerebral injury and having depressive symptoms. However, they differ from the other studies in the gender and age of the participants, as they found that these people were younger and mostly men.

Alcohol and cognitive functions

Between 50% and 80% of people in early abstinence suffer from cognitive and motor deficits,[29] which depend on different variables such as consumption patterns (for example, quantity of alcohol consumed, type, frequency), age at start of alcohol use, duration of use and duration of abstinence.[28] This section discusses two studies that set out to analyse which cognitive functions are most affected in a sample of people diagnosed with AUD.

Romero-Martínez et al.[28] compared the neuropsychological profile of a group of people diagnosed with AUD and who had abstained for 3 years with another group who did not consume alcohol or whose consumption was <30 g/day. The sociodemographic variables of both groups were very similar. They found that the group of long-term abstinent alcoholics (LTAA) had deficits in processing speed, sustained attention, working memory and long-term (verbal and visuospatial) memory compared to the CG. The LTAA group also had less cognitive flexibility and worse planning skills, as well as problems in developing logical strategies, in abstract reasoning, and the need for more time to plan their decisions and inhibit their inappropriate responses. The authors argue that this may be due to deficits in sustained attention and working memory, as these limit the capacities for learning, remembering and the adaptive use of associations, reasoning and problem solving.

The study by Caneva et al.[29] focused on a sample of people diagnosed with AUD who were part of a 28-day rehabilitation programme. Their results showed that a considerable number had deficits related to executive functions, visuospatial skills and memory. Furthermore, they also showed that 70.73% of the total sample had poor performance in at least one of the series of neuropsychological tests administered. When the obtained results were adjusted with the patients' sociodemographic variables, it was observed that those patients with a low level of education (≤8 years) obtained worse performance in the tests to evaluate memory, executive functions and visuospatial skills than the group with a high level of education (≥9 years). Older adults (aged ≥ 51 years) scored lower on tasks related to attention and executive functions compared to the younger group (aged 30–50 years). As for clinical and psychological factors, people who consumed multiple substances or had a history of drug abuse performed worse on the test to assess visuospatial skills than the group that only consumed alcohol, and people with high levels of anxiety scored better in the abstract reasoning test. The authors explain that the relationship between anxiety and executive functions is open to dispute, as previous studies have reported both positive and negative associations using tests that assessed these domains in different populations.

Discussion

Although the results of almost all the studies in the first section[23–27] are consistent, the limitations of each study, as mentioned by their respective authors, must be taken into account.

Two of the studies[24,26] coincide in that one of the limitations is that the alcohol use was measured by self-reporting, and it is possible that participants under-reported their actual consumption or that cognitive abilities could affect the validity of the self-reporting. Furthermore, the authors of the study in the population with AUD[26] state that they were unable to take into account the time of onset and the magnitude of the disorder, since the CAGE questionnaire, although it discriminates well between subjects with and without AUD, does not assess these aspects.

Another of the limitations mentioned by Koch et al.[24] is that, by not having information on the history of alcohol use of their participants, it was not possible to separate lifelong teetotallers from former drinkers, and one single category was formed, that of "non-drinkers". They mention that this separation is important, as former drinkers may have stopped drinking for health reasons that are not necessarily associated with their previous alcohol intake. This limitation, although not mentioned by the other authors, is also found in most of the studies analysed, as only one of them separates these two groups.[27] Lobo et al.[27] mention in the discussion of their study that the inverse association between low to moderate alcohol intake and cognitive impairment found in other studies may originate from the inclusion of former drinkers in the reference category of teetotallers.

Still on the subject of classification of participants according to their alcohol use, it has to be mentioned that the selected categories differ from one study to another (Table 2), making it quite difficult to compare the results of the different articles.

We should also mention that, although all the studies asked their participants about their consumption of beer, wine and

spirits, none of them analysed their results based on this variable. The study by Lobo et al.[27] discusses the above point, stating that they could not carry out such an analysis because wine was by far the most consumed beverage among their entire sample (96.1% of the people who consumed alcohol).

Analysing the results of all the studies in general, it can be deduced that there is a clear relationship between alcohol use and cognitive impairment; zero or excessive alcohol use can be harmful, but a moderate consumption may have no repercussions. This is in line with the systematic review by Gutwinski et al.,[30] who state that frequent and excessive alcohol use alters brain functions and decreases cognitive performance, and can lead to a higher risk of contracting any type of dementia (including Alzheimer's disease). They also explain that moderate alcohol use can improve cognitive performance and reduce the risk of dementia, but they specify that it is very difficult to define the exact amount of alcohol intake necessary for this to happen.

However, a 2020 article on J-shaped curves by Stott[31] states that the critical analysis of epidemiological data has shown that the apparent health benefits associated with low to moderate alcohol intake are due to other factors, such as socioeconomic status. Higher socioeconomic status is closely associated with moderate alcohol intake, and socioeconomic status is a strong predictor of longevity. Furthermore, this article also mentions that the optimal level of alcohol intake for health and longevity is zero.

The report drafted by the Lancet Commission,[32] which includes guidelines for preventing dementia, includes excessive alcohol use among the 12 risk factors that, if modified, could prevent or delay up to 40% of dementia cases worldwide. In this report the authors state that alcohol abuse (>21 units a week) increases the risk of dementia by up to 17% and a reduction in consumption would improve cognitive reserve and thus help prevent dementia.

Nevertheless, the results of this systematic review should be interpreted with caution, as it includes only a small number of studies and the samples in most of them are small. Furthermore, all the negative consequences of prolonged alcohol use must also be taken into account, given that it causes 5.3% of all deaths in the world and is a causal factor in more than 200 diseases and disorders.[33]

As regards the second section of our study,[28,29] the cognitive functions that are most affected by prolonged alcohol use are executive functions, visuospatial skills, attention and memory. The authors of both articles state that this impairment may be a key factor in the relapse of patients with AUD. It is important to note that these results should be analysed with caution, as both studies used a very small sample and their data are cross-sectional. Further studies are therefore needed in order to explore which cognitive functions are most affected in patients with an AUD, so that rehabilitation programmes can be adapted to benefit users and reduce alcohol relapse rates, as discussed by the authors.

Conclusions

Prolonged and excessive alcohol use can lead to cognitive impairment, although it is worth highlighting the need for more studies on the points raised in this study, with larger samples that allow the results to be extrapolated and solid and valid conclusions to be drawn that will help in the preparation of prevention and rehabilitation plans for people who consume excessive amounts of alcohol.

Conflicts of interest

The authors declare that they have no conflicts of interest.

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