**The Association Between Loneliness and Substance use Among Dutch College Students**

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**Abstract**

Substance use frequently occurs among college students and increases the risk of health problems. To combat these health problems, it is important to understand factors associated with substance use. Previous studies have suggested that loneliness is associated with substance use among adolescents. Most of that literature focused on high-school students, while substance use is a more frequent problem among college students. Therefore, the current study examines the association between loneliness and substance use among college students. This study uses cross-sectional data of the YOUth Got Talent study. A total of 851 students are included in the analysis, with a mean age of 17.14 (*SD* = 1.54). Results show that students experiencing more loneliness drink alcohol less frequently and are less likely to use tobacco than students experiencing less loneliness. Additionally, experiencing loneliness is not associated with cannabis use. Furthermore, the relation between loneliness and alcohol, tobacco, and cannabis use was similar for boys and girls. Even though previous literature has suggested that loneliness is associated with more substance use among adolescents, this study shows that it is not the case among college students. Due to small effect sizes and the cross-sectional nature of this study, further research is needed.

*Keywords:* Loneliness, Alcohol use, Tobacco use, Cannabis use, Gender

**Samenvatting**

Middelengebruik komt vaak voor onder Nederlandse studenten en vergroot de kans op mentale en fysieke problemen. Om die problemen tegen te gaan is het van belang om te weten welke factoren bijdragen aan middelengebruik. Voorgaand onderzoek suggereert dat eenzaamheid samenhangt met middelengebruik onder adolescenten. Echter, het meeste onderzoek is gedaan onder middelbare scholieren, terwijl middelengebruik vaker voorkomt onder studenten. Daarom wordt in deze studie onderzoek gedaan naar de samenhang tussen eenzaamheid en middelengebruik onder studenten. De studie maakt gebruik van cross-sectionele data van de YOUth Got Talent studie. In de analyse zijn 851 studenten meegenomen, met een gemiddelde leeftijd van 17.14 jaar (*SD* = 1.54). De resultaten tonen aan dat eenzaamheid de kans om frequent alcohol te drinken en de kans om te roken verkleint, en niet samenhangt met cannabisgebruik. Gender heeft geen effect op de relatie tussen eenzaamheid en alcohol-, tabak- en cannabisgebruik. Door kleine effectgroottes en het cross-sectionele karakter van deze studie is vervolgonderzoek nodig.

# Loneliness and Substance use Among Dutch College Students

 Substance use among college students is a prominent public health concern in the Netherlands. A national representative study has shown that 68% of Dutch college students drink alcohol regularly, 11% smoke cigarettes daily, and 15% use cannabis monthly (Van Dorsselaer et al., 2020). These frequent rates of substance use can be explained by adolescents’ heightened responsiveness to rewards, combined with a not fully developed control response for inhibiting behaviors (Squeglia & Cservenka, 2017). This leaves adolescents more vulnerable to hazardous behaviors, such as substance use (Squeglia & Cservenka, 2017). Moreover, research has suggested that being at college increases the risk of substance use, due to heightened academic pressures, and substance use being considered to be a normative part of the college experience (Skidmore et al., 2016). Therefore, the current study focuses on college students.
 Substance use can have negative consequences for students’ well-being, ranging from poor decision making to long-term effects, including cognitive deficits and lasting health damage (Ayala et al., 2017; Squeglia & Cservenka, 2017). Accordingly, attempts have been made to lower substance use among college students in the Netherlands. However, most interventions have proven to be ineffective (Sannen et al., 2015; Voogt et al., 2013). So, a better understanding of factors associated with substance use among college students is needed, both to treat at-risk students and to improve prevention efforts.
 One factor that seems to be positively associated with substance use is loneliness (Peltzer & Pengpid, 2017). Loneliness is most commonly defined as “an unpleasant experience which emerges when an individual perceives deficiency in the quality and quantity of his or her social relationships” (Çivitci & Çivitci, 2009). Although loneliness may be experienced in any period of life, adolescents are most susceptible to loneliness (Qualter et al., 2015). This heightened susceptibility may emanate from rapid social changes that occur during adolescence, such as distancing from parents (Laursen & Hartl, 2013), increased need for social affiliation, and increased time spent alone (Koenig & Abrams, 1999). Yet, interventions have thus far not focused on loneliness in order to lower substance use among adolescents. Most research investigating the link between loneliness and substance use during adolescence is done among high-school students, while limited research is done among college students (McBroom et al., 2008). However, substance use is more prevalent among college students than high-school students (Stevens et al., 2017; Van Dorsselaer et al., 2020). Therefore, the current study expands prior literature investigating the relation between loneliness and substance use by focusing on college students.
**Loneliness and Substance use**
 Several explanations address why students’ loneliness relates to substance use. The first explanation derives from the self-medication theory of Khantzian (1977), which posits that individuals might use substances as an external way to modify their negative feelings. Since loneliness can be a painful and distressing phenomenon (Stickley et al., 2014), lonely students might use substances to manage negative feelings that emanate from loneliness (Mcbroom et al., 2011). The second explanation derives from the reconnection theory of Maner et al. (2007), which suggests that loneliness can intensify motivations to satisfy the need for social connectedness. Since substance use can promote social connectedness (Skidmore et al., 2016), lonely students might be driven towards substance use behaviors in order to (re)connect with others (DeWall & Pond, 2010). So, loneliness might increase substance use.
 The third explanation stems from the social control theory (Hirschi, 1969), arguing that not being a member of a cohesive group increases the likelihood to engage in behaviors that violate conventional norms, such as substance use (Osgood et al., 2014). Individuals actively weigh the costs and benefits associated with deviating from social norms, and lonely adolescents have less to ‘lose’ by engaging in unconventional behaviors like substance use than socially connected adolescents (Han et al., 2015). This theory might be least applicable to alcohol use, since it is the most socially accepted substance in European countries (Verkooijen et al., 2007). The last explanation derives from research suggesting that individuals who frequently use substances are less able to invest in meaningful personal relationships than those using substances less often (Chou et al., 2011), making frequent substance use a risk factor for experiencing loneliness (Dingle et al., 2015). Thus, loneliness and substance use might be positively associated.
 Contrarily, loneliness may be associated with less frequent substance use. Substance use is widely considered to be a normative part of the college experience (Skidmore et al., 2016) – contrary to the social control theory (Hirshi, 1969). Moreover, substances are often used in social contexts during college (Ford & Blumenstein, 2013; Welsh et al., 2019). Especially alcohol can be seen as a group-level activity (Copeland et al., 2018) which has a social nature in college (Mcbroom et al., 2011). Therefore, lonely students may be less likely to engage in substance use, compared with their socially connected peers.
 Research has shown diverse outcomes for the association between loneliness and substance use. The current study distinguished between alcohol, tobacco, and cannabis use, since these are the three most used substances among college students (Van Dorsselaer et al., 2020). Regarding the association between loneliness and alcohol use, cross-sectional research has found a positive association (Alwan et al., 2011; Peltzer & Pengpid, 2017; Stickley et al., 2014), as well as a negative association (Diehl et al., 2018; McBroom et al., 2008; Pedersen & Von Soest, 2015; Varga & Piko, 2015). Moreover, longitudinal research has shown that loneliness does not have an effect on alcohol consumption (Segrin et al., 2017). Regarding tobacco use, cross-sectional research has shown a positive relation between loneliness and tobacco use (Christopherson & Conner, 2012; DeWall & Pond, 2011; Pengpid & Peltzer, 2021), as well as a negative relation (Varga & Piko, 2015). Regarding cannabis use, cross-sectional studies have shown that loneliness is associated with more cannabis use (Alwan et al., 201; Stickley et al., 2014).
 Results regarding the association between loneliness and substance use are diverse, especially for alcohol use. However, there seems to be a slight majority of evidence indicating that loneliness is related to less alcohol use, in particular among college students (Diehl et al., 2018; McBroom et al., 2008). In contrast, loneliness seems to be associated with more tobacco use and more cannabis use.
**Gender Differences**
 The link between loneliness and substance use might be influenced by gender. Research has suggested that girls tend to cope with negative feelings more often in problem solving ways, whereas boys cope with more avoidance and escape mechanisms (Connor-Smith et al., 2002; Eschenbeck et al., 2007). Those avoidance and escape mechanisms are associated with risk for substance use (Nolen-Hoeksema, 2012; Piko, 2001; Kuper, 2010). Following this line of research, and given that loneliness can lead to negative feelings (Stickley et al., 2014), the link between loneliness and substance use could be stronger for boys than girls. Regarding the reconnection theory, Read et al. (2004) showed that girls tend to expect more social benefits from alcohol use than boys. Moreover, Piko et al. (2015) showed that girls smoke cigarettes to fit in, not boys. So, it might be that girls more often use substances in order to increase or gain social connectedness, which can be reinforced by feelings of loneliness (DeWall & Pond, 2010). Yet, gender differences in the association between loneliness and substance use within these theories are not tested for.
 When looking at empirical evidence for the effect of gender on the association between loneliness and substance use, results are diverse. Stickley et al. (2014) found that lonely boys in Russia are more likely to use tobacco than lonely girls. They also found that in the United States, loneliness is associated with alcohol and cannabis use among girls, not boys. Contrarily, Alwan et al. (2011) showed that boys who felt lonely were more likely to report cannabis use than lonely girls. Theoretical explanations for the gender effects were not given in the studies by Alwan et al. (2011) and Stickley et al. (2014).
 It seems that gender has an effect on the association between loneliness and substance use. Since Stickley et al. (2014) found differing gender effects for different types of substance use, this study investigates gender effects in the link between loneliness and alcohol, tobacco, and cannabis use separately. When the association between loneliness and alcohol, smoking, or cannabis differs between boys or girls, that should be considered in prevention strategies.
**The Current Study**
 This study investigates the association between loneliness and substance use among Dutch college students (Figure 1), using data from the YOUth Got Talent (YGT) study. The current study defines college students as Mbo-students, also known as vocational students. Mbo is one of the lower educational levels for college students in the Netherlands. This study focuses on Mbo-students, since they are at heightened risk for excessive substance use, compared to higher educated students (Malmberg et al., 2012; Sannen et al., 2015). The associations between loneliness and alcohol, tobacco, and cannabis use are investigated separately, since loneliness does not seem to have the same effects on each of the three substances (Osgood et al., 2014; Rhew et al., 2020). Diverse associations could imply distinct strategies for preventing and reducing alcohol, tobacco, or cannabis use (Osgood et al., 2014).  The research question of this study is: “What is the association between loneliness and alcohol, tobacco, and cannabis use among Mbo-students in the Netherlands?”. The sub-question is: “Does gender have an effect on the association between loneliness and alcohol, tobacco, and cannabis use among Mbo-students in the Netherlands?”. Based on contradicting results of Alwan et al. (2011) and Stickley et al. (2014), no gender-specific assumptions are made in the current study. Since both loneliness and substance use could be influenced by family support and age (Osgood et al., 2014), the current study controls for those two variables. The following hypotheses are derived from the literature:
Hypothesis 1: Loneliness is negatively related to alcohol use.
Hypothesis 2: Loneliness is positively related to tobacco use.
Hypothesis 3: Loneliness is positively related to cannabis use.
Hypothesis 4: Gender has an effect on the association between loneliness alcohol use.
Hypothesis 5: Gender has an effect on the association between loneliness and tobacco use.
Hypothesis 6: Gender has an effect on the association between loneliness and cannabis use.

**Figure 1***Theoretical Model Associations Between Loneliness and Substance use*



**Method**

**Procedure**

 The current study used cross-sectional data derived from the first wave of the YGT study, a study investigating wellbeing among Dutch Mbo-students. Before data collection took place, ethical approval was given by the Faculty Ethical Review Committee of the Faculty Social Science (200420). For the current study, ethical approval was given for the secondary use of the YGT data.

 All three Mbo-schools in Utrecht agreed to participate in the YGT study. Within these schools, a selection of classes was made, and all students within these classes were approached for participation. Parents of participants under the age of 18 were informed in advance of the study through consent letters. All participants were informed at school (in class) at least one day before the study took place. The information included that participation was voluntary and that consent could be withdrawn at any time. Participants gave active consent and were informed that their data would be anonymized. All participants were able to decline participation at any time before or during the hour in which questionnaires were administered. Students were informed of this by the research assistant who oversaw the study in their classroom.
 Self-report questionnaires were completed in participants’ classrooms during the fall of 2018. Students who did not participate in the study were able to work on homework instead. Adolescents under the age of 16 were excluded from the study. The most common non-response reasons were sickness or other classroom absence (15%) and refusal to participate (2.5%).

**Participants**

The YGT questionnaire was completed by 1,231 Mbo-students. Participants were excluded when answers were missing on the items of alcohol use, tobacco use, cannabis use, gender, and age, and when more than 50% of the items of parental support and loneliness were missing. After checking for missing, 851 participants remained. Of the sample, 54.3% (*N* = 462) were girls and 45.7% (*N* = 389) were boys, with an overall mean age of 17.14 (*SD* = 1.54). Most of the participants had a Dutch background (81.4%). Among participants’ fathers, 6.5% achieved primary or high-school education, 27.9% finished (a few years of) a vocational study, 33.2% studied at college or university level, and from 33.5% information was missing. Among participants’ mothers, 5.8% achieved primary school or high-school education, 31.9% finished (a few years of) a vocational study, 34.8% studied at college or university level, and from 27.5% information was missing.

**Measures**
 In this study, the variables loneliness, alcohol use, tobacco use, cannabis use, gender, family support, and age were used, derived from the YGT dataset.
***Loneliness*** The predictor variable loneliness was measured with the use of a Dutch translated and shortened version of the well validated University of California, Los Angeles Loneliness Scale (UCLA Loneliness Scale; Russel et al., 1980). The UCLA Loneliness Scale showed high internal consistency in a previous study using a college sample, with an Alpha value of .94 (Russel et al., 1980). Out of the twenty original UCLA Loneliness Scale items, ten items were used in the YGT study. Examples of the items were “I do not have real friends” and “There are people I can talk to” (reversely scored). Students could indicate the extent to which they agreed with the statement by means of a 5-point Likert scale, ranging from 0 = “Totally disagree” to 4 = “Totally agree”, with a higher score suggesting more loneliness. A mean score of loneliness was created when at least five out of the ten statements were answered. The loneliness scale had a Cronbach’s Alpha value of .88 in the current study.
***Substance use*** Substance use was measured as alcohol use, tobacco use, and cannabis use. Participants were asked: “How many days did you drink alcohol/ smoke cigarettes/ used cannabis (marihuana) or hash in the past four weeks?”. The response options were as follows; 1 = Never, 2 = 1 or 2 days, 3 = 3-5 days, 4 = 6-9 days, 5 =10-19 days, 6 = 20-29 days and 7 = 30 days or more. Following previous work, respondents were categorized as non-drinkers (0 days), occasional drinkers (< 10 days), and frequent drinkers (≥ 10 days of the past 30 days; Jiang & Ling, 2013). Regarding cannabis use, respondents were categorized as non-users (0 days), occasional users (1–5 days), and heavy users (≥ 6 days of the past four weeks), following research of Huas et al. (2008). Regarding tobacco use, respondents were categorized as non-smokers (0 days), occasional smokers (1–19 days), and frequent smokers (≥ 20 days of the past 30 days), following research of Jiang and Ling (2013). However, since the assumption of proportional odds was not met for tobacco use, the variable was dichotomized (Bender & Grouver, 1998). Responses were coded as 0 = non-smoker and 1 = smoker, following previous research (McDonough et al., 2016; Osgood et al., 2014).
***Gender*** The moderator variable gender was measured by the question “Are you a boy or a girl?”. The answers were coded as 0 = girl and 1 = boy.
***Parental Support***
 Four items were used to measure the control variable parental support. These items were derived from the “Multidimensional Scale of Perceived Social Support” (MSPSS; Zimet & Zimet, 1988). The MSPSS showed good internal reliability, test-retest reliability, and strong factorial validity in several studies (Bruwer et al., 2008; Kazarian & McCabe, 1991). The four items of parental support showed high internal consistency in previous work, with an Alpha value of .87 (Zimet & Zimet, 1988). Example items included: “My family members really try their best to help me” and “At home, I get the emotional support that I need”. The response options were measured on a 7-point Likert Scale, ranging from 0 = “Totally disagree” to 6 = “Totally agree”. A mean score of parental support was created when at least two out of the four statements were answered. A higher score means that adolescents experience more parental support. The parental support scale had a Cronbach’s Alpha value of .91 in the current study.
***Age*** The control variable “age” was measured using one question of the YGT study: “When were you born (year)?”.

Analysis
 Version 27.0 of the software program SPSS was used for analyzing the YGT dataset. First, the assumption of multicollinearity was checked based on VIF values, with VIF-values > 5 being considered as problematic. Second, it was checked whether the data had too influential cases, with a leverage value > .0176, and outliers, with a Cook’s value > 1. The assumption of proportional odds was checked by the test of parallel lines (Erkan & Yildiz, 2014). The assumption was met when *p* > .05. An ordinal logistic regression analysis was performed to investigate the association between loneliness and alcohol and cannabis use, controlling for parental support, and age.

Since the assumption of proportional odds was not met for tobacco use, a binary logistic regression analysis was performed. The assumption of linearity between the continuous independent variables and the logit transformation of the dependent variable was checked by means of the Box-Tidwell procedure (Box & Tidwell, 1962). Finally, the effect of gender as a moderator on the association between loneliness and substance use was investigated by creating an interaction variable of loneliness and gender. Again, parental support and age were controlled for.

**Results**

 Before analyzing the data, multicollinearity was checked. All VIF-values were near 1 (the highest being 1.33), meaning that there was no multicollinearity. There were no outliers, since there were no cases with a Cook’s value above the critical value of 1. A total of 27 cases were excluded from the analysis due to being too influential, with values above the leverage critical value (> 0.0176). A total of 824 cases remained. For alcohol use, the assumption of proportional odds was met, as assessed by a full likelihood ratio test, χ2(4) = 5.61, *p* = .230, meaning that the regression coefficient of the predictors was the same for each equation. Regarding cannabis use, the assumption of proportional odds was met too, χ2(4) = 4.68, *p* = .322. Regarding tobacco use, the assumption of proportional odds was not met, χ2(4) = 9.61, *p* = .047. Therefore, a binary analysis was executed for tobacco use, following previous research (Bender & Grouver, 1998). Loneliness, parental support, and age were linearly related to the logit of the dependent variable, as assessed through the Box-Tidwell (1962) procedure. A Bonferroni correction was applied, resulting in statistical significance being accepted when *p* < .007 (Tabachnick & Fidell, 2014).
 Table 1 shows the descriptive statistics of the dependent, independent, and control variables. The mean of alcohol use, tobacco use, cannabis use, and loneliness were all relatively low, while the mean of parental support was relatively high. Table 1 also shows the correlations between the three dependent variables (alcohol, tobacco, and cannabis use) and between the three continuous variables (loneliness, parental support, and age). Missing correlations are due to different levels of measurements of the variables, for which a Spearman correlation, Pearson correlation, or Chi-Square test could not be applied. The correlation between tobacco use and cannabis use was the highest (*r* = -.52, *p* < .01), meaning that the more frequently a student uses cannabis, the more likely they are to smoke cigarettes (or the other way around).

**Table 1***Means and Standard Deviations of all Variables and Correlations Between Alcohol use, Tobacco use, and Cannabis use, and Between Loneliness, Parental Support, and age.*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  *M* (*SD*) | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 Alcohol usea | 1.67 (0.59) | 1 | .33\*\* | .22\*\* | - | - | -  | -  |
| 2 Tobacco usea | 1.29 (0.62) |  | 1 | .52\*\* | -  | - | -  | -  |
| 3 Cannabis usea | 1.21 (0.53) |  |  | 1 | -  | - | - | - |
| 4 Lonelinessb | 0.83 (0.63) |  |  |  | 1 | -  | -.48\*\* | .04 |
| 5 Gender | 0.45 (0.50) |  |  |  |  | 1 | - | - |
| 6 Parental Supportb | 4.81 (1.31) |  |  |  |  |  | 1 | -.06 |
| 7 Ageb | 16.97 (1.20) |  |  |  |  |  | 1 |

*Note.* In order to perform correlation analyzes between the three substances, tobacco use was still considered as an ordinal variable. Gender was coded as 0 = girl, 1 = boy.
a Spearman correlation b Pearson correlation.

\*\* *p* < .01.

**Loneliness and Alcohol use** An ordinal logistic regression with proportional odds was run to determine the association between loneliness and frequency of alcohol use, controlled for parental support and age (see Table 2, Model 2 of alcohol use). The final model significantly predicted the dependent variable over and above the intercept-only model, χ2(3) = 23.22, *p* < .001. The model explained 3% (Nagelkerke R2) of the variance of alcohol use. Loneliness was negatively associated with alcohol use, with an odds ratio of 0.59 (*p* < .001).

**Loneliness and Cannabis use**

 A cumulative odds ordinal logistic regression was run to examine the association between loneliness and frequency of cannabis use, controlling for parental support and age (see Table 2, Model 2 of cannabis use). The final model significantly predicted the dependent variable, χ2(3) = 11.87, *p* = .008. However, loneliness was not associated with cannabis use, with an odds ratio of 0.84 (*p* = .321). The model explained 2% (Nagelkerke R2) of the variance of cannabis use.

**Loneliness and Tobacco use**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  By means of a binary logistic regression, the association between loneliness and the likelihood of using tobacco was analyzed (see Table 2, Model 2 of tobacco use). The model was significant, χ2(3) = 22.07, *p* < .001. The model explained 4% (Nagelkerke R2) of the variance of tobacco use and classified 80.0% of the cases correctly. The results show that loneliness is associated with a lower likelihood of using tobacco, with an odds ratio of 0.61 (p = .003).**Table 2***Associations Between Alcohol, Tobacco, and Cannabis use and the Moderating Effect of Gender, Controlled for Parental Support and Age.*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | *B* | *SE* | Wald | *df* | *p* | Odds Ratio | 95% CI For Odds Ratio  Lower Upper  |
| Model 1 Alcohol use |
|  Parental Support | -0.04 | 0.05 | 0.46 | 1 | .498 | 0.97 |  0.87 1.07 |
|  Age |  | 0.14 | 0.06 | 5.71 | 1 | .017 | 1.15 |  1.03 1.29 |
| Model 2 |  |  |  |  |  |  |  |  |
|  Loneliness | -0.52 | 0.13 | 16.89 | 1 | .000 | 0.59 |  0.46 0.76 |
| Model 3 |  |  |  |  |  |  |  |  |
|  Gender |  | -0.07 | 0.23 | 0.09 | 1 | .768 | 0.93 |  0.59 1.47 |
|  Loneliness\*Gender | 0.04 | 0.22 | 0.03 | 1 | .875 | 1.04 |  0.67 1.61 |
| Model 1 Cannabis use   |
|  Parental Support | -0.15 | 0.07 | 4.91 | 1 | .027 | 0.86 |  0.75 0.98 |
|  Age |  | 0.18 | 0.07 | 5.65 | 1 | .017 | 1.19 |  1.03 1.38 |
| Model 2 |  |  |  |  |  |  |  |  |
|  Loneliness | -0.18 | 0.18 | 0.99 | 1 | .321 | 0.84 |  0.59 1.19 |
| Model 3 |  |  |  |  |  |  |  |  |
|  Gender |  | -0.40 | 0.33 | 1.52 | 1 | .218 | 0.67 |  0.35 1.27 |
|  Loneliness\*Gender | -0.03 | 0.31 | 0.01 | 1 | .934 | 0.97 |  0.53 1.79 |
| Model 1 Tobacco use  |
|  Parental Support | -0.13 | 0.06 | 4.37 | 1 | .037 | 0.88 |  0.77 0.99 |
|  Age |  | 0.19 | 0.07 | 8.03 | 1 | .005 | 1.21 |  1.06 1.38 |
| Model 2 |  |  |  |  |  |  |  |  |
|  Loneliness | -0.50 | 0.17 | 7.79 | 1 | .003 | 0.61 |  0.44 0.84 |
| Model 3 |  |  |  |  |  |  |  |  |
|  Gender |  | 0.19 | 0.29 | 0.43 | 1 |  .512 | 1.21 |  0.69 2.13 |
|  Loneliness\*Gender |  | -0.21 | 0.30 | 0.52 | 1 |  .473 | 0.81 |  0.45 1.45 |

*Note.* Model 1 shows the association between the control variables and substance use. Model 2 shows the association between loneliness and substance use, controlled for parental support and age. Model 3 shows the moderating effect of gender, including the effects of gender, loneliness, parental support, and age.  |  |  |  |

**Moderating Effect of Gender**

The results presented in Table 2, Models 3, show the effect of gender on the association between loneliness and alcohol use, tobacco use, and cannabis use, respectively. Gender did not have a significant effect on the association between loneliness and alcohol use (*p* = .875), tobacco use (*p* = .473), or cannabis use (*p* = .934). Thus, the association between loneliness and substance use did not differ between boys and girls.

**Discussion**

 Substance use is a prominent health problem among Dutch college students (Van Dorsselaer et al., 2020). In order to combat the problem, it is important to understand factors associated with substance use. One factor that seems to be linked to substance use is loneliness (Peltzer & Pengpid, 2017). Studies researching the link between loneliness and substance use among adolescents were mostly done among high-school students, while substance use is more prevalent among college students (Stevens et al., 2017; Van Dorsselaer et al., 2020). Therefore, the current study focussed on college students. Results showed that loneliness is associated with less frequent alcohol use, a lower likelihood to use tobacco, and is not associated with cannabis use. Additionally, no gender effects were found.

 The finding that students experiencing more loneliness drink less frequently than students experiencing less loneliness is in line with previous work (Diehl et al., 2018; McBroom et al., 2008; Varga & Piko, 2015). This finding supports the notion of alcohol use being a normative part of the college experience (Skidmore et al., 2016) and often used in social contexts during college (Ford & Blumenstein, 2013), making lonely students less inclined to drink alcohol (Mcbroom et al., 2011). However, these results should be interpreted with care, since effect sizes in the current study, as well as in previous studies (McBroom et al., 2008; Varga & Piko, 2015), were small.

 The finding that students who experience more loneliness are less likely to smoke cigarettes than students who experience less loneliness is not in line with previous studies (Christopherson & Conner, 2012; DeWall & Pond, 2011; Peltzer & Pengpid, 2017). An explanation could be that tobacco use – just as alcohol use – is a social and normative behavior during college (Ford & Blumenstein, 2013), making lonely students less likely to smoke cigarettes. It could also be that the contradicting result is due to small effect sizes in the current study (Nagelkerke R2 ≤ 0.04), as well as in previous studies, with Odds Ratio’s < 2 (Pengpid & Peltzer, 2021; Sullivan & Feinn, 2012) or Cohens’ *d* < .05 (DeWall & Pond, 2011). Therefore, it might be that relation between loneliness and tobacco use is negligible.
 The finding that loneliness is not associated with cannabis use is contradicting with previous literature as well (Alwan et al., 2011; Stickley et al., 2014). A possible explanation is that the current study did not differentiate between solitary substance use and social substance use. It could be the case that lonely students are more likely to drink in a solitary setting, and non-lonely students in a social setting, canceling out each other’s effect. This argument could also apply to alcohol and tobacco use, which might explain the small effect sizes. Another explanation could be that studies finding an association between loneliness and cannabis use (Alwan et al., 2011; Stickley et al., 2014) did not control for parental support, whereas the current study did. Literature has shown less parental support increases the likelihood of experiencing loneliness (Machado et al., 2020). Moreover, less parental support heightens the risk of cannabis use among adolescents (Goldstick et al., 2018). So, the significant effects of Alwan et al. (2011) and Stickley et al. (2014) could be due to the influence of parental support.
 Finally, the finding that the association between loneliness and alcohol, tobacco, and cannabis use is similar for both boys and girls is contradicting with previous research (Alwan et al., 2011; Stickley et al., 2014). An explanation for the unexpected results could be that gender differences were expected based on the assumption that loneliness would increase substance use, which was not the case in the current study. Another possibility is that socio-cultural factors play a role, since the current study was done in the Netherlands, while the study of Alwan et al. (2011) was done in the Seychelles (Africa) and the study of Stickley et al. (2014) was done in Connecticut and Russia. In the Netherlands, socialization processes regarding substance use are similar for boys and girls (Ciairano et al., 2009), while, for instance, in the Seychelles socio-cultural norms tend to stigmatize girls who engage in substance use (Alwan et al., 2011). Moreover, in Russia, it is less culturally acceptable for females to use tobacco compared to boys (Stickley et al., 2014). Therefore, when applying the social control theory (Hirschi, 1969) – stating that lonely people are driven away from cultural norms – girls might use substances more often than boys. On the other hand, girls might under-report their substance use behaviors due to stigmas (Stickley et al., 2014). However, further research is needed to investigate whether and how those socio-cultural factors play a role.
**Practical Implications** The current study showed that loneliness does not increase substance use among college students. Additionally, effect sizes were small in the current study, as well as in previous studies **(**DeWall & Pond, 2011; Pengpid & Peltzer, 2021). Thus, in order to decrease substance use, it might be beneficial for interventions to focus on other factors than loneliness.
 However, when further research will be done on the link between loneliness and substance use, it can be insightful to distinguish between solitary and social substance use, to see whether a strong effect between loneliness and solitary substance use exists. Additionally, high-school students and college students could be compared in the same study, to see whether the contradicting results of the current study are due to the differences between high-school settings and college settings. Also, different educational levels of college could be included, to see whether the results of the current study can be generalized to other educational levels. Finally, a qualitative study might be beneficial, to understand lonely students’ motives for substance use or non-use.
**Strengths and Limitations** The current study has several strengths. First of all, the study has a large sample size, warranting the reliability of the study. Second, age and parental support were used as control variables, since both variables can influence either loneliness and substance use (Osgood et al., 2014), strengthening the internal validity. Third, this study looked at the frequency of alcohol and cannabis use, not only the likelihood to drink alcohol or use cannabis, which was done by most of the previous literature (Alwan et al., 2011; Stickley et al., 2014; Varga & Piko, 2015). That is important, because using substances more frequently has more severe consequences than using them less frequently (Bonn‐Miller & Zvolensky, 2010).
 However, this study also has several limitations. Firstly, this study used cross-sectional data. Therefore, the study does not give insights into the causal relation between loneliness and substance use. For instance, even though loneliness and less alcohol use are associated, it is not clear whether loneliness leads to less alcohol use or that using less alcohol leads to more loneliness. The latter possibility is not supported by theories or previous research, making it less plausible. It could be, however, that confounding variables play a role. For instance, not having many friends increases the risk of loneliness (Holt-Lunstad, 2017) and decreases the risk for substance use (Osgood et al., 2014). So, it could be that the relationship between loneliness and substance use was confounded by the number of friends students have.
 Secondly, this study made use of self-report questionnaires, making the answers subjective. Students may report that they use substances less often than they do, for instance, because of societal standards. It was noticeable that in this study, 350 out of 1,231 participants did not fill in any of the loneliness items. It could be that those students felt lonely and did not want to report on it. Not including those 350 participants in the analysis could have biased the results of this study

 Finally, only the frequency of substance use was measured, not the quantity. When, for instance, a student drinks eight beers on 3-5 days and another student drinks one beer on 6-9 days, the first person drinks more alcohol, while in the number of days (and thus in the current study) it seems as if the second person drinks more alcohol. So, frequency of substance use does not give the full amount of information.

**Conclusion**
 This study showed that loneliness is not a contributor to substance use among Dutch college students, contrary to what was shown in most studies among high-school students. The current study showed that loneliness was associated with less frequent alcohol use and a lower likelihood to use tobacco. Loneliness was not associated with cannabis use. Finally, the associations between loneliness and alcohol, tobacco, and cannabis use were similar among boys and girls.

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