



## The Relationship between depression and use of ecstasy among adolescents in Taiwan

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### ABSTRACT

**Introduction:** The aim of this cross-sectional study was to examine the relationship between depression and ecstasy use among adolescents in Taiwan by controlling for the effects of demographic characteristics and cannabis use.

**Methods:** A total of 10,262 adolescents aged 12-18 years completed research questionnaires that assessed their severity of depression, status of ecstasy use, and history of cannabis use. The participants were grouped into non-users, ex-users, and current users. Severity of depression among these three adolescent groups was compared using analysis of covariance (ANCOVA), considering the history of cannabis use and demographic characteristics as covariates.

**Results:** After controlling for history of cannabis use and age, the study found that current ecstasy users experienced more severe depressive symptoms than ex-users and non-users. The difference between ex-users and non-users was not significant.

**Conclusion:** This study found that current ecstasy users had more severe depressive symptoms than non-users and ex-users. Psychological health professionals must monitor depressive symptoms among adolescent ecstasy users and provide emotional regulation strategies and psychological intervention for those with significant depression.

### Keywords

Depressive symptoms, Adolescent, Ecstasy, Cannabis

### Introduction

Ecstasy use in adolescents is an important public health issue. In the United States (U.S.), the prevalence rate of ecstasy use in grades 8, 10, and 12 was found to be 2.5%, 4.5%, and 6.5%, respectively [1]. Although a previous study found that the prevalence rate of ecstasy

use among junior high school students in Taiwan was relatively low (0.63-0.77%[2]), a street outreach study found that a high proportion (12.1-14.5%) of adolescents with truant behavior in Taiwan reported having ever used ecstasy in their lifetime [3]. Furthermore, several adverse consequences have been found to accompany ecstasy use in adolescents, including

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polydrug use and reduced school attendance [3], impaired cognitive performance [4], and co-occurrence of negative emotional status (NES) [5]. The literature indicates the neurotoxic effects of ecstasy on serotonergic neurons [6]. Consumption of ecstasy can cause serotonin depletion, which may result in short-term or long-term depression [7].

The results of studies on the association between ecstasy use and mood problems in adolescents are still mixed. In a study by Keyes, et al. [8] on psychiatric diagnoses and ecstasy use among a large-scale sample of adolescents in a community, current ecstasy users were more likely to have anxiety-related diagnoses, and former users were more likely to have mood-related disorders than non-users. Huizink et al. [6] followed a group of 1580 individuals from childhood to adulthood to track their behavioral and emotional problems and found that those with depressive or anxious symptoms were at higher risk of using ecstasy. However, not every ecstasy user has mood problems. A study by Falck et al. [9] of 402 ecstasy users found that only 16.4% of users had a moderate to severe level of depression. Further study is needed to examine the association between ecstasy use and depression in adolescents and to control for the possible confounding factors in the association. For example, Matthews and Bruno [10] found that cannabis use was a significant predictor of depressive symptoms among regular ecstasy users. Meanwhile, demographic characteristics may have a moderating effect on the relation between ecstasy use and depressive symptoms. For example, the relation between use of ecstasy and depressive symptoms has been observed to differ depending on gender [11].

Therefore, the aim of this cross-sectional study was to examine the relationship between depression and different patterns of ecstasy use among adolescents in Taiwan by controlling for demographic characteristics and cannabis use. This study hypothesized that use of ecstasy is significantly associated with severity of depressive symptoms after controlling for the effect of demographic characteristics and cannabis use.

## Method

### ■ Participants and procedure

In 2004, there were 202,456 adolescent students in 140 senior high/vocational schools and 257,873 adolescent students in 209 junior high

schools in four counties and three metropolitan areas in southern Taiwan. From the Taiwan Demographic Fact Book [12], 10 senior high/vocational schools and 11 junior high schools were randomly selected from non-urban areas, and 19 senior high/vocational schools and 12 junior high schools were randomly selected from urban areas. The classes in the schools selected were stratified into three levels based on grade and then 207 classes with 12,210 adolescents were randomly selected according to their grades. Of them, 11,111 (91.0%) adolescents returned their written informed consents. Of these, 10,262 (84.05%, 5232 girls and 5030 boys) adolescents completed the research questionnaires without omission.

Research assistants explained the purpose of this study to all eligible students, emphasizing respect for their privacy and encouraging them to participate. The adolescents were asked to anonymously complete the questionnaire based on the explanations by and under the direction of the research assistants. Each student received a gift worth NT\$33 (one US dollar) at the end of the assessment.

### ■ Measures

*The Chinese version of the Center for Epidemiologic Studies Depression Scale (CES-D).* The Chinese version [13] of the CES-D [14] was originally translated by two psychiatrists and found to be valid among Taiwanese adolescents [15]. Subjects are asked how often they have experienced each symptom during the past week. Response categories include (0) rarely or none of the time (less than 1 day), (1) some or a little of the time (1-2 days), (2) occasionally or a moderate amount of the time (3-4 days), and (3) most or all of the time (5-7 days). The values of these response categories are reversed for the four positive affect items. Total scores range from 0 to 60, and higher CES-D total scores indicate more severe depression. The Cronbach alpha for the CES-D in the present study was 0.930, and two-week test-retest reliability ( $\rho$ ) was 0.782.

*The Questionnaire for Experience in Substance Use (Q-ESU).* The Q-ESU was used to inquire how often respondents smoked, consumed alcohol, chewed betel nut, took sedatives/hypnotics, and used illicit drugs (including cannabis, ketamine, ecstasy, glue, methphetamines, and heroin) during the preceding year [16]. For this purpose, the participants were divided into three groups according to their response to the question for ecstasy use: non-users, who had never used

ecstasy in their lifetime ( $n=10162$ ); ex-users, who had ever used ecstasy but had quit in past 12 months ( $n=54$ ); and current users, who reported current use of ecstasy ( $n=46$ ). Participants were also divided into those who had ever and those who had never used cannabis.

## ■ Statistics

Data analysis was performed using SPSS 14.0 statistical software. Descriptive analysis was utilized to compare demographic characteristics (gender and age) among the three groups of adolescents. Analysis of covariance (ANCOVA) was applied to compare the severity of depression among three groups by considering cannabis use and demographic characteristics as covariates.

## Results

Demographic characteristics, severity of depression, and history of cannabis use among the three groups of adolescents are shown in **Table 1**. There was no significant difference in gender among the three groups ( $\chi^2=.55$ ,  $df=2$ ,  $p > .05$ ). However, there was a significant difference in age among the three groups ( $F_{2,10259}=21.473$ ,  $p < .01$ ). The results of post hoc testing indicated that non-users were younger than the other two groups, and there was no significant difference in ages between ex-users and current users. In addition, more current users reported having used cannabis in the past year than the other two groups ( $\chi^2=2767.68$ ,  $df=2$ ,  $p < .01$ ).

We further compared the severity of depression among the three groups by using ANCOVA and controlling for the effects of age and the history of cannabis use. The results indicated that there was a significant difference in the severity of depression among the three groups ( $F_{2,10253}=4.80$ ,  $p < .01$ ). The results of post hoc testing indicated that current users reported more severe depressive symptoms than the other two groups (current users vs. non-users: mean difference=5.20,  $p < .01$ ; current users vs. ex-users: mean difference=4.10,  $p < .05$ ). However, there was no significant difference in the severity of depressive symptoms between non-users and ex-users (mean difference=1.13,  $p > .05$ ).

## Discussion

This study found that current ecstasy users reported more severe depressive symptoms than ex-users and non-users after adjusting for the effects of age and the history of cannabis use. The results of this study were similar to that of a

**Table 1:** The distribution of demographic characteristics, severity of depression, and history of cannabis use among three groups ( $N = 10,262$ ).

	<b>Non-users (N = 10162) n (%) or Mean (SD)</b>	<b>Ex-users (N = 54) n (%) or Mean(SD)</b>	<b>Current users (N = 46) n (%) or Mean(SD)</b>	<b>p-value</b>
Gender (Female)	5184 (51.0)	27 (50.0)	21 (45.70)	$p > .05$
Age (years)	14.62 (1.74)	15.72 (1.64)	15.80 (1.67)	$p < .01$
Severity of depression on the CES-D	16.67 (10.04)	19.22 (10.21)	23.93 (12.60)	$p < .01$
Cannabis use	8 (0.10)	11 (21.20)	19 (42.20)	$p < .01$

Cannabis use: participants reported having used cannabis in past year; CES-D: The Chinese version of the Center for Epidemiologic Studies Depression Scale.

study by Keyes et al. [8]. However, the findings of this study were inconsistent with the findings of some previous studies. For example, a study by Roiser and Sahakian [7] found that current and ex-ecstasy users scored significantly higher on the Beck Depression Inventory-II (BDI-II) than the ecstasy-naïve controls, but there was no significant difference between current and ex-ecstasy users. One possible explanation for the discrepancy is the difference in the instruments used for measuring depression. Guillot and Greenway [17] have raised the possibility that BDI-II might not precisely and sensitively detect the fluctuation of depressive symptoms in different types of ecstasy users. A study by Thomasius et al. [18] on adult ecstasy users found that ex-ecstasy users reported higher levels of depressive symptoms than controls and current ecstasy users. One possible explanation for the discrepancy is the difference in research populations. The research population of the present study was a group of adolescents aged 12 to 18 years, an age period that is a time of experimental or occasional illicit drug use. Thus, the long-term effects of ecstasy use were not easy to observe among either adolescent ex-users or current users. On the other hand, ecstasy use may result in persistent psychopathological symptoms and deteriorated memory performance among adult ex-ecstasy users [19].

Some limitations of this study should be addressed. First, the cross-sectional research design of this study limited our ability to draw conclusions regarding the causal relationships between ecstasy use and depression. Second, the data were provided by the adolescents themselves, and the validity of reported illicit drug use and depression cannot be easily quantified. Third, this study recruited school population adolescent students as the research population; however, adolescents who had dropped out from school and were students of night schools were not recruited into this study. Although adolescent

dropouts are proportionately small in number, they may have different patterns of illicit drug use compared with the adolescents recruited for this study.

## Conclusion

In conclusion, this study found that current ecstasy users had more severe depressive symptoms than non-users and ex-users. Psychological health professionals must monitor

depressive symptoms among adolescent ecstasy users. Emotional regulation strategies and psychological intervention should be provided for adolescent ecstasy users with significant depression.

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