

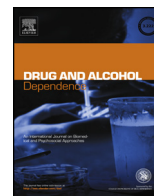


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# The relation between risk-taking behavior and alcohol use in young adults is different for men and women

L. de Haan<sup>a,\*</sup>, A.C.G. Egberts<sup>a,b</sup>, E.R. Heerdink<sup>a,b</sup>

<sup>a</sup> Division of Pharmacoepidemiology and Clinical Pharmacology, Utrecht Institute of Pharmaceutical Sciences, Utrecht University, Universiteitsweg 99, 3584 CG Utrecht, The Netherlands

<sup>b</sup> Department of Clinical Pharmacy, University Medical Center Utrecht, Heidelberglaan 100, 3584 CX Utrecht, The Netherlands

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### ABSTRACT

**Objective:** The present study examined the relationship of risk-taking behavior and alcohol use and the role of sex herein, while adjusting for age, depression, anxiety, stress and lifestyle.

**Methods:** Participants were 6002 university students. They were classified as either abstinent, drinker but non-binge drinker, or binge drinker based on self-reported alcohol consumption. Risk-taking and risk assessment were evaluated with the RT-18 and depression, anxiety and stress with the DASS-21.

**Results:** The odds of being a binge versus non-binge drinker increased with risk-taking as well as risk assessment for both men and women. The odds being a non-binge drinker versus abstinent were increased by risk-taking for women only. For binge drinking versus abstinence, risk-taking had a significant increasing effect for both sexes, but risk assessment was only significant in women.

**Conclusion:** These results may assist with alcohol use prevention techniques because risk-taking behavior exerts, even when corrected for age, lifestyle, depression, anxiety, and stress levels, a solid, sex-specific independent effect on alcohol use.

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## 1. Introduction

Nearly eight and four percent of all male and female deaths, respectively could be attributed to alcohol use worldwide in 2012 (World Health Organization, 2014). This sex difference is largely explained by variations in consumption: women are more often abstainers, drink alcohol less frequently and in smaller quantities, and are less often engaged in heavy episodic drinking (Dawson and Archer, 1992; World Health Organization, 2014).

This sex-specific pattern of alcohol use could also partly be explained by physical characteristics. Females need less alcohol to reach the same state of inebriety as men due to their average lower body weights, smaller liver capacities to metabolize alcohol, and higher proportions of body fat (Smarandescu et al., 2014; World Health Organization, 2014).

Psychological factors could also contribute to sex differences in alcohol use. A large body of research has identified that personality traits such as impulsivity and sensation seeking consistently correlate with alcohol use (Ball, 2005; Dick et al., 2010; Hittner and Swickert, 2006; Ibáñez et al., 2010). Sex differences in

risk-taking behavior and related personality traits are also well known, with men typically being more likely to engage in risky behavior than women (Byrnes et al., 1999). In general, men score higher on measures of behavioral disinhibition, impulsivity and sensation seeking, each of which correlate to heavy alcohol use and related problems (Nolen-Hoeksema, 2004; Rounsaville et al., 1998).

In addition to risk-taking behavior, psychiatric disorders have been linked to alcohol use (Ball, 2005; Rounsaville et al., 1998). An association between major depression and alcohol consumption exists, although the causality and direction of this relationship varies based on patient characteristics and is thus unclear (Boden and Fergusson, 2011). In general, women are twice as likely to experience depression as men (Nolen-Hoeksema and Girgus, 1994), implying different relations between alcohol use and depression based on the heavier alcohol consumption in men. Other psychiatric disorders that influence or coincide with alcohol use also have well known sex-related disparities. For instance, women are more likely to develop anxiety disorders (McLean and Anderson, 2009) and female problem drinkers have reported more serious depressive symptoms and health-related stressful events compared to males (King et al., 2003).

Sex differences in alcohol use can thus be attributed to physical and psychological factors, as well as psychiatric disorders. We

\* Corresponding author.

E-mail address: [l.dehaan@uu.nl](mailto:l.dehaan@uu.nl) (L. de Haan).

were particularly interested in the relationship between risk-taking behavior, alcohol consumption and the role of sex herein in young adults. This age group is known to consume alcohol in dangerous levels (e.g., binge drinking or more than 4 (female)/5 (male) consecutive alcoholic consumptions) (Wechsler et al., 1995a,b) and have elevated levels of risk-taking behavior as well (Steinberg et al., 2008). Therefore, the present study examined the relationship between risk-taking behavior and alcohol use in a large sample of young male and female adults while adjusting for age, depression, anxiety, stress, and lifestyle. We hypothesized: (1) risk-taking behavior is significantly and positively related to alcohol use, even after adjustments for age, depression, anxiety, stress, and lifestyle and that (2) this relation is different for men and women.

## 2. Material and methods

### 2.1. Participants

Participants were 6002 students from the online Utrecht Student Survey (USS; de Haan et al., 2012b), which has been extensively described elsewhere. In brief, the USS was conducted in June of 2011, among students from Utrecht University and the University of Applied Sciences Utrecht. These students were invited to participate via an internal university email. The aim of the survey was 3-fold: (1) to determine the potential impact of alcohol mixed with energy drinks (AMED) on overall alcohol consumption and alcohol-related consequences; (2) to investigate motivations for specific alcohol consumption patterns; (3) to identify personality characteristics, risk-taking behavior and their relationship with alcohol consumption. Data from this sample were previously analyzed for the purpose of evaluating AMED and alcohol consumption (de Haan et al., 2012a). Approximately 70,000 students received the email containing the link to the online survey. A total of 7158 students opened the link to the survey provided by email, yielding a response rate of 10.2%. Respondents were first presented with the online informed consent form stating the purpose, procedures, risks, confidentiality, compensation, and contact information. To proceed, participants had to agree by clicking on the "I agree to participate" button. In case the participant chose to click the "I decline to participate" button, they were redirected to a thank you page, and the survey was shut down. After cleaning the data, 6002 students remained for analysis (de Haan et al., 2012b). A total of 39 were excluded for not giving consent; 570 did not meet the age criterion of 18–30 years; 525 did not answer the questions that were necessary to classify them as part of one of the drinking groups; and 22 stated they did not answer the items truthfully (de Haan et al., 2012b). From 6002 participants,  $n=2116$  (35.3%) were male and  $n=3886$  (64.7%) female.

### 2.2. Alcohol consumption

To assess alcohol consumption, items from the Quick Drinking Screen (Sobell et al., 2003) were adapted and measured in three possible drinking scenarios: consumption of just alcohol (i.e., beer or wine or unmixed liquor); consumption of alcohol mixed with energy drinks; and consumption of alcohol with other mixers (e.g., cola, juice, etc.). Participants were asked to report number of standard drinks, with 250cc of beer, 100cc of wine, and 35cc of liquor equal to one standard drink. For this analysis, alcohol consumption data from all three scenarios were combined into pooled alcohol consumption data. For those who used alcohol, consumption over the previous month (yes/no) and the occurrence of binge drinking days (yes/no) in the past month, were extracted. Binge drinking was defined as consuming more than four (females) or five (males) alcoholic beverages in one day. Subjects were classified as either abstinent, drinker but non-binge drinker, or binge drinker.

### 2.3. Risk-taking behavior

The Risk Taking questionnaire-18 items (RT-18; de Haan et al., 2011) consists of 18 dichotomous 'yes' or 'no' items taken from the Impulsiveness-Venturesomeness-Empathy questionnaire (Eysenck et al., 1985), the novelty-seeking subscale of the Temperament and Character Inventory (Cloninger et al., 1993), and the impulsiveness-sensation-seeking subscale of the Zuckerman Kuhlman Personality Questionnaire (Aluja et al., 2006; Zuckerman, 2002). The RT-18 has two subscales: risk-taking and risk assessment (each subscale score consists of the sum of nine specific items, with three items reversely scored). Risk-taking scores are correlated with actual risk-taking behavior (i.e., engagement in risky behaviors), whereas a high score on risk assessment indicates a low level or less consideration of possible consequences (i.e., acting without thinking). Cronbach's alpha was calculated in this sample. Risk-taking and assessment had internal consistencies of 0.79, and 0.73, respectively.

### 2.4. Other measures

Demographic information was collected regarding sex, age, height and weight. Depression, anxiety and stress levels were assessed with the Depression Anxiety

Stress Scales 21 items (DASS21; de Beurs et al., 2001; Lovibond and Lovibond, 1995), which is a quantitative self-report measure of depression, anxiety and stress. Example items include, "I found it hard to wind down" for the stress scale, "I was aware of dryness in my mouth" for the anxiety scale, and "I couldn't seem to experience any positive feeling at all" for the depression scale. Responses were based on a three-point Likert-scale related to feelings over the past week. Cronbach's alphas were 0.87, 0.76, and 0.85 for depression, anxiety and stress, respectively. Lifestyle was based on BMI scores (i.e., dividing weight in kilograms by squared height in meters), membership in a fraternity or sorority (yes/no), illicit drugs use in the previous year (yes/no), current medication use (yes/no), and tobacco use (yes/sometimes/no).

### 2.5. Data analysis

Data were gathered in Excel and prepared for analyses using R version 3.0.2 (RCoreTeam, 2014) with Hmisc, Psych and Nnet packages. Sex differences were assessed through either independent *t*-tests or chi-square tests for age, weight, height, BMI, risk-taking, risk assessment, depression, anxiety, stress, fraternity or sorority membership, medication use, illicit drug use, tobacco use and alcohol use. The relation between risk-taking behavior and alcohol use was assessed in a hierarchical multinomial logistic regression model. Based on preliminary analysis where sex acted as an effect modifier, we stratified the analysis for sex. The crude model was corrected for possibly confounding variables in three steps. First, the crude model was corrected for age (model 1; Barnes et al., 2002; Feil and Hasking, 2008). The second model was adjusted for age and lifestyle (model 2). Lifestyle comprises BMI, fraternity or sorority membership, tobacco use, medication use and illicit drug use, which all are known confounders in the literature (Barnes et al., 2002; Capone et al., 2007; Kleiner et al., 2004; Reed et al., 2007). Third, the model was corrected for age, lifestyle, and DASS21 results (model 3; Buckner et al., 2011; Feil and Hasking, 2008). Dummy variables were created where necessary. Effect sizes were expressed as odds-ratios with 95% confidence intervals (95%CI). A total of twelve determinants (including dummies) were included in the third model. This implies at least  $12 * 15 = 180$  observations were needed to fulfill the power requirement. Male abstinent ( $n=180$ ) represented the category with the least members. Therefore, we met the prerequisite threshold. All statistical tests were two-sided. Effects with  $p < 0.05$  and confidence intervals that did not contain zero were considered significant.

## 3. Results

Sex differences are depicted in Table 1. Men were slightly older ( $t(4259) = 4.16, p < 0.001$ ), heavier ( $t(3920) = 42.90, p < 0.001$ ), taller ( $t(3927) = 72.84, p < 0.001$ ), and had higher BMI scores ( $t(4619) = 7.44, p < 0.001$ ). For RT-18 scores, the difference was largest for risk-taking ( $t(4259) = 4.16, p < 0.001$ ) and substantially smaller for risk assessment ( $t(4046) = 2.06, p = 0.04$ ). There were no significant differences for depression ( $t(2325) = 1.80, p = 0.07$ ) and anxiety ( $t(2424) = 1.18, p = 0.24$ ). However, women had much higher stress scores ( $t(2636) = -6.38, p < 0.001$ ). Sorority or fraternity membership yielded a small difference ( $\chi^2(1) = 5.54, p = 0.02$ ), whereas more women indicated medication use compared to men ( $\chi^2(1) = 241.47, p < 0.001$ ). Interestingly, more men reported tobacco ( $\chi^2(2) = 38.95, p < 0.001$ ) and illicit drug use ( $\chi^2(1) = 124.61, p < 0.001$ ). Men also reported more use of alcohol (91.5%, ( $\chi^2(1) = 20.56, p < 0.001$ )) and 75.4% were classified as binge drinkers. A total of 87.6% of women reported alcohol use in the past month, and 59.5% were identified as binge drinkers, which was significantly lower percentage than that for men ( $\chi^2(2) = 154.99, p < 0.001$ ). Fig. 1 shows the distribution of the RT-18 risk-taking and risk assessment scores for men and women in each of the three alcohol use categories.

Table 2 summarizes the results of the hierarchical multinomial logistic regression for males. The regression coefficients and odds ratios for the three contrasts are shown, including non-binge drinkers compared to abstinent, binge drinkers compared to non-binge drinkers, and binge drinkers compared to abstinent. A highly significant effect of risk-taking on alcohol use was found for binge drinkers versus abstinent, and the final model (i.e., corrected for age, lifestyle and the DASS21 subscales) yielded an OR of 1.17. Interestingly, risk assessment did not significantly influence this male specific model for alcohol use. Just a small difference between non-binge drinkers and abstinent (OR between 1.03 and 1.00 for all four models) was found, and the effect of risk-taking on binge drinkers

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