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Alcohol in moderation, premorbid intelligence and cognition In Older Adults: results from the Psychiatric Morbidity Survey

¹Claudia Cooper, ¹Paul Bebbington, ²Howard Meltzer, ³Rachel Jenkins, ⁴Traolach Brugha, ⁴James EB Lindesay, ¹Gill Livingston

¹Dept of Mental Health Sciences, University College London, UK

²Department of Health Sciences, University of Leicester, UK

³Institute of Psychiatry, London, UK

⁴Department of Psychiatry, University of Leicester, UK

All correspondence to be sent to:

Claudia Cooper, Dept of Mental Health Sciences, University College London,
Holborn Union Building, Archway Campus, Highgate Hill, London, N19 5LW.
Tel: +44 (0) 207 2885931 Email: ccooper@doctors.org.uk

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Abstract

Aims: To test the hypothesis that the association previously reported between moderate alcohol use and better cognition, is an artefact of confounding by (a) higher premorbid education and socioeconomic status; (b) a lifestyle of moderation (using smoking as a risk marker); and (c) decreased alcohol consumption in people with physical illnesses.

Method: We analysed data from people aged 60-74 interviewed for the 2000 British National Psychiatric Morbidity Survey, representative of people living in private homes.

Alcohol use information was available for 1985 (98.9%) of eligible participants, of whom 1735 (87.4%) who drank moderately or abstained were included in analyses. Our main outcome measures were the Alcohol Use Disorders Identification Test (AUDIT), the Telephone Interview for Cognitive status screen for cognitive impairment and the National Adult Reading Test to measure crystallised (premorbid) intelligence. Our physical health measures were the number of prescribed medications and physical illness reported and the 12-item Short Form Health Survey's Physical Component Score.

Results: The relationship between current cognition and alcohol use was reduced and no longer significant after considering premorbid intelligence or physical health. In our final model, the significant predictors of current cognition amongst non-problem drinkers were: age ($B=-.13, -.18-.08, p<0.001$) and crystallised intelligence ($B=0.14, .12-.17, p<0.001$).

Smoking was not associated with cognition.

Conclusions: In people who were not problem drinkers, higher alcohol intake was not associated with improved current cognition after controlling for premorbid intelligence and physical health. Our findings suggest that, despite previous suggestions, moderate alcohol consumption does not protect older people from cognitive decline.

Introduction

There is concern that, as the population ages, the number of older adults misusing alcohol will increase substantially (1). Since 1950, alcohol consumption in the UK has risen from 3.9 litres pure alcohol per person per year to a peak of 9.4 litres in 2004 (2). Recent literature suggests that 11-33% of older people misuse alcohol and the physical, cognitive and psychological effects are greater than in younger people (3;4). Due to the physiological changes of ageing, older people may experience alcohol-related problems at lower consumption levels (5). Excessive alcohol consumption is associated with a higher risk of dementia (6), and around 10% of dementias are directly related to alcohol (7;8).

While the deleterious effects of problem drinking on cognition are well described, there is evidence that the relationship between more moderate alcohol consumption and cognition is not linear. In one representative cross-sectional study, light drinkers (up to 14 standard drinks per week for men and seven per week for women) performed best, better than abstainers, occasional drinkers and heavy drinkers, on cognitive tasks (9). A large UK study with more than 6000 participants also concluded that moderate alcohol consumption is associated with better cognitive health than abstinence in older people (10). Although neither study controlled for premorbid cognition, these and similar findings have led to suggestions that alcoholic drinks may have a direct protective effect on cognition (11). This is biologically plausible, given the role of vascular pathology in cognitive decline in both Alzheimer's disease and vascular dementia, and the cardio protective effect of alcohol at low doses. Alcohol has antithrombotic properties, and can increase high-density lipoprotein levels. Polyphenol compounds in red wine may also inhibit low-density lipoprotein oxidation and thrombosis independently of alcohol (12).

People with higher premorbid intelligence (who are generally less socio-economically disadvantaged) tend to drink regularly but moderately (2). It is therefore possible that the link between moderate drinking and better cognition in older people may be indirect, and explained by premorbid intellect. The cognitive reserve hypothesis (13) offers a further

possible explanation of this relationship. People with better premorbid cognition, and therefore more “cognitive reserve” tend to have a higher threshold for experiencing functional impairment as a result of the pathological dementing process than those with lower premorbid cognition, and consequently develop clinical dementia later. In a recent systematic review, moderate alcohol intake was associated with a 38% reduced risk of incident dementia, but had no effect on cognitive decline (11). The authors suggest that methodological limitations of the reviewed studies could explain the discrepancy between these findings. They could also potentially be explained by the cognitive reserve hypothesis.

Poor health status may also confound the relationship between alcohol use and better cognition. Proponents argue that those who are less healthy and take more medication (which may interact with alcohol) are more likely to abstain from alcohol or to drink very occasionally; they are also more likely to be cognitively impaired. Finally, it has been suggested that moderate alcohol drinking may be an indicator of a generally moderate lifestyle, which includes eating healthily and refraining from harmful activities such as smoking (14).

With the projected increase in the numbers of older people in the UK in the next decades (15), it is important to clarify the advice we should be giving older people about alcohol and cognitive health. In this study, we investigated the relationship between alcohol use and cognition in the general older population (aged 60-74), using the National Psychiatric Morbidity Survey 2000 (NPMS). We hypothesised that, in people who were not problem drinkers, higher alcohol intake would cease to be associated with better cognition after controlling for confounders. Specifically, the relationship would be confounded by (a) higher premorbid education and socioeconomic status; (b) a general lifestyle of moderation (using smoking as a risk marker for this); and (c) decreased alcohol consumption in people with worse physical health.

Methods

Procedures

The second British National Survey of Psychiatric Morbidity involved computer-assisted interviews carried out with a national probability sample in the year 2000. Throughout Britain, 15,804 delivery points were randomly drawn from postal sectors of the Small Area Postcode Address File, stratifying for socio-economic grouping. Using a grid method (16), 12,792 adults aged 16-74 were selected from 14,285 eligible households. Sixty-nine percent (8,580) of those approached agreed to take part. In this report, we included participants aged 60 and over (n=2007); information about alcohol use was available for 1985 (98.9%) of these participants. See Evans et al (17) for further details of the study.

Measures

Standardised questions provided information about age, gender, marital status (married or cohabiting, or not), ethnic origin (White British or other), tenure (whether living in accommodation they owned or rented), education (whether or not they had obtained any qualifications) and social class (manual or non-manual occupation). Participants also completed the following measures:

The *Alcohol Use Disorders Identification Test (AUDIT)*(18) to measure recent alcohol use.

This instrument was developed by the World Health Organisation and is widely used in younger and older adult populations (19). A score of eight or more indicates problem drinking. 250 (12.6%) of the older people interviewed had an AUDIT score of 8 or more indicating a drinking problem, and as our hypotheses related to the impact of moderate drinking, we excluded these participants from subsequent analyses.

Cognitive measures. The Telephone Interview for Cognitive status (TIC-m) screens for cognitive impairment (Plassman et al, 1995). It was administered face to face, and tests orientation, concentration, immediate and delayed memory, naming, calculation, comprehension and reasoning. A score of < 21 is equivalent to an MMSE score of below 25 (20). *The Animal Naming Test* is a measure of verbal fluency from the Consortium to Establish a Registry for Alzheimer's Disease (CERAD)(21). Participants were asked to name as many animals as they could in one minute. This tests executive functioning, and is also influenced by intelligence.

Participants also completed the National Adult Reading Test (NART) (22). This test is a widely used and validated brief measure of crystallised (premorbid) intelligence for English speakers.

Physical health: Participants were asked the number of longstanding physical illnesses, and the number of oral medications they were currently prescribed. *The 12-item Short Form Health Survey (SF-12)* is an acceptable and valid measure of health-related quality of life for use in large community-based studies, including those of older people (23). We used the Physical Component Score to measure physical health-related quality of life.

The number of cigarettes previously smoked was employed as a measure of “healthy lifestyle”. One of the authors (CC) calculated this from the information available in the NPMS regarding the age the person started smoking, the age they stopped, and the average number of cigarettes smoked on weekdays and at weekends.

Data analysis

All analyses were performed using weighted data. Weighting was carried out in three steps, to take account of (1) different sampling rates for postal sectors in Scotland (and the one postal sector included twice by mistake); (2) the different probabilities of selecting respondents in different sized households; and (3) differential non-response among regions and age groups.

We applied post-stratification weights based on age, sex and region, in order to ensure that the results were representative of the British Household population. We used the relevant ‘survey’ commands in STATA, release 8.2 (StatCorp, 2003), which allow for the use of clustered data modified by probability weights and provide robust estimates of variance.

We described the variables studied using weighted means and proportions, and determined which of these were significantly associated with AUDIT score. As the survey commands in STATA do not allow correlations, we used the ‘svyregression’ command to determine the relation between continuous variables, and reported $\sqrt{R^2}$ as an approximation of the correlation coefficient. As this is a conservative approach, we defined $r > 0.5$ as indicating a risk that collinearity affected results (24), and, where this occurred, omitted the variable less

strongly associated with the variables of interest in the multivariate regression analyses (alcohol use and cognition). For categorical data, we tested univariate associations using the “svymean” and “lincom” commands, and reported mean differences (and their confidence intervals and p-values).

Using linear regression, we tested our hypothesis that, among those not reporting problem-drinking, higher cognition scores (measured using the TIC-m and verbal fluency measure) were associated with increased alcohol use controlling for socioeconomic characteristics. We then investigated this relationship after controlling for sociodemographic variables, and (1) crystallised intelligence (NART score), and measures of (2) physical health and (3) moderate lifestyle (total number of cigarettes smoked in pack years).

Results

1735 of the older adults in the survey drank moderately or not at all. Their mean AUDIT score was 2.7 (2.6-2.8). 233 (11.6%) participants abstained from alcohol completely. Of these, 106 (45.5%) had never drunk, while 127 (54.5%) had given up alcohol at some point in their lives. The most common reason endorsed for giving up alcohol was for their health (n=65). The TIC-m score was lower, indicating worse current cognition, in those who abstained from alcohol (22.3, 95% Confidence Interval (CI) 21.6-23.0) compared with those who drank at least sometimes (23.8, 23.5-24.0). However, among those who abstained, there was no significant difference between those who had never drunk and those who had stopped drinking (coefficient for difference of means =-0.15 (-1.69-1.40); $t=-0.19$, $p=0.85$).

The relationship of AUDIT score to the socio-demographic and cognitive variables studied is shown in Tables 1 and 2. Alcohol intake was higher at the younger end of our age range, in men, in people with qualifications or who were from a non-manual social class, in those who scored higher on measures of cognition (TIC-m), crystallised intelligence (NART score); and in those who took fewer oral medications. Verbal fluency was not associated with alcohol use on univariate analyses, so we did not explore this relationship further.

Physical health-related quality of life (PHRQoL) and the number of longstanding illnesses were collinear, so we only included PHRQoL in multivariate analyses, as this measure was more highly correlated with NART score.

Alcohol use predicted current cognition in multivariate analyses, after controlling for the socio-economic characteristics studied (Table 3). However, when either higher crystallised intelligence or physical health was also considered, the strength of this relationship was reduced and no longer significant at conventional significance levels. As cigarette use was associated with neither cognition nor alcohol use on univariate analyses, we did not pursue further the hypothesis that a generally healthy lifestyle explained the association between cognition and alcohol use. In our final model, the only predictors of current cognition amongst non-problem drinkers were: age and crystallised intelligence (see Table 4).

Discussion

As hypothesised, drinking more alcohol was associated with current cognitive abilities in the older people interviewed, after controlling for socio-economic variables alone. This is in keeping with previous findings (10). We found, however, that current cognition was no longer associated with alcohol use after controlling for the higher premorbid intelligence or better physical health of those who drank more. Only premorbid intelligence and younger age predicted higher alcohol intake when all the factors studied were considered.

While there is certainly no evidence that moderate alcohol use is harmful to cognitive health, we also found no evidence that it benefited cognition in the older general population. This suggests that it would be wrong actively to promote moderate drinking as beneficial for cognitive wellbeing, as has been suggested previously (14). Our hypotheses that the relationship between moderate alcohol use and better cognition would be confounded by higher premorbid intelligence and physical health status were supported.

Strengths and limitations

This is, to our knowledge, the first study to examine the relationship between cognition and moderate alcohol use, to control for premorbid cognition and to use a validated measure of alcohol consumption. The AUDIT scale is a more sensitive way of measuring alcohol use (18)

than the categorical measures of alcohol use employed in most previous studies. We acknowledge that the cross-sectional design of our survey is a potential limitation, as it is possible that current alcohol consumption does not reflect previous use. We found, however, that the cognition of those who had never drunk and those who had given up were not significantly different, suggesting that abstinence in previously heavy drinkers has not confounded our results. While it is not possible to determine the direction of causality, this does not effect our conclusion that there is no relationship between cognitive status and alcohol use.

We did not record type of alcohol consumed. It is interesting that two large studies conducted in the Bordeaux (25) and Nantes (26) regions of France have found a relationship between moderate alcohol consumption and better cognition after controlling for premorbid intelligence, while results from a previous British cohort (27;28) are equivocal. It is possible that the higher consumption of red wine in France, which is cardioprotective in moderate quantities (12), might also protect from cognitive decline. Our hypothesis that lower smoking, as a proxy measure of a healthy lifestyle, also confounded the relationship between alcohol and cognition was not supported. This may be a true finding, or it may reflect the limitation of using smoking status as the sole proxy of healthy living, rather than assessing healthy diet and exercise as central components of a healthy lifestyle. We did not interview people aged 75 and over, so our results may not be generalisable to the oldest old. We also excluded those in residential care, although they were unlikely to be drinking much alcohol.

Conclusion

After the exclusion of problem drinkers, higher alcohol intake was not associated with better current cognition once the confounding effects of premorbid intelligence and physical health were taken into account. While an association between moderate alcohol consumption and a reduced risk of coronary heart disease has been demonstrated, the American Heart Association recently urged against over-interpreting these findings, as more than three drinks a day are associated with hypertriglyceridemia, cardiomyopathy, hypertension, and stroke

(12). Our findings also urge caution, and indicate that, despite previous suggestions, moderate alcohol consumption may not protect older people from cognitive decline.

Table 1: Relationship of AUDIT score (in non-problem drinkers) to characteristics studied (categorical variables)

Sociodemographic characteristics		number	AUDIT score (mean + 95% CI)	Mean difference (coefficient) + 95% CI and p value
Gender	Male	684	3.2 (3.0-3.4)	0.85 (0.63-1.07); p<0.001
	female	1051	2.3 (2.1-2.4)	
Tenure	Owned	1283	2.7 (2.6-2.8)	0.085(-0.17-0.34); p=0.51
	rented	427	2.6 (2.4-2.8)	
Ethnicity	White British	1676	2.7 (2.5-2.8)	0.23(-0.42-0.88); p=0.48
	Other	37	2.4 (1.8-3.0)	
Any qualifications?	Yes	786	2.9 (2.8-3.1)	0.46(0.23-0.68); p<0.001
	no	937	2.4 (2.3-2.6)	
Married and cohabiting?	Yes	1019	2.6 (2.5-2.8)	0.079(-0.16-0.32); p=0.51
	no	713	2.7 (2.5-2.9)	
Social class	Non-manual	917	2.8 (2.7-3.0)	0.36(0.14-0.59); p=0.002
	manual	778	2.5 (2.3-2.7)	

Table 2: Correlation matrix of continuous variables, in non-problem drinkers¹

	n	AUDIT score	Age	TICm	Verbal fluency	NART	Medication	PHRQoL
Age	1735	-.09***						
TICM score	1735	.09***	-.12***					
Verbal fluency score	1721	.00	.02	.05				
NART score	1676	.12***	.02	.47***	.04			
Number of medications	1232	-.14***	.07*	-.08**	.05	-.08*		
Physical health-related quality of life (PHRQoL)	1705	0.0	.04	.05*	.04*	.13***	-.10**	
Number of long term illnesses (NLTI)	1729	-.03	.01	.03	.00	-.09**	.07*	-.61***
Cigarettes smoked in life (pack years)	1722	-.01	.01	.04	-.04*	-.01	.01	-.15***

*=p<0.05; **=p<0.01; ***=p<0.001

¹ We used the STATA ‘svyregression’ command to determine the relation between continuous variables, and reported $\sqrt{R^2}$ as an approximation of the correlation coefficient.

Table 3: Relationship of alcohol AUDIT score in regression analyses, with dementia score as dependent variable

Independent variables in equation, in addition to socioeconomic characteristics ¹	n	R ²	AUDIT score	
			Coefficient	p
AUDIT score alone	1672	.14	.12 (.03-.22)	.007
AUDIT score and NART score	1626	.26	.05 (-.04-.14)	.26
AUDIT score and physical health factors ²	1179	.14	.09 (-.01-.20)	.083
AUDIT score and number of cigarettes smoked	1662	.14	.13 (0.04-0.22)	.005
AUDIT score, NART score and physical health factors ²	1143	.27	.02 (-.08-.12)	.71

¹gender, age, ethnicity (White British or other), tenure (whether owned or rented accommodation), whether any qualifications or not, whether married and cohabiting or not; social class)

²physical health related quality of life and number of medications

Table 4: Final model with TICm score as dependent variable

Variable	Coefficient (95% CI)	t	p
AUDIT score	0.02 (-0.08-0.12)	0.41	0.68
Age	-0.13 (-0.18--0.075)	-4.83	<0.001
Female gender	0.22 (-0.23-0.68)	0.96	0.34
Home owner	0.47 (-0.06-1.0)	1.75	0.08
White British ethnic group	0.09 (-1.06-1.24)	0.15	0.88
Married	-0.16 (-0.58-0.26)	-0.76	0.45
Social class (IIM-V)	-0.35 (-0.90-0.19)	-1.28	0.20
Any qualifications	-0.42 (-0.94-0.11)	-1.56	0.12
Cigarettes smoked	-0.001(-0.01-0.01)	-0.22	0.83
NART score	0.14 (0.12-0.17)	11.5	<0.001
Physical health-related quality of life	-0.01(-0.03-0.01)	-0.85	0.39
Number of medications	-0.01(0.11-0.09)	-0.26	0.80

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