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"A CASE-CROSSOVER STUDY OF ALCOHOL CONSUMPTION, MEALS AND THE RISK OF ROAD TRAFFIC CRASHES"

Surgery

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ABSTRACT

This study aims at investigating the association between alcohol and meal consumption and the risk of RTCs using intrapersonal comparisons of subjects while driving.

Materials and Methods: Drivers admitted to an emergency room (ER) after RTAs in 2016 were interviewed about personal, vehicle, and crash characteristics as well as hourly patterns of driving, and alcohol and food intake in the 24 hours before the crash.

Results: Of 574 patients enrolled, 326 (56.8%) reported previous driving from 6 to 18 hours before the RTC and were eligible for analysis. The ORs (mutually adjusted) were 2.25 (95%CI 1.11-4.57) for alcohol and 0.94 (0.47-1.88) for meals. OR for alcohol was already increased at low (1-2 units) doses - 2.17 (1.03-4.57) and the trend of increase for each unit was significant - 1.64 (95%CI 1.05-2.57).

KEYWORDS

Alcohol, driving.

Introduction:

Driver-related behavioural factors are major contributors to the occurrence of road traffic accidents (RTAs), [1,2] that in turn are the commonest cause of injury fatalities worldwide [3]. Among these factors, alcohol consumption plays an important role. In fact, 30-40% of driver deaths in the European Union result from driving under the influence of alcohol [4].

One study has shown that alcohol use in the 6 hours prior to injury is associated with an increased risk of injury and postulated a dose-response effect [5]. Other studies have demonstrated that the effect of alcohol is stronger for acute exposure than for long-term exposure and that the risk is significant even at a low (1-2 units) consumption level [6-8].

All these studies benefited from the case-crossover design, [9,10] that has proved to be effective in estimating the risk of sudden events associated with transient exposures with short effect, such as acute alcohol consumption.

Finally, alcohol is often consumed during meals, which may both delay its absorption [11] and cause sleepiness [12] which is an additional trigger of RTCs [13]. To investigate the acute effects of alcohol and meal consumption on the risk of RTCs, we conducted this case-crossover study.

Materials and methods:

Subjects for this case-crossover study were recruited at the emergency room in a tertiary hospital in central India, from Jan 1st, 2016, to 31st december 2016. They were injured drivers (including motorcyclists and cyclists) who presented for care to the ER after being involved in a RTC. Drivers were eligible if they were ≥ 14 years of age, alive at the time of arrival at the ER, and sufficient to give an interview. Subjects were included in the study if they (or their parents in case of drivers <18 years of age) provided written consent to participate in the research and if an interview was possible within 36 hours from the time of RTC.

The questionnaire collected information on socio-demographic characteristics of the driver and driving habits, characteristics of the vehicle and the RTC, usual alcohol consumption and drink & drive habits, and other potential risk factors not reported in this article. Conditional logistic regression was used to estimate the Odds Ratio (OR) of RTC. As in previous studies, [5-8] the main exposure variable was consumption of at least 1 unit of alcohol (i.e., 10 milliliters of ethanol, approximately equivalent to 1 small glass of wine, one can of lager beer or a bar measure - 30 ml - of spirit) in the hazard period vs. none. A dose-response analysis of alcohol consumption was also conducted (0, 1-2, and 3 or more units).

Results:

Of all the 574 cases, 326 (56.8%) reported driving at some stage between 6 and 18 hours before the RTC and underwent the pair-matched analysis. The distribution of pairs according to both alcohol and meal-intake exposure is shown in table 1. The unadjusted OR for alcohol consumption was 1.33 (95%CI: 0.69-2.60) and for meal intake was 1.08 (95%CI: 0.59-2.00).

The results of the full model including the two exposures and the time of day are shown in table 2, the ORs were 2.25 (95%CI: 1.11-4.57) for alcohol and 0.94 (95%CI: 0.47-1.88) for meals.

Table 3 shows the OR for alcohol and meals from the full model stratified by potential effect modifiers. Alcohol use in the previous 6 hours and being at fault strongly interacted in triggering the crash.

Discussion:

This study shows that consumption of any quantity of alcohol within 6 hours prior to driving is associated with a 2.25-fold increase in RTC risk. In the previous studies that adopted the same hazard period and presented analyses stratified for mechanism of injury, [5,6,8] alcohol was associated with a OR of RTC of 2.7, 5.0 and 3.9, respectively. However, because these studies included all types of injuries, they did not adopt the correct definition of time at risk, i.e., did not restrict the time at risk to driving time.

The effect of alcohol is present even at intake of 1-2 units - OR = 2.17, 95% CI: 1.03-4.57. This is a flaw of several current laws worldwide that had already been pointed out [17].

As for meal intake, despite the reasonable and common belief that its detrimental effects on cognitive functions [12,19,20] could increase the risk of RTCs, this association is not confirmed on the whole by our study, the first one we are aware of. Nor did the consumption of meals seem to influence the risk of alcohol assumption, perhaps because this interaction can go in 2 opposite directions, as already explained. The results of the analysis of the interaction with sleep deprivation show a doubling of the point estimate of risk (2.06), but are limited in precision (95%CI: 0.25-17.00). Therefore it seems wise not to question the common belief that driving should be avoided after heavy meals until more evidence is gathered.

The case-crossover design offers the conspicuous advantage of eliminating interpersonal confounding and problems in the selection of control groups. Its previous applications to the study of risk factors for RTCs have been successful [13,14,21]. However, this particular application requires the fulfilment of the 'driving opportunity' criterion, i.e. a special definition of time at risk that should be 'time while driving'. Since previous studies targeted all injuries, they did not restrict the hazard period to time while driving. Moreover, in these studies not only drivers but all injured patients were included. It is questionable though if alcohol assumption by a transported passenger can have any role in the causation of a RTC as indirectly shown also by our data on effect modification by culpability.

Another limitation of our estimates is that they cannot be generalized to severely injured patients because they could not be interviewed and therefore are not represented. Once again, however, this is likely to have led to an underestimation of the global risk of alcohol consumption because there is evidence of increased effect with increasing injury severity [6].

Finally, recall bias is also an issue when past exposure measurement is based on interviews. It is known that the accuracy of recall in humans significantly depends on the time interval between the event and the time of its assessment: the longer the interval, the higher the probability of incorrect recalls [22]. It is also known, from case-control studies that data, even about irrelevant exposures, are often remembered better by cases or/and underreported by controls [23].

This study confirms that recent alcohol consumption, even at low doses, is a risk factor for RTCs that doubles in case of consumption of any quantity in the 6 hours prior to driving.

Tables:

TABLE 1: Unadjusted matched pair analysis of alcohol and food intake exposure prior to road traffic crash (RTC) and prior to the previous occurrence of driving.

Alcohol consumption in the 6 hours prior to crash	Alcohol consumption in the 6 hours prior to previous episode of driving		
	yes	no	total
yes	3	24	27
no	18	281	299
total	21	305	326
OR = 1.33 (95%CI: 0.69-2.60)			

Meal intake in the 2 hours prior to crash	Meal intake in the 2 hours prior to previous episode of driving		
	yes	no	total
yes	4	25	29
no	23	276	297
total	27	301	326
OR = 1.08 (95%CI: 0.59-2.00)			

Table 2: Odds Ratios (OR) and 95% confidence intervals (CI) for alcohol and food intake with mutual and time-of-day adjustment

Variable	OR	95%CI
Alcohol consumption in the previous 6 hours	2.25	1.11-4.57
Meal intake in the previous 2 hours	0.94	0.47-1.88
Time band 05:00-08:59	1	
Time band 09:00-12:59[a]	1.63	0.99-2.68
Time band 13:00-16:59[a]	2.08	1.30-3.33
Time band 17:00-20:59[a]	0.79	0.52-1.19
Time band 21:00-00:59[a]	0.30	0.14-0.66
Time band 01:00-04:59[a]	0.91	0.30-2.77

Table 3: Odds ratios (OR) and 95% confidence intervals (CI) for alcohol and meal intake stratified by potential effect modifiers

Possible modifier	Exposure			
	Alcohol consumption		Meal intake	
	OR[a]	95%CI	OR[a]	95%CI
Gender				
Male (N = 175)	1.83	0.77-4.35	1.72	0.63-4.66
Female (N = 151)	4.58	0.81-25.93	0.63	0.20-1.96
Age				
<25 years (N = 57)	5.00	0.43-57.31	0.55	0.08-3.59
≥ 25 years (N = 269)	2.10	0.99-4.44	0.98	0.45-2.11
Level of education (high school or higher)				
No (N = 110)	5.99	1.04-34.57	2.09	0.41-10.60
Yes (N = 216)	2.16	0.91-5.14	0.64	0.28-1.47
Vehicle				
Car, van, truck (N = 234)	2.55	1.04-6.25	0.81	0.36-1.82
Motorcycle (N = 64)	2.68	0.50-14.26	1.02	0.15-6.82
Bicycle (N = 28)	2.99	0.09-99.06	0.83	0.02-31.40
Driving license held for (only motor-vehicle drivers)				
<5 years (N = 41)	9.99	0.46-217.78	0.61	0.05-7.34
≥ 5 years (N = 257)	1.96	0.89-4.29	0.79	0.36-1.73
Driver at fault				
Yes (N = 80)	21.22	2.31-194.79	0.82	0.16-4.18
Yes or partially (N = 110)	10.25	2.42-43.33	0.95	0.24-3.77
No (N = 214)	1.12	0.47-2.69	0.82	0.36-1.85
Habitual consumption of 12 or more drinks a month				
No (N = 211)	4.17	0.72-24.16	0.77	0.29-2.05
Yes (N = 115)	1.63	0.67-3.96	1.31	0.47-3.64

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