ORIGINAL PAPER

International Journal of Occupational Medicine and Environmental Health 2016;29(3)
http://dx.doi.org/10.13075/ijomeh.1896.00638

POOR WEIGHT CONTROL, ALCOHOLIC BEVERAGE CONSUMPTION AND SUDDEN SLEEP ONSET AT THE WHEEL AMONG ITALIAN TRUCK DRIVERS: A PRELIMINARY PILOT STUDY

GIAN LUCA ROSSO[1,2,3], CRISTINA MONTOMOLI[4], and STEFANO M. CANDURA[5,6]

[1] Azienda Sanitaria Locale CN1, Cuneo, Italy

Medical Emergency Service

[2] Medical Services, Servizi Medici Se.M. s.r.l., Cuneo, Italy

Occupational Safety and Health

[3] University of Pavia, Pavia, Italy

Department of Public Health, Experimental and Forensic Medicine

[4] University of Pavia, Pavia, Italy

Department of Public Health, Experimental and Forensic Medicine, Unit of Biostatistics and Clinical Epidemiology

[5] Salvatore Maugeri Foundation, Work and Rehabilitation, IRCCS, Scientific Institute of Pavia, Pavia, Italy

[6] University of Pavia, Pavia, Italy

Department of Public Health, Experimental and Forensic Medicine, Unit of Occupational Medicine

Abstract

Objectives: The aim of this study was to investigate the prevalence of obesity, alcoholic beverage consumption, unhealthy alcohol use and sudden sleep onset at the wheel among Italian truck drivers. In addition to prevalence rates, this study also aimed at investigating potential predictors for sudden-onset sleepiness and obesity. **Material and Methods:** A sample of truck drivers was extracted from the database of the High Risk Professional Driver Study. Data concerning demographics, anthropometry, medical information and working conditions were collected using anonymous questionnaires. Logistic regression analyses were performed to assess the association of the reported body mass index (BMI), alcohol consumption and sudden sleep onset with working conditions and general lifestyle factors. **Results:** Three hundred and thirty-five questionnaires were collected. According to their BMI, 45% of the participants were overweight and 21.4% of them were obese. Twenty-four point two percent declared they drank alcoholic beverages during working hours or work breaks and 21.3% of the drivers had an Alcohol Use Disorders Identyfication Test Consumption (AUDIT C) score ≥ 5 (the threshold value for unhealthy alcohol use). Forty-one point six percent of the interviewees experienced one episode of sudden sleep onset at the wheel per month (5.5% per week and 0.9% daily). Predictive factors for obesity were: length of service (odds ratio (OR) = 1.09, confidence interval (95% CI): 1.04–1.15, $p < 0.001$) and the AUDIT C total score (OR = 1.34, 95% CI: 1.08–1.66, $p = 0.008$). Predictive factors for sudden-onset sleepiness at the wheel were: age > 55 years old (OR = 5.22, 95% CI: 1.29–21.1, $p = 0.020$), driving more than 50 000 km per year (OR = 2.89, 95% CI: 1.37–6.11, $p = 0.006$) and the Chalder Fatigue Questionnaire (CFQ) score > 11 (adjusted OR = 2.97, 95% CI: 1.22–7.21, $p = 0.016$). **Conclusions:** This study strongly emphasizes the need for intervention in order to reduce and prevent important risk factors for the sake of road safety and truck drivers' health.

Key words:
Obesity, Fatigue, Road safety, Professional drivers, Alcohol consumption, Truck drivers

Received: March 19, 2015. Accepted: June 12, 2015.
Corresponding author: G.L. Rosso, Via Torre Allera 55, 12100 Cuneo, Italy (e-mail: glrosso77@gmail.com).

INTRODUCTION

Recent studies have shown that occupation of a professional driver (PD) in Italy presents several problems in terms of risk factors both for the health of a driver and for road safety [1–3]. In particular, high prevalence of obesity has been highlighted (a condition which is more limited when compared with percentages from other countries [4], but, which is well above the national data reported for all workers [5]). Issues related to sudden-onset sleepiness while driving professionally and a high consumption of alcoholic beverages have been also pointed. Although these three risk conditions do not have a close and direct relationship, they clearly represent a critical issue among PDs. Working conditions (such as long working shifts, hours spent sitting in the cab, poor food choices, inability to choose the break time, etc.) might be particularly important as a cause of the onset of obesity, fatigue and thus, episodes of sudden sleep onset at the wheel [6,7]. With regard to alcoholic beverage consumption, very little is known about the actual workplace behavior of Italian truck drivers, but the extent of the phenomenon of alcohol abuse within this profession seems to be widespread [3]. In fact, it is possible that, fearing a negative impact on their work fitness assessment, truck drivers tend to deny alcohol consumption in the workplace and understate or do not declare alcohol consumption outside working hours. Consumption of alcoholic beverages might be in some way related to the type of work performed, and it may be influenced both by some work-related (working alone, poor controls, etc.) and non-work-related factors (age, educational level, etc.).

As of now, however, on a national basis neither there is data that would determine the magnitude of these critical issues within the profession of truck drivers in Italy, nor there are any suggestions or hypotheses about the possible work-related and non-work-related variables that most influence those conditions. Indeed, the so far conducted studies have combined two different categories of PDs (truck and bus drivers). However, what should be taken into consideration is the fact that there are substantial differences between these 2 professions, which might influence the effect of certain variables in some way (e.g., to work alone, to have the responsibility to carry people, etc.). On the basis of these assumptions we have analysed the above risk factors (those highlighted by the HiRis_PD study [1–3] in the Italian PDs category) only for the truck drivers through conducting a pilot study on a convenience sample intended to generate hypotheses for a further investigation. Indeed, prevention of the above-mentioned risk factors among PDs is a priority in the workplace, and for these reasons an occupational health physician (OHP) should encourage adoption and maintenance of healthy lifestyle patterns, and stimulate preventive decision-making in order to reduce risky behaviors and risk factors. Therefore, the aim of this pilot study was to investigate drinking habits, the prevalence of obesity and episodes of sudden-onset sleepiness at the wheel among Italian truck drivers for the purpose of generating hypotheses for a further investigation.

MATERIAL AND METHODS

Study design

The truck drivers' questionnaires used in this study came mainly from the database of the High Risk Professional Driver Study. They were then supplemented by data collected after the end of the above-mentioned study, using the same questionnaire [1–3]. The High Risk Professional Driver Study was conducted from 1 October 2012 to 31 May 2013, and consisted of a self-administered and anonymous questionnaire given to PDs during their periodic Driver Qualification Card (DQC) training. The study participants were recruited on a voluntary basis from driving schools and associations across six towns in the province of Cuneo (an area of the Piedmont region in Northern Italy). Periodic training is delivered through courses that drivers attend after a 5-year period for which their current Driver Certificate of Professional Competence (CPC) is granted. There is no pass or fail element to these tests.

Material

The participants were asked to fill in a questionnaire that included, apart from general information (demographics, anthropometry and medical information), their driving and accident history. Specifically speaking, the main questions related to this study were, as follows:

– In the 12 past months, have you experienced sudden-onset sleepiness at the wheel while driving? Answers: 1 = never, 2 = a few times (about once a month), 3 = often (about once a week), 4 = more than once a week.
– Have you ever drunk alcohol during work or during lunch at work? Answers: a) never, b) rarely, c) often, d) regularly while I am having lunch.

We included a validated questionnaire to measure the severity of fatigue – the Chalder Fatigue Questionnaire (CFQ), which has been used in several studies before. The 11-item scale was found to be reliable (Physical Fatigue: r = 0.85; Mental Fatigue: r = 0.82; Total Score: r = 0.89) and valid [8]. Fatigue is defined as a continuous dimension as opposed to a category. Response options include: 0 = 'better than usual,' 1 = 'no more than usual,' 2 = 'worse than usual' and 3 = 'much worse than usual.' The Likert scale was used with a range 0–33. According to Cella et al., a score of 29 on the fatigue scale can distinguish between patients (chronic fatigue syndrome sufferers) and non-patients with 96% accuracy, and a score above 30 discriminates in 100% of cases [9].

The questionnaire also included the Alcohol Use Disorders Identification Test Consumption (AUDIT C), which is a revised and shorter version of AUDIT (a gold standard of identification tests, developed by the World Health Organization (WHO), consisting of 10 alcohol identification questions) [10]. The AUDIT C assesses the frequency and quantity of alcohol consumption, and frequency of heavy drinking (6 or more drinks a day). Total scores range from 0 to 12. As with the 10-item AUDIT, higher scores indicate more problematic alcohol use. In men, a score of 4 points or more is considered positive for problematic alcohol use. Due to an error in the initial photo-reproduction of the questionnaires, some of these did not include the AUDIT C and/or the CFQ on the second page. These questionnaires were used for the analysis of all the other properly collected variables.

Body mass index (BMI) was calculated as weight divided by height squared (kg/m^2). A BMI ≥ 30 kg/m^2 was regarded as an indicator of obesity. Overweight was defined by a BMI ranging 25–29.9 kg/m^2.

Statistical analysis

Descriptive statistics were used to report the prevalence of various factors. Categorical data were presented as numbers (per cent), continuous data as means ± standard deviation (M±SD) for normally distributed variables. The Student's t-tests were used for parametric values (Satterthwaite for unequal variances), Wilcoxon rank sum tests for non-parametric values, and Pearson's Chi^2 tests for dichotomous variables in the univariate analysis (Fisher's exact test when the expected numbers were small). The one-way analysis of variance (ANOVA) was used to determine whether there were any significant differences between the means of independent groups (age classes, educational level, treatment declared, etc.).

A linear regression model using BMI as a continuous variable was used to estimate the association between the work-related, individual, anthropometric and medication intake variables, and the BMI levels. Variables with $p < 0.20$ in the univariate linear regression analysis were used in a multivariate regression model. Variables that showed co-linearity or low frequency were excluded from the multivariate model, whereas variables with more than 2 categories were transformed into indicator (dummy) variables.

The final models for the linear regression analysis were constructed using the stepwise regression analysis to select the minimum set of predictors that significantly ($p \leq 0.05$)

maximized the model R^2. Logistic regression was applied to explain truck drivers' risk factors (obesity, alcohol consumption and episodes of sudden-onset sleepiness at the wheel) in relation to their demographic and work information. We then included the factors that were associated with the outcome measure with a $p < 0.20$ in the univariate analysis into a multivariate logistic regression model. We adjusted the odds ratios for potential confounders, namely, demographic characteristics potentially associated with the analysed risk factors, i.e., age, length of service, occupational category, coffee and alcohol intake, smoking and medication intake. Results were considered significant if $p \leq 0.05$. Odds ratios (OR) were reported with 95% confidence intervals (CI).

All statistical calculations were performed using STATA software (version 11.0 STATA Corporation, College Station, TX, USA).

RESULTS

Driver habits and medical conditions

We received the filled in questionnaires from 335 of the 524 PDs participating in CPC courses (122 specified themselves as bus drivers and 67 did not declare their driver category and therefore, were excluded from the analysis). The list of participants in CPC courses to whom the questionnaires were administered revealed that more than 99% of them were male, but in order to ensure anonymity, gender was not required in the questionnaire.

Table 1 shows the main characteristics of the study sample and presents the risk factors associated with obesity, alcohol consumption/misuse and sudden sleep onset at the wheel using the univariate logistic regression.

Of the participants, 56/335 (16.7%) declared they regularly used medicines – the reasons included: 11/335 (3.3%) allergies, 1/335 (0.3%) anxiety and depression, 6/335 (1.8%) diabetes, 6/335 (1.1%) heart conditions and 33/335 (9.9%) high blood pressure. Two hundred and eighty-five (85.6%) of the drivers declared themselves as substantial out-of-home eaters, with a similar distribution between truck drivers who stated they ate food prepared at home (39.9%) and drivers who declared they ate meals only in restaurants (33%). No differences in BMI among the two groups (out-of-home eaters vs home eaters) were detected (mean BMI of 27.4 and 26.9, respectively, $p = 0.33$). Eighty truck drivers (24.2%) declared they drank alcoholic beverages during working hours or work breaks.

Seventy-nine (23.6%) of the drivers did not receive a questionnaire that included the AUDIT C. With this limitation, the response rate to this test was 98.8%. Thirty seven (21.3%) participants had an AUDIT C score ≥ 5, while 36.2% had a score ≥ 4. No differences in the mean score were detected between the truck drivers with a lower educational level and those with a higher one (respectively 3 and 2.9, $p = 0.95$). The mean score for each of the three questions was respectively: 1.6 (SD = 1.26), 0.18 (SD = 0.55), 0.72 (SD = 0.94) (Figure 1 reports percentages of responses, separate for the 3 questions that form the AUDIT C questionnaire).

Seventy PDs (21.4%) had a body mass index indicating obesity (BMI ≥ 30) (Figure 2 reports percentage distribution of the truck drivers analysed according to the BMI status). Mean BMI was also statistically different between the truck drivers with a lower educational level and those with a higher one (27.8 vs. 26.3, respectively, $p = 0.006$). An inverse association was detected between educational attainment and obesity, and the associated risk of obesity for the truck drivers with a lower educational level was OR 2.1 (unadjusted; 95% CI: 1.12–3.95, $p = 0.021$).

By performing the multiple linear regression analysis using BMI as a dependent variable, effect of the length of service ($b = 0.12$, 95% CI: 0.06–0.18, $p < 0.001$) and hours spent per day at the wheel ($b = 0.32$, 95% CI: 0.09–0.56, $p = 0.008$) was significant and their coefficients were positive, indicating that the greater the length of service and the number of hours spent at the wheel, the greater the BMI. The multivariate regression indicated the AUDIT C total

Table 1. Socio-demographic, health and work characteristics of the truck drivers (N = 335) from the High Risk Professional Driver Study [1–3] and risk factors associated with obesity, alcohol consumption and misuse (considered as AUDIT C ≥ 5) and sudden sleep onset at the wheel using the univariate logistic regression

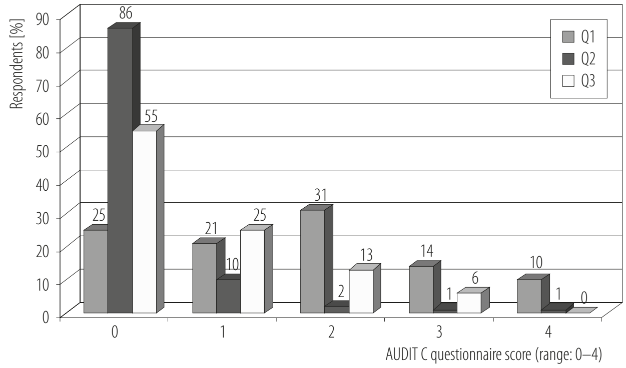
Variable	Total [n (%)]	Obese truck drivers		p	Alcohol consumption during work hours		p	AUDIT C score		p	Sudden sleep onset at the wheel		p
		BMI < 30	BMI ≥ 30		never	≥ once a month		< 5	≥ 5		never	≥ once a month	
Truck drivers [n (%)]	335	257 (78.6)	70 (21.4)		251 (75.8)	80 (24.2)		137 (78.7)	31 (21.3)		171 (52)	158 (48)	
Age [year] (M±SD)	42.7±9.7	41.9±9.3	45±10.7	0.022	42.1±9.6	44.5±9.8	0.056	42.8±9.4	40.4±11.0	0.191	41.8±9.5	43.6±9.7	0.103
Length of service [year] (M±SD)	18.0±9.8	17.3±9.2	20.3±11.6	0.054	17.6±9.7	19.6±10	0.132	18.6±9.9	18.6±11.3	0.999	16.8±9.5	19.3±9.9	0.023
Main routes				0.374			0.008			0.342			0.001
national	241 (83.4)	207 (79.6)	53 (20.4)		205 (77.6)	59 (22.4)		115 (77.2)	34 (22.8)		144 (55.2)	117 (44.8)	
international	48 (16.6)	37 (74.0)	13 (26.0)		30 (60.0)	20 (40.0)		14 (87.5)	2 (12.5)		14 (29.1)	34 (70.9)	
Educational level				0.020			0.082			0.907			0.953
elementary middle school	204 (65.0)	149 (74.5)	51 (25.5)		145 (71.8)	57 (28.2)		84 (84.3)	24 (22.2)		103 (51.5)	97 (48.5)	
high school university degree	110 (35.0)	92 (86.0)	15 (14.0)		88 (80.7)	21 (19.3)		44 (78.6)	12 (21.4)		56 (51.9)	52 (48.1)	
Body mass index							0.176			0.007			0.293
underweight-normal (< 25)	110 (33.6)	110 (33.6)			90 (82.6)	19 (17.4)		41 (73.2)	15 (26.8)		62 (57.9)	45 (42.1)	
overweight (25–30)	147 (45.0)	147 (45.0)			107 (74.3)	37 (25.7)		79 (87.8)	11 (12.2)		73 (50.3)	72 (49.7)	
obese class I (30–35)	52 (15.9)		52 (15.9)		36 (69.2)	16 (30.8)		12 (60.0)	8 (40.0)		22 (43.1)	29 (56.8)	
obese class II (35–40)	12 (3.7)		12 (3.7)		7 (58.3)	5 (41.7)		1 (50.0)	1 (50.0)		4 (33.3)	8 (66.7)	
obese class III (> 40)	6 (1.8)		6 (1.8)		4 (66.7)	2 (33.3)		1 (50.0)	1 (50.0)		3 (50.0)	3 (50.0)	
Audit C total score	2.9±2.2	2.7±2.1	4±2.6	0.006	2.5±2	3.9±2.4	< 0.001				2.6±2.2	3.2±2.1	0.048
Q1. How often do you have a drink containing alcohol?				0.494			0.007						0.065
never	62 (24.6)	47 (79.7)	12 (20.3)		53 (89.8)	6 (10.2)					41 (69.5)	18 (30.5)	
monthly or less	53 (21.0)	38 (73.1)	14 (26.9)		41 (78.8)	11 (21.2)					23 (43.4)	30 (56.6)	
2–4 times/month	77 (30.6)	63 (84.0)	12 (16)		50 (64.9)	27 (35.1)					41 (54.7)	34 (45.3)	
2–3 times/week	36 (14.3)	30 (85.7)	5 (14.3)		24 (66.7)	12 (33.3)					18 (51.4)	17 (48.6)	
≥ 4 times/week	24 (9.5)	18 (75.0)	6 (25.0)		15 (62.5)	9 (37.5)					11 (45.8)	13 (54.2)	

Table 1. Socio-demographic, health and work characteristics of the truck drivers (N = 335) from the High Risk Professional Driver Study [1–3] and risk factors associated with obesity, alcohol consumption and misuse (considered as AUDIT C ≥ 5) and sudden sleep onset at the wheel using the univariate logistic regression – cont.

Variable	Total [n (%)]	Obese truck drivers		p	Alcohol consumption during work hours		p	AUDIT C score		p	Sudden sleep onset at the wheel		p
		BMI < 30	BMI ≥ 30		never	≥ once a month		< 5	≥ 5		never	≥ once a month	
Audit C total score – cont.	2.9±2.2	2.7±2.1	4±2.6	0.006	2.5±2	3.9±2.4	< 0.001				2.6±2.2	3.2±2.1	0.048
Q2. How many units of alcohol do you drink on a typical day when you are drinking?				< 0.001			0.005						0.656
1–2	152 (86.3)	134 (90.5)	14 (9.5)		115 (76.2)	36 (23.8)					84 (56.0)	66 (44.0)	
3–4	18 (10.2)	11 (61.1)	7 (38.9)		10 (55.6)	8 (44.4)					9 (50.0)	9 (50.0)	
5–6	4 (2.3)	2 (50.0)	2 (50.0)		1 (25.0)	3 (75.0)					1 (33.3)	2 (66.7)	
7–9	1 (0.6)	1 (100.0)	0 (0)		0 (0)	1 (100.0)					1 (100.0)	0 (0)	
≥ 10	1 (0.6)	0 (0)	1 (100.0)		0 (0)	1 (100.0)					0 (0)	1 (100.0)	
Q3. How often have you had 6 or more units, on a single occasion in the last year?				0.184			0.041						0.451
never	136 (54.8)	111 (84.1)	21 (15.9)		106 (79.7)	27 (20.3)					77 (58.3)	55 (41.7)	
less than monthly	63 (25.4)	50 (79.4)	13 (20.6)		44 (71)	18 (29)					29 (46.8)	33 (53.2)	
monthly	33 (13.3)	21 (65.6)	11 (34.4)		22 (66.7)	11 (33.3)					17 (51.5)	16 (48.5)	
weekly	15 (6.1)	10 (76.9)	3 (23.1)		7 (46.7)	8 (53.3)					8 (57.1)	6 (42.9)	
daily or almost daily	1 (0.4)	1 (100.0)	0 (0)		1 (100.0)	0 (0)					0 (0)	1 (100.0)	
Smoking	134 (40.1)	109 (82.0)	24 (18)	0.211	97 (73.5)	35 (26.5)	0.432	50 (76.9)	15 (23.1)	0.674	69 (52.3)	63 (47.7)	0.895
Treatment declared				< 0.001			0.225			0.159			0.570
none	280 (83.6)	225 (82.1)	49 (17.9)		212 (76.8)	64 (23.2)		111 (79.3)	29 (20.7)		147 (53.4)	128 (46.6)	
antidiabetic	6 (1.8)	3 (100.0)	2 (0)		3 (50.0)	3 (50.0)		1 (33.3)	2 (66.7)		3 (50.0)	3 (50.0)	
antihypertensive	33 (9.8)	14 (42.4)	19 (57.6)		24 (72.7)	9 (27.3)		14 (73.7)	5 (26.3)		13 (40.6)	19 (59.4)	
sedatives	1 (0.3)	1 (100.0)	0 (0)		0 (0)	1 (100.0)		0 (0)	0 (0)		0 (0)	1 (100.0)	
other drugs	15 (4.5)	14 (100.0)	0 (0)		12 (80.0)	3 (20.0)		11 (91.7)	1 (8.3)		8 (53.3)	7 (46.7)	

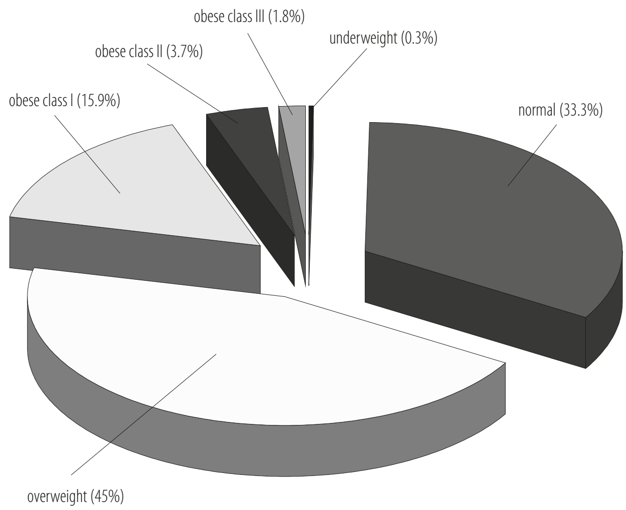
Coffee (cups/day) [n] (M±SD)	3.3±2.3	3.2±1.9	3.9±2.8	0.203	3.3±2.4	3.4±2.0	0.723	3.1±1.8	3.6±2.4	0.353	3.2±1.7	3.6±2.8	0.218
Chalder Fatigue Score (M±SD)	8.4±4.3	8.4±4.2	9.0±4.2	0.421	8.4±4.2	8.5±4.4	0.919	8.0±4.4	9.0±3.3	0.231	7.6±4.1	9.3±4.4	0.005
Driven distance [km/year ×1000] (M±SD)	84.2±65.2	79.4±60.9	94.0±38.1	0.088	83±64.7	89.0±67.5	0.592	76.5±56.4	68.4±42.5	0.519	71.2±53.0	99.0±76.0	0.006
Time spent driving [h/day] (M±SD)	7.5±2.4	7.3±2.4	8.2±2.4	0.032	7.6±2.3	7.2±2.7	0.292	7.3±2.4	7.4±2.7	0.842	7.0±2.5	7.8±2.1	0.021

BMI – body mass index; Q1 – first question of the AUDIT C; Q2 – second question of the AUDIT C; Q3 – third question of the AUDIT C.
M – mean; SD – standard deviation.



Q1, Q2, Q3 as in Table 1.

Fig. 1. Responses to the Alcohol Use Disorders Identification Test Consumption (AUDIT C) questionnaire



BMI range: underweight = 16–18.5, normal = 18.5–25, overweight = 25–30, obese class I = 30–35, obese class II = 35–40, obese class III > 40.

Fig. 2. Body mass index (BMI) in the studied truck drivers

score (OR = 1.34, 95% CI: 1.08–1.66, p = 0.008) and the length of service (OR = 1.09, 95% CI: 1.04–1.15, p <0.001) as the best predictive factors for obesity.

Workplace conditions, fatigue and sudden-onset sleepiness at the wheel

Two hundred and seven (69.7%) truck drivers declared their company had ≤ 10 employees. Ninety-five point one percent of the truck drivers declared a maximum distance

Table 2. Association between obesity and sudden sleep onset at the wheel and their related risk factors by the multivariate logistic regression

Variable	Obesity		p	Sudden sleep onsetiness at the wheel		p
	OR	95% CI		OR	95% CI	
Length of service	1.09	1.04–1.15	< 0.001	–	–	–
AUDIT C total score	1.34	1.08–1.66	0.008	–	–	–
Driving > 50 000 km/year	–	–	–	2.89	1.37–6.11	0.006
CFQ score > 11	–	–	–	2.97	1.22–7.21	0.016
Age > 55 years old	–	–	–	5.22	1.29–21.10	0.020

CFQ – Chalder Fatigue Questionnaire; OR – odds ratio; CI – confidence interval.

lower than 150 000 km/year, and 91.3% reported working less than 10 h/day. Of all the participants, 158/329 (48%) reported having experienced trouble staying awake while driving (at least once a month). The CFQ was compiled only by 205 truck drivers, while about 130 drivers completed a questionnaire that did not include the CFQ.

Forty-two out of two hundred and five (20.5%) truck drivers totalled a score higher than 11. The mean score was not statistically different among the truck drivers who drove more than 8 h per day or more than 50 000 km per year compared with those who drove less. No differences in the Chalder Fatigue Score (CFS) between the obese and the non-obese groups were detected (8.4 vs. 9, respectively, p = 0.42). By performing the regression analysis using the CFS as a dependent variable, the effect of age was not significant (b = –0.05, 95% CI: –0.15–0.05, p = 0.35), while the length of service (b = 0.15, 95% CI: 0.05–0.24, p = 0.004) was significant and its coefficient was positive, indicating that the greater the length of service, the higher the CFS. The CFS was associated with sudden-onset sleepiness at the wheel (unadjusted OR = 1.10; 95% CI: 1.03–1.18, p = 0.006), and a CFS higher than 11 was associated with an increased difficulty in staying awake while driving of OR = 2.65 (unadjusted; 95% CI: 1.3–5.4, p = 0.008).

Predictive factors for sudden-onset sleepiness at the wheel were, as follows: age > 55 years old (OR = 5.22, 95% CI: 1.29–21.1, p = 0.020), driving more than 50 000 km per year (OR = 2.89, 95% CI: 1.37–6.11, p = 0.006) and CFS > 11 (adjusted OR = 2.97, 95% CI: 1.22–7.21, p =0.016). Obesity was not found to be related to the episodes of sudden-onset sleepiness at the wheel (OR = 1.59, 95% CI: 0.93–2.7, p = 0.091). In this study, in the multivariate analysis, the number of hours spent per day at the wheel was not a predictive factor for the sudden-onset sleepiness at the wheel. Non-significant differences in coffee consumption or smoking habits were detected among those who declared episodes of sleepiness at the wheel and those who did not.

Table 2 shows the risk factors associated with obesity and sudden-onset sleepiness at the wheel using the multivariate logistic regression.

DISCUSSION

Studies in recent decades have demonstrated that there is an association between obesity and the risk of road accidents [11], and that among truck drivers there is high prevalence of excessive body weight and elevated arterial blood pressure, which are the risk factors for diabetes and obstructive sleep apnea (OSA) [12,13].

The prevalence of obesity in our sample was high, with about 21.4% of the respondents having a BMI over 30. This compares with the national average of 7.8% (data

from the surveys conducted annually between 2006 and 2010 among subjects in the productive age) [5]. Clearly, obesity in our convenience sample cannot be compared to 7.8% for the national average, but surely it may be a call for attention to a real problem of the group.

These results are similar to those reported by Lemos in a Brazilian study (prevalence values of 47.8% and 16.2% for overweight and obesity, respectively) and by Sabbagh-Ehrlich in an Israeli study (prevalence values of 37.5% and 15%, respectively), both involving truck drivers [7,14]. In the United States the prevalence of obesity among long-haul truck drivers was found to be much higher than in the above-mentioned studies (69%), and twice as prevalent in truck drivers as in the 2010 U.S. adult working population [4].

Although our study was conducted in an area where the Mediterranean diet is deeply rooted, obesity remains a real problem among Italian truck drivers. Our results suggest the importance of paying attention to driver's length of service and to the number of hours spent at the wheel (the greater the length of service and the number of hours spent at the wheel, the greater the BMI), which is consistent with a Colombian study that has highlighted the potential deleterious health effects of prolonged driving time, which was positively associated with overweight and abdominal obesity in adult Colombian males [15]. The relationship between educational attainment and obesity is a well-known factor. Gender and the country's economic development level can influence this relationship. Our results showed an inverse association between educational level and obesity, which is common in studies in higher-income countries. On the contrary a positive association is more common in lower-income countries [16].

Obesity is not only an important risk factor for several diseases, but it also appears to be associated with the future risk of heavy truck road accidents among newly recruited commercial drivers. A recent study has indicated that, compared to drivers with normal BMI, the risk ratio for all accidents was significantly higher among the drivers in obesity classes II and III [17]. The recent results of the HiRis PD study suggest a positive correlation between obesity and sudden-onset sleepiness at the wheel as the main cause of this increased risk [2]. This is coherent with the results of Moreno et al. study, which indicates a shorter sleep length in obese truck drivers [18]. This correlation was not found in our study, probably because of a smaller number of the studied drivers.

In this regard, almost half of the participants (48%) declared experiencing an episode of sudden-onset sleepiness while driving at least once a month. This finding is consistent with, and adds to, the results observed in other studies performed worldwide, with some variability depending on a questionnaire used. In a group of Israeli truckers, more than 30% of the 160 drivers recalled falling asleep at least once while driving, and 10.6% had fallen asleep while driving in the month before the interview. Predictive factors of falling asleep while driving were: moderate to severe sleep quality, frequent difficulty in finding parking places when tired, employers demanding that drivers work more than the legal hour limit and working more than 12 h/day several times a week [7]. Excessive daytime sleepiness was also correlated with younger age, snoring and working > 10 h without rest [19].

A Belgian study has indicated low educational level, current smoking, unrealistic work schedules and risk for OSA as risk factors for daytime sleepiness among truck drivers [20]. In this regard, a Brazilian study has estimated around 26% of a large sample of truck drivers to be a high-risk group for OSA [21]. According to the 2006 Triagency Task Force of the American College of Chest Physicians, National Sleep Foundation, and American College of Occupational and Environmental Medicine, more than 5% of our sample (drivers who had BMI > 35) should have been screened for sleep apnea [22].

Important risk factors for falling asleep at the wheel that emerged from this study were: advanced age (> 55 years

old), driving more than 50 000 km per year and self-reported fatigue (CFS > 11). This means that we must focus our prevention efforts not only on young truck drivers but also on older ones. The association between distance travelled per year and episodes of sudden-onset of sleepiness at the wheel emerged already from the HiRis PD study [2]. There is a wide range of mechanisms that most probably underlie truck drivers fatigue: poor working conditions (e.g., long periods of time away from home and a dangerous nature of work), long working hours (sometimes more than the legal limit) or sleep-related factors (lack of sleep and sleeping disorders). A short self-administered questionnaire like the CFQ (which has a well-known validity in assessing fatigue in the general population) could be useful for measuring fatigue in this group. According to our results, a CFS > 11 indicates a risk of experiencing sudden-onset sleepiness at the wheel three times higher than for a CFS ≤ 11, which is in agreement with a previous study [2]. Such a risky behavior appears to be widespread among PDs and to be even more serious in the subgroup of truck drivers [2].

The HiRis PD study has found a correlation between the habit of drinking alcohol in the workplace and the length of service, but in our subgroup we did not find such a correlation. This risky behavior seems to be more frequent in those who travel on international routes, consistent with the above-mentioned study. The high percentage of at-risk drinkers that emerged in our study highlights the need for screening Italian truck drivers to assess their level of alcohol consumption. In this regard, the optimal AUDIT C thresholds for unhealthy alcohol use in the US, based on a comparison with detailed gold standard interviews, are ≥ 4 points for men and ≥ 3 points for women [23].

Other studies suggested higher sensitivities with a cut-off score ≥ 5 points [24,25]. In this study we decided to use a cut-off score ≥ 5 points as a countermeasure to any bias related to the high response rate and selection bias. Even though the AUDIT C questionnaire seems to be a good, user-friendly test in detecting those with problematic alcohol consumption, we believe that its use during health sanitary surveillance can promote under-reporting (responses might be affected by the fear of negative consequences on medical assessment).

Limitations

This study was a pilot study intended to generate hypotheses for a further investigation, and thus, the analysis has several limitations. A convenience sample was used and a selection bias cannot, therefore, be excluded. It has a relatively small population (N = 335), which somewhat limits the generalizability of the findings. In addition, the results are based on cross-sectional data that include only a range of variables that can potentially determine the outcomes analysed in this study (we do not record the role of work-family conflict, lack of physical activity, varying driving shifts, etc.). The study relied on self-reported data that are prone to bias (especially self-reported alcohol use).

For these reasons the participants were assured confidentiality, questionnaires were clear and completely anonymous (therefore, they were less likely to promote under-reporting). The drivers in this study were asked questions about the number of drinks, rather than the number of alcohol units. It is unclear how the participants' calculation of the number of drinks they consume compares to these standard drink definitions and the type of alcohol consumed. It is likely that the participants under-reported their consumption. Hence, the associations seen in this study most likely represent an under-estimation of the selected outcomes. This is a cross-sectional study, and therefore, we cannot infer any causal links or directionality between the variables studied. Nevertheless, the current associations are strong and they are of interest, regardless of direction.

CONCLUSIONS

In conclusion, the results of this study show that obesity, alcohol consumption, fatigue and sleepiness at the wheel are prevalent among Italian truck drivers. The use of simple

and self-administered questionnaires (such as the AUDIT C and the CFQ) might be helpful in detecting truck drivers with problematic alcohol consumption and at a high risk of obesity and sleepiness at the wheel. Implementation of educational programmes, particularly targeting obese drivers and promoting increased awareness of the deleterious effects of alcohol consumption, fatigue and sleepiness while driving, may help improve professional drivers' well-being and reduce accidents among this category.

ACKNOWLEDGMENTS

The authors express their thanks to: "Federazione Autotrasportatori Italiani associazione provinciale di Cuneo," and to the "C.S.G. Consorzio Scuole Guida della provincia di Cuneo," particularly to the Autoscuola Dho di Brondello Livio e Musso Ivano Snc.

REFERENCES

1. Rosso GL, Perotto M, Feola M, Bruno G, Caramella M. Investigating obesity among professional drivers: The high risk professional driver study. Am J Ind Med. 2015;58(2):212–9, http://dx.doi.org/10.1002/ajim.22400.
2. Rosso GL, Perotto M, Feola M, Caramella M. Falling asleep at the wheel among Italian professional drivers: Results from the HiRis PD study. Int J Occup Med Environ Health. 2014;27(6):1005–12, http://dx.doi.org/10.2478/s13382-014-0327-z.
3. Rosso GL, Perotto M, Feola M, Caramella M. Workplace drug testing and alcohol policy in Italy; there is still a long way to go. Drug Test Anal. 2014;6(9):893–7, http://dx.doi.org/10.1002/dta.1569.
4. Sieber WK, Robinson CF, Birdsey J, Chen GX, Hitchcock EM, Lincoln JE, et al. Obesity and other risk factors: The National Survey of U.S. Long-Haul truck driver health and injury. Am J Ind Med. 2014;57(6):615–26, http://dx.doi.org/10.1002/ajim.22293.
5. Gallus S, Odone A, Lugo A, Bosetti C, Colombo P, Zuccaro P, et al. Overweight and obesity prevalence and determinants in Italy: An update to 2010. Eur J Nutr. 2013;52(2):677–85, http://dx.doi.org/10.1007/s00394-012-0372-y.
6. Perttula P, Ojala T, Kuosma E. Factors in the fatigue of heavy vehicle drivers. Psychol Rep. 2011;108(2):507–14, http://dx.doi.org/10.2466/06.13.22.PR0.108.2.507-514.
7. Sabbagh-Ehrlich S, Friedman L, Richter ED. Working conditions and fatigue in professional truck drivers at Israeli ports. Inj Prev. 2005;11(2):110–4, http://dx.doi.org/10.1136/ip.2004.007682.
8. Chalder T, Berelowitz G, Pawlikowska T, Watts L, Wessely S, Wright D, et al. Development of a fatigue scale. J Psychosom Res. 1993;37(2):147–53, http://dx.doi.org/10.1016/0022-3999(93)90081-P.
9. Cella M, Chalder T. Measuring fatigue in clinical and community settings. J Psychosom Res. 2010;69(1):17–22, http://dx.doi.org/10.1016/j.jpsychores.2009.10.007.
10. Saunders JB, Aasland OG, Babor TF, de la Fuente JR, Grant M. Development of the alcohol use disorders identification test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption-II. Addiction. 1993;88(6):791–804, http://dx.doi.org/10.1111/j.1360-0443.1993.tb02093.x.
11. Abu Dabrh AM, Firwana B, Cowl CT, Steinkraus LW, Prokop LJ, Murad MH. Health assessment of commercial drivers: A meta-narrative systematic review. BMJ Open. 2014;4(3):e003434, http://dx.doi.org/10.1136/bmjopen-2013-003434.
12. Marcinkiewicz A, Szosland D. Selected risk factors of diabetes mellitus among road transport drivers. Int J Occup Med Environ Health. 2010;23(2):175–80, http://dx.doi.org/10.2478/v10001-010-0018-3.
13. Xie W, Chakrabarty S, Levine R, Johnson R, Talmage JB. Factors associated with obstructive sleep apnea among commercial motor vehicle drivers. J Occup Environ Med. 2011;53(2):169–73, http://dx.doi.org/10.1097/JOM.0b013e3182068ceb.
14. Lemos LC, Marqueze EC, Sachi F, Lorenzi-Filho G, Moreno CR de C. Obstructive sleep apnea syndrome in truck

drivers. J Bras Pneumol. 2009;35(6):500–6 [cited 2014 October 14]. Available from: http://www.ncbi.nlm.nih.gov/pubmed/19618029.

15. Flórez Pregonero A, Gómez LF, Parra DC, Cohen DD, Arango Paternina CM, Lobelo F. Time spent traveling in motor vehicles and its association with overweight and abdominal obesity in Colombian adults who do not own a car. Prev Med. 2012;54(6):402–4, http://dx.doi.org/10.1016/j.ypmed.2012.04.002.
16. Cohen AK, Rai M, Rehkopf DH, Abrams B. Educational attainment and obesity: A systematic review. Obes Rev. 2013;14(12):989–1005, http://dx.doi.org/10.1111/obr.12062.
17. Anderson JE, Govada M, Steffen TK, Thorne CP, Varvarigou V, Kales SN, et al. Obesity is associated with the future risk of heavy truck crashes among newly recruited commercial drivers. Accid Anal Prev. 2012;49:378–84, http://dx.doi.org/10.1016/j.aap.2012.02.018.
18. Moreno CRC, Louzada FM, Teixeira LR, Borges F, Lorenzi-Filho G. Short sleep is associated with obesity among truck drivers. Chronobiol Int. 2006;23(6):1295–303, http://dx.doi.org/10.1080/07420520601089521.
19. De Pinho RSN, da Silva-Júnior FP, Bastos JPC, Maia WS, de Mello MT, de Bruin VM, et al. Hypersomnolence and accidents in truck drivers: A cross-sectional study. Chronobiol Int. 2006;23(5):963–71, http://dx.doi.org/10.1080/07420520600920759.
20. Braeckman L, Verpraet R, van Risseghem M, Pevernagie D, de Bacquer D. Prevalence and correlates of poor sleep quality and daytime sleepiness in Belgian truck drivers. Chronobiol Int. 2011;28(2):126–34, http://dx.doi.org/10.3109/07420528.2010.540363.
21. Moreno CRC, Carvalho FA, Lorenzi C, Matuzaki LS, Prezotti S, Bighetti P, et al. High risk for obstructive sleep apnea in truck drivers estimated by the Berlin questionnaire: Prevalence and associated factors. Chronobiol Int. 2004;21(6):871–9, http://dx.doi.org/10.1081/CBI-200036880
22. Hartenbaum N, Collop N, Rosen IM, Phillips B, George CF, Rowley JA, et al. Sleep apnea and commercial motor vehicle operators: Statement from the joint task force of the American College of Chest Physicians, the American College of Occupational and Environmental Medicine, and the National Sleep Foundation. Chest. 2006;130(3):902–5, http://dx.doi.org/10.1378/chest.130.3.902.
23. Delaney KE, Lee AK, Lapham GT, Rubinsky AD, Chavez LJ, Bradley KA. Inconsistencies between alcohol screening results based on AUDIT-C scores and reported drinking on the AUDIT-C questions: prevalence in two US national samples. Addict Sci Clin Pract. 2014;9(1):2, http://dx.doi.org/10.1186/1940-0640-9-2.
24. Vitesnikova J, Dinh M, Leonard E, Boufous S, Conigrave K. Use of AUDIT-C as a tool to identify hazardous alcohol consumption in admitted trauma patients. Injury. 2014;45(9):1440–4, http://dx.doi.org/10.1016/j.injury.2014.01.004.
25. Calabria B, Clifford A, Shakeshaft AP, Conigrave KM, Simpson L, Bliss D, et al. Identifying Aboriginal-specific AUDIT-C and AUDIT-3 cutoff scores for at-risk, high-risk, and likely dependent drinkers using measures of agreement with the 10-item Alcohol Use Disorders Identification Test. Addict Sci Clin Pract. 2014;9:17, http://dx.doi.org/10.1186/1940-0640-9-17.