Eating Disorders and Associated Health Risks Among University Students
Marie Pierre Tavolacci, MD, MPH1,2; Sébastien Grigioni, MD, PhD2,3; Laure Richard, MPH3; Gilles Meyrignac, MD4; Pierre Déchelotte, MD, PhD2,3; Joël Ladner, MD, PhD2,5

ABSTRACT
Objective: To determine the prevalence of eating disorders among university students and its relationship to behavioral characteristics and substance use.
Design: Cross-sectional study collected socioeconomic characteristics and behavioral risk.
Setting: University of Upper Normandy, France.
Participants: University student volunteers.
Phenomenon of Interest: The Sick, Control, One stone, Fat, Food (SCOFF) screening test was used to identify subjects with eating disorders by a confidential questionnaire self-administered either online or on paper.
Analysis: Multivariate logistic regression models with \( P < .05 \) considered significant.
Results: A total of 3,457 students were included with a male-to-female ratio of 0.57. The prevalence of positive SCOFF screening was 20.5% among students. A positive relation between the positive SCOFF was observed with female gender (adjusted odds ratio [AOR], 2.98; 95% confidence interval [CI], 2.28–3.89; \( P < .001 \)), stress (AOR, 1.10; 95% CI, 1.09–1.12; \( P < .001 \)), depression (AOR, 8.62; 95% CI, 3.37–22.10; \( P < .001 \)) alcohol abuse problems (AOR, 1.52; 95% CI, 1.20–1.95; \( P = .006 \)), and risk of cyber-addiction (AOR, 5.09; 95% CI, 2.69–9.62; \( P < .001 \)).
Conclusions and Implications: Eating disorders are highly prevalent among university students in France and associated with other behavior risks, stress, and depression. It might prove necessary in the future to screen students with the SCOFF questionnaire upon entry to the university to inform student about the risk of eating disorders and advise them to consult with their general practitioner.
Key Words: eating disorders, physical activity, alcohol, cyber-addiction, university students (J Nutr Educ Behav. 2015;47:412-420.)
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INTRODUCTION
Eating disorders (ED) are characterized by behaviors aiming to achieve or maintain a slim body shape; great importance is given to thinness as a requisite for self-esteem. The absence of prodromic signs and lack of diagnostic criteria during the early stages of ED often result in late diagnosis. Screening scales may allow earlier diagnosis and nutritional intervention. One such scale is the Sick, Control, One stone, Fat, Food (SCOFF), a screening and diagnostic facilitating test for eating disorders in university students.1,2,3 Eating disorders are particularly frequent in young adults,4 college students included. There is evidence from a variety of sources that symptoms of ED are pervasive in university populations, with a prevalence ranging from 8% to 17%5,6 and peaking around 30% in students with war stress in Lebanon.7 To the authors’ knowledge, the prevalence of ED described in the literature is variable and no study has been conducted in France among college students. Indeed, there is only 1 European study on ED in an adult population, which involved 6 countries including France.8 This prevalence was based on clinical diagnosis; people who did not consult a doctor or who had subclinical symptoms and eating disorders not otherwise specified were not included.

Many surveys have shown that dissatisfaction with body weight among...
Understanding populations that do not receive clinical care, such as those at risk of ED, is particularly important for early detection and treatment. The aims of this study were to assess the prevalence of ED and to identify its relationship to associated risks including socioeconomic factors, substance use, behavioral addictions, stress, and depression across a large sample of university students in France.

METHODS
Setting and Participants
This study was conducted on university campuses located in Upper Normandy, France, where a health education program was provided to higher education students aged 18 to 25 years. The program included a regional multidisciplinary group, Ta Santé en 1 Clic (“Your Health in 1 Click”), consisting of several partners from the health, higher education, and voluntary sectors (mainly members of associations for cancer prevention) as well as other students, all actively involved in the project design with the health forums and the Ta Santé en 1 Clic Web site. Students were recruited by posters and leaflets on campus or during their mandatory medical survey at the university medical department. The study sample was not randomly selected. University student volunteers from Upper Normandy filled out a confidential self-administered questionnaire online or on paper. This observational study design was approved by the Commission Nationale de l’Informatique et des Libertés (French Electronic Data Protection Authority) and by the Rouen University Hospital Institutional Review Board without mandatory informed consent.

Research Design
A cross-sectional study was carried out between March, 2009 and December, 2012 among university students in France.

Data Collection
All questions in the online questionnaire were compulsory. Indeed, the online questionnaire was created with compulsory answers, meaning that students could not continue with the questionnaire if a previous question remained unanswered. Students could choose to answer all questions on the paper questionnaire, but this was not compulsory. Although the data were anonymous, a registration number was available for all students. This ensured that there was no duplication.

Instrumentation and Measures
Socioeconomic characteristics. Data on age, gender, weight, size, grant holder status, student job, and lifestyle were collected.

University curriculum. Four student groups were formed: (1) the mixed university group including faculties and schools specializing in psychology, sciences, arts, and sports; (2) the health care group including faculties and schools specializing in medicine, dentistry, pharmacy, nursing, physiotherapy, midwifery, and radiology technologist studies; (3) the engineering group including engineering and business schools; and (4) the technology group including different short technical courses.

Body mass index. Self-reported height and weight were used to calculate body mass index (BMI) using the standard formula (BMI = weight [kg] / height [m²]) and was classified as: underweight (BMI < 18.5), normal (BMI between 18.5 and 24.9), overweight (BMI between 25.0 and 29.9), and obese (BMI > 30).

Diet and physical activity recommendations. Food consumption thresholds used in this study were taken from French nationwide Nutrition and Health Program recommendations (Programme National de Nutrition et Santé [PNNS]). Established between 2001 and 2005 and then extended to 2010, PNNS is a nutrition policy that aims to improve the health status of the population by acting on nutrition. This program includes both diet and physical activity recommendations that are widely disseminated to the general population, such as eating at least 5 portions of fruit or vegetables a day and briskly...
walking 30 minutes each day. Questions were about usual food intake were: How many portions of fruit do you eat a day? (range, 0–5 and >5); How many portions of vegetables do you eat a day? (range, 0–3 and >3); then, fruit and vegetable scores were added and classified as 5 or more or 5 or fewer day [as in the guidelines]. Other questions were: How long do you walk each day (sports excepted)? The answer was open and then classified as more than or less than 30 minutes of brisk walking a day. The PNNS guidelines recommended limiting consumption of fatty foods but did not specify limitations. The number of high-fat snack products consumed each week (fast food, pizza, nuggets, kebabs, etc) was recorded. The question asked was: How many times do you eat high-fat snack products a week (french fries, kebabs, doughnuts, etc)? (range, 0–5 and >5).

Eating disorders. The SCOFF questionnaire is a screening tool used to identify risk of ED, including anorexia nervosa, bulimia nervosa, and ED not otherwise specified in young adults.1,3 The questionnaire has been translated into French (SCOFF-F) and validated; internal consistency (Cronbach alpha) was .76.27,28 It is scored from 0 to 5, according to the number of positive answers. It has been demonstrated to be a highly effective screening instrument, with excellent sensitivity and specificity for the presence of ED with at least 2 positive answers. A positive SCOFF score indicates that there were at least 2 positive answers to the 5 yes/no questions: Do you make yourself sick because you feel uncomfortably full? Do you worry that you have lost control over how much you eat? Have you recently lost more than 1 stone (6.35 kg) in a 3-month period? Do you believe yourself to be fat when others say you are too thin? Would you say that food dominates your life?

Sports practice. Students reported practicing sports for leisure or competition, by group or individually, and the length of time per week. Weekly sports practice was considered to be regular.

Sleep duration. Students reported their usual bedtime and waking time during the previous week and the mean duration of sleep per night was calculated. Insufficient sleep was determined as < 8 hours per night. Epidemiological evidence indicates that daily sleep duration of 7–8 h is optimal and is associated with overall good health status in adults.29

Stress and depression. The Perceived Stress Scale was developed to measure how stressful recent life status was appraised as being.30 Each of 10 items was scored from 0 (never) to 4 (very frequent); scores of items 4, 5, 7, and 8 were reversed. Higher scores corresponded to higher perceived stress (linear relation). The Perceived Stress Scale is not a diagnostic instrument, so there were no cutoffs to determine stressed individuals and only comparisons between individuals were allowed. Internal consistency (Cronbach alpha) was .83.31

The 13-item version of the Beck Depression Inventory, which measures the intensity of depression, has been validated for undergraduate students.32 The French Beck Depression Inventory (short form) was used in the current survey with an internal consistency (Cronbach alpha) of .83.33 It consists of 13 items on a 4-point scale (0–3), so that scores range from 0 to 39 (0–3: no depression; 4–7: low depression; 8–15: moderate depression; and >16: severe depression). This score was only introduced in the questionnaire in September, 2011; thus, Beck data were collected in only 1,561 of the 3,457 students included in the analysis.

Substance use. The current study focused mainly on the 3 most common psychoactive substances used by students: tobacco, alcohol, and cannabis. In this study, a regular smoker was defined as smoking at least 1 cigarette/d, a regular alcohol consumer was defined as drinking alcohol at least 10 times/mo, and a regular cannabis user was defined as using cannabis at least 10 times/mo.20 Students who reported ≥ 5 alcoholic drinks (≥4 for female students) on any 1 occasion at least once a month were classified as regular binge drinkers, and < 1 occasion a month as occasional binge drinkers. In 2003, Naimi et al34 defined regular drunkenness as at least 10 episodes of acute drunkenness per year Alcohol abuse problems were assessed by the Auto, Détente, Oubli, Seul, Problème, Ami test,35 the French version of the Car, Relax, Alone, Forget, Family/Friends, Trouble questionnaire,36 with an internal consistency (Cronbach alpha) of .65–.86.37 This questionnaire is a mnemonic screen tool to identify alcohol abuse problems in young adults and contains 6 items that describe using alcohol to relax, using alcohol when alone, drinking alcohol and driving or riding with an alcohol-drinking driver or rider, family or friends’ concerns about alcohol use, and experiencing negative consequences of drinking. A score of ≥ 2 positive items usually indicates an alcoholic disorder.

Risk of cyber-addiction. The 9-item Orman Test was used to assess the risk of becoming an Internet addict.38 Students with < 3 positive answers were classified as being at low risk of cyber-addiction, between 4 and 6 positive answers at moderate risk, and > 7 positive answers at severe risk.

Statistical Analysis
Students with missing data or outliers were removed from the analysis. Thus, 3,457 students of the original 3,568 students were included in the analysis. Chi-square was used for comparisons of categorical data. Continuous variables were summarized with means, SD, and medians and compared using Student t test. The researchers performed logistic regression to identify independent determinants of risk of ED (positive SCOFF). Crude odds ratios and adjusted odds ratios (AOR) for the logistic regression and 95% confidence intervals (CI) were calculated. Factors with P < .20 were included in the multivariate analysis and P < .05 was considered significant. Interaction terms (gender × behavior) were tested regarding behavior variables that were included in logistic regression. Statistical analysis was conducted using the Statview software package (version 5.01, SAS, Abacus Concept Inc, Berkeley, CA, 2008).

RESULTS
Population Description
A total of 3,457 students with whole data were included between March,
2009 and December, 2012. Mean age of students was 20.5 years (SD, 2.2 years) with a male-to-female ratio of 0.57. Body mass index calculated from self-report was normal in 78.5% of students and mean BMI was 21.4 kg/m² (SD, 2.98). Table 1 describes baseline characteristics of students.

Prevalence of ED, Eating Habits, and Physical Activity

Overall, 26.3% of students had been on a diet at least once (52.8% of students with positive SCOFF scores vs 19.1% of those with a negative SCOFF; P < .001). Answers for each SCOFF item are displayed in the Figure. A quarter of students reported worrying about losing control over how much they ate, and 1 of 5 students reported believing themselves to be fat when others said they were too thin.

The prevalence of positive SCOFF screening was 20.5% (95% CI, 19.2–21.8); 22.4% in the university group, 20.5% in the engineering group, 18.3% in the health group, and 16.7% in the technology group (P = .07). Positive SCOFF score was higher in female than male students (26.4% vs 10.3%; P < .001). Concerning baseline characteristics, SCOFF screening differed according to gender, BMI, student job status, and length of sleep (Table 1). There was a higher prevalence of overweight and obese students with positive SCOFF than negative SCOFF (16.3% and 11.3%, respectively) (Table 1).

Two thirds of students had regular physical activity and did the recommended brisk walking (Table 1). There was no difference in SCOFF score regarding physical activity and eating habits except for the recommendation to eat at least 5 portions of fruit and vegetables each day, which was better respected by students with a positive SCOFF score (Table 1).

Factor and Behavior Risks Associated With ED

Students with a positive SCOFF score were more stressed and more depressed than students with a negative SCOFF score (Table 2). They also consumed more anxiolytics and antidepressants (16.1% vs 5.8%, P < .001; and 5.6% vs 1.4%; P < .001). The prevalence of disorders and substance use are described in Table 2. There was no difference in regular consumption of alcohol and cannabis, or state of drunkenness and binge drinking between positive and negative SCOFF scores (Table 2). However, there was a significantly higher prevalence of smoking as well as alcohol abuse problems and moderate or severe risk of cyber-addiction in students with a positive SCOFF score (Table 2).

Table 3 presents logistic regression analyses comparing students with positive SCOFF scores with those with a negative SCOFF score. Variables with P < .20 in univariate analysis were included in multivariate analysis. Interaction terms (gender × behavior) regarding behavior variables included in the logistic regression—tobacco; sports; Auto, Détente, Oubli, Seal, Problème, Ambitieux; and cyber-addiction (Orman)—were not statistically significant. A positive relation was observed between female gender, stress, alcohol abuse problems, and the risk of cyber-addiction with a dose-response relationship according to the degree of risk of cyber-addiction. Regression with the Beck Depression Inventory (1,561 students) did not modify the previous results. Moderate and severe Beck Depression Inventory were significantly associated with a positive SCOFF score (AOR 2.73, 95% CI, 1.61–4.63; and AOR 8.62, 95% CI, 3.37–22.10, respectively).

SCOFF indicates Sick, Control, One stone, Fat, Food.
DISCUSSION

To the authors’ knowledge, this is the first study conducted in a large population of university students in France, focusing on the relationship between the risk of ED and socioeconomic factors, substance use, behavioral addictions, stress, and depression.

Screening male and female university students with the SCOFF questionnaire may quickly identify students with eating disorders.

In this study, 1 in 5 university students had a positive SCOFF score, a prevalence similar to that reported in Greek university students. These data confirm earlier findings reported in the French SCOFF validation study and in other reports on health care students. As expected, the risk of ED among university students was gender-related: Female students were 3 times more likely to have a positive SCOFF score than their male counterparts. Several authors have observed that women's health is more influenced by structural and psychosocial factors, such as stress, lower levels of self-esteem, and sense of coherence, whereas men’s health is more affected by health behaviors such as smoking, drinking, and physical activity. However, the researchers found no gender difference in behavioral risk factors associated with ED because there was no interaction between gender and behavior.

In this study, students at risk of ED were more stressed and also experienced moderate or severe depression. Konstantinos et al also evidenced this independent association with depression but did not analyze relations with substance use.

Risk of ED was positively associated with alcohol abuse problems, as also reported by Vaz-Leal et al in patients with bulimia nervosa. In an adult case-control study, loss of control over drinking correlated with ED but not with current alcohol drinking status.

The results showed a correlation between risk of ED and severity of cyber-addiction. Indeed, Tao reported significantly more binge eating, weight concern, and weight change in cyber-addicts than in non-cyber-addicts. Among all participants, depression contributed to the relationship between Internet addiction and bulimia.

In the fields of addiction and ED, several theories attempt to explain this striking comorbidity. Research suggested several models of etiology: addictions, genetic/familial heritability, biological, and personality/temperament. The addictions model focuses on similar symptoms underlying both disorders, including craving, lack of control, and denial.

Research has shown that ED patients who abuse substances demonstrate worse ED symptomatology and poorer outcomes than those with ED alone, including increased general medical complications and psychopathology, longer recovery times, poorer functional outcomes, and higher relapse rates. The functional relationship between the ED and substance of abuse varies across ED and needs to be assessed.

Stress, depression, alcohol abuse, and cyber-addiction may be associated with eating disorders in a university student population.

In the study, regular sports practice was not associated with ED. A previous study focused on exercising to lose the body of calories that were anticipated or already consumed through alcohol. The risk of ED seems to be related to the anxiety of competitive sports rather than noncompetitive sports.

The current study also provides new evidence about the prevalence of concerns regarding body image and eating behavior indicative of subthreshold ED. It is important to identify these concerns because students may benefit from preventive interventions in a university setting. Loss of control over food quantity and feeling fat despite being thin were found in 25% and 20% of students, respectively, in the current study, in accordance with other reports. This indicates that having a single positive answer to SCOFF may reveal an atypical ED.

The mean BMI of students in the study (Table 1) was close to that in the French nationwide survey on
overweight and obesity, which reported a BMI of 22.4 kg/m² and prevalence rates of 12.9% for overweight status and 5.4% for obesity in young adults (aged 18–24 years). Students with ED were more often obese or overweight than those with negative SCOFF scores, even though there were overweight students without ED. Regarding underweight students, being underweight was not enough to identify an ED because students with positive SCOFF scores were often underweight.

Body mass index alone is not sufficient to detect eating disorders in a university student population.

Clearly, BMI alone is a weak predictor of the prevalence of ED, but it may be used in combination with SCOFF to delineate the type of ED, e.g., restrictive or hyperphagic. In this study, students with positive SCOFF scores were more overweight or obese than those with negative SCOFF; however, this was neither the cause nor the consequence of short duration of sleep as reported in the literature, particularly in younger age groups.

## Table 2. Frequency of Disorders, Substance Use, and SCOFF Screening (n = 3,457)

<table>
<thead>
<tr>
<th></th>
<th>Positive SCOFF (n = 717)</th>
<th>Negative SCOFF (n = 2,740)</th>
<th>Total (n = 3,457)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Perceived Stress scale (SD)</td>
<td>20.1 (7.1)</td>
<td>14.3 (6.8)</td>
<td>15.5 (7.2)</td>
<td>&lt; .001</td>
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</table>

**Beck Depression Inventory** %

<table>
<thead>
<tr>
<th>Level</th>
<th>Positive</th>
<th>Negative</th>
<th>Total</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>25.4</td>
<td>59.7</td>
<td>53.3</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Low</td>
<td>27.1</td>
<td>25.9</td>
<td>26.1</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>35.4</td>
<td>13.2</td>
<td>17.3</td>
<td></td>
</tr>
<tr>
<td>Severe</td>
<td>12.1</td>
<td>1.2</td>
<td>3.3</td>
<td></td>
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</table>

**Regular smoker (%)**

<table>
<thead>
<tr>
<th></th>
<th>Positive</th>
<th>Negative</th>
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<th>P</th>
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<tbody>
<tr>
<td>No</td>
<td>26.6</td>
<td>21.4</td>
<td>22.5</td>
<td>.003</td>
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**Regular cannabis user (%)**

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<tr>
<td>No</td>
<td>3.4</td>
<td>3.1</td>
<td>3.1</td>
<td>.68</td>
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**Regular alcohol user (%)**

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<tbody>
<tr>
<td>No</td>
<td>17.9</td>
<td>18.0</td>
<td>18.0</td>
<td>.96</td>
</tr>
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**Binge drinking (%)**

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<th>Type</th>
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<th>Negative</th>
<th>Total</th>
<th>P</th>
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<tbody>
<tr>
<td>Never</td>
<td>18.4</td>
<td>20.1</td>
<td>19.8</td>
<td>.53</td>
</tr>
<tr>
<td>Occasional</td>
<td>67.8</td>
<td>65.7</td>
<td>66.1</td>
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<tr>
<td>Regular</td>
<td>13.8</td>
<td>14.2</td>
<td>14.1</td>
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**Drunkenness ≥ 1/mo (%)**

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<th>P</th>
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<tbody>
<tr>
<td>No</td>
<td>14.0</td>
<td>14.7</td>
<td>14.5</td>
<td>.66</td>
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**Alcohol abuse problems (%)**

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<thead>
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<th></th>
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<th>Negative</th>
<th>Total</th>
<th>P</th>
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<tbody>
<tr>
<td>No</td>
<td>34.0</td>
<td>24.1</td>
<td>26.1</td>
<td>&lt; .001</td>
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**Risk of cyber-addiction (%)**

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<tr>
<th></th>
<th>Positive</th>
<th>Negative</th>
<th>Total</th>
<th>P</th>
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<tbody>
<tr>
<td>No</td>
<td>8.9</td>
<td>16.7</td>
<td>15.0</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Low</td>
<td>54.2</td>
<td>60.5</td>
<td>59.3</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>30.8</td>
<td>21.0</td>
<td>23.0</td>
<td></td>
</tr>
<tr>
<td>Severe</td>
<td>6.1</td>
<td>1.8</td>
<td>2.6</td>
<td></td>
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SCOFF indicates Sick, Control, One stone, Fat, Food.

*Available for 1,561 students; †As indicated by a positive Auto, Détente, Obli, Seul, Problème, Ami test.

The study sample was not randomly selected and it may not be representative of all university students of the region in which the research was carried out. The convenience sample used limits the generalizability of findings beyond French university populations. However, several study disciplines were represented, and almost half the students were recruited during their compulsory medical evaluation. This large sample comprised almost 10% of students in the Upper Normandy Region. In France, as in most European countries, there is a higher representation of female than male students in higher education. A survey conducted by the National Prevention and Health Education Institute reported the frequency of smoking (23.2%) and regular binge drinking (11.2%) in college students to be similar to that in the current study. Therefore, even if this was a convenience sample, these characteristics do not seem to be different from those of other French college students and might be considered representative of the student population. The question remains of the applicability of these results to other cultural settings.

Relying on cross-sectional data limits the study's ability to make causal inferences about the relationship found in the research. Indeed, a longitudinal approach might be more appropriate as in the adolescent cohort of Ferreiro et al. Some of the factors assessed could be conceptualized as both determinants and outcomes of ED, which perhaps merits further exploration. In addition, this cross-sectional study was based on self-reported information provided by students, which might represent some sort of bias, because participants may not be reliable in reporting their behaviors. Web-based self-reported weight and height data could be considered valid enough to be used when studying associations of nutritional factors with anthropometrics and health outcomes, and quality of information provided by the Web-based anthropometric questionnaire used has been shown equal to or better than that of the paper version. However, the accuracy of self-reported BMI declines with increasing BMI and self-reported BMI underestimates the prevalence of overweight.
or obesity. Heavier consumers might not have been present when the study was administered. Students might have underreported their own substance use, because this measure was based on self-reporting. However, self-reported substance use questionnaires have been shown to be reliable for the substances studied.

No precise clinical diagnostic data were available to validate ED screening in the current study; thus, they can refer to only a global risk of ED, not to specific types. Nevertheless, a previous study reported the sensitivity, specificity, and area under the curve of SCOFF-F (French version of SCOFF), with a cutoff of 2 positive responses, as 94.6%, 94.7%, and 97.9%, respectively. Cohen's kappa coefficient between SCOFF-F and Metabolism, Infection, and Immunity in Inborn Errors of Metabolism results was 89%. In addition, analysis of BMI data in male and female students with positive SCOFF scores may suggest different profiles of ED: predominantly restrictive in female students (low or normal BMI) and predominantly compulsive in male students (more prone to overweight).

### IMPLICATIONS FOR RESEARCH AND PRACTICE

There are clinical implications regarding components that should be included in programs for preventing ED in both female and male university students. Eating disorders are highly prevalent among university students in France and are associated with other behavior risks (alcohol abuse and cyber-addiction) and health-related factors such as stress and depression. The absence of prodromal signs and lack of diagnostic criteria in the early stages of ED often result in delayed diagnosis. It might prove beneficial in the future to screen students systematically during their compulsory medical survey at the university medical department with an easy and quick screening test such as the SCOFF questionnaire. Even if the risk of ED is higher for women, screening men must not be neglected because 10% of male students have ED. Subsequently, students could be informed about their ED risk and advised to consult their general practitioner. It is important to detect not only ED from the first symptoms but also the hidden problems that are often linked to ED. This could prevent ED from becoming chronic and more difficult to treat. Without an interaction between gender and behavior regarding the risk of ED, implications concerning associated health behaviors should not be different according to the gender of students. Finally, because of the detrimental effects of ED on physical and emotional health, it seems mandatory to set up prevention programs. These programs could include the active participation of students with attention to personal factors and environmental influences as well as information provided about the nature and consequences of ED and the negative effects of weight control methods, and training for skills to resist social pressures.

### ACKNOWLEDGMENTS

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CONFLICT OF INTEREST

The authors have not stated any conflicts of interest.