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Health Behaviors and Related Expectations of German First-Semester Students During and Following Covid-19 Restrictions

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Abstract: *Engagement in risky health behaviors typically observed during the transition to university may have been influenced by COVID-19 restrictions. Our assessed current and expected food consumption, physical activity, and alcohol use of first-semester students during and after COVID-19 related restrictions. Participants were first-semester students during (N = 208 participants; M_{age} = 20.90, SD = 4.10; 82.7% females) and after (N = 171; M_{age} = 21. 15, SD = 2.84; 71% female) COVID-19 restrictions. Data from two cross-sectional studies were included. Data was collected online and within the initial weeks of the semester. Current and expected food consumption and physical activity were significantly unhealthier during and healthier after the restrictions. Current and expected alcohol use was significantly lower during and higher after the restrictions. Given inconsistent cohort differences, differential strategies are needed to facilitate healthy behaviors during restrictive circumstances. Contextual factors shaping alcohol-related outcomes during periods of disruption should be addressed.*
Keywords: first-semester, university students, Germany, COVID-19, health behaviors

INTRODUCTION

A large body of empirical literature consistently indicates that the consumption of healthy food (Schwingshackl et al., 2018), engagement in physical activity (Lee et al., 2012), and limited alcohol use (Rehm et al., 2009) play an important role in sustaining good health and preventing chronic diseases. The frequent consumption of unhealthy food (high in calories, sugar, saturated fats, and sodium, and low in essential nutrients) increases the risk of obesity, cardiovascular diseases, as well as other chronic health conditions (Nguyen et al., 2016). In addition, physical inactivity has been associated with an increased risk for chronic diseases such as obesity, diabetes, and heart disease (Warburton et al., 2006). Furthermore, problematic alcohol intake has been

linked to negative health outcomes, such as liver disease, cancer, and mental health issues (Shield et al., 2013).

LITERATURE UNDERPINNING

First-Semester University Students

First-semester university students are at increased risk of engaging in unhealthy behaviors (e.g., Boekeloo et al., 2011; Wengreen & Moncur, 2009). In Germany, first-semester students often show unhealthy food consumption patterns (Hilger et al., 2017), frequently report physical activity levels that do not meet the recommended guidelines for physical activity (Diehl & Hilger, 2016), and display a higher incidence of alcohol use than students in more advanced semesters (Akmatov et al., 2011). Furthermore, many students may also expect to behave in unhealthy ways during their first semester (Olmstead et al., 2019), which could contribute to their actual unhealthy behaviors (Grube, 2004). Findings suggest that the anticipations that students have about the effects of alcohol play a significant role in influencing their alcohol consumption patterns (Kenney et al., 2015). Similar relationships have also been found among first-semester students regarding other health behaviors (e.g., food consumption and physical activity; Gesualdo & Pinquart, 2023). As such, unhealthy expectations may discourage first-semester students from adopting healthy behaviors and also undermine their willingness to prioritize their physical health during this transitional period.

Transition to University and Influence of COVID-19 Restrictions on Health Behaviors

As emerging adults transition into university, they tend confront challenges and experience situations that can influence their health behaviors. For instance, changes in living arrangement (e.g., moving out of the parental home and into the university town with declined parental supervision; Small et al., 2013) can impact available opportunities and the choices made in favor of unhealthy behaviors (e.g., increased involvement in the student drinking culture; Schulenberg et al., 2005). First-semester students face a unique circumstance as they often relocate at the start of their studies. In contrast, most students in later semesters typically have already established residence in the university town. Specific considerations emerge that are pertinent to first-semester students' health behaviors that may not apply to other groups. For instance, regarding alcohol use, previous research indicates that the transition to college is linked to an escalation in drinking among individuals who no longer reside with their parents (Schulenberg et al., 2005). Conversely, those who continue to live with their parents exhibit comparatively modest changes in drinking (Schulenberg et al., 2005).

Usual engagement in risky health behaviors observed among young people during the transition to university may have been influenced by the COVID-19 pandemic and related restrictions. COVID-19 related restrictions presented unusual conditions for first-semester students undergoing the transition to university (e.g., closure of university campus, fitness studios, bars, restaurants; Busse et al., 2021; Zusammen gegen Corona, 2020). Thus, it is plausible that the COVID-19

pandemic may have had an influence on drinking behavior among first-semester students. Due to distance learning during the pandemic, a substantial proportion of students refrained from moving out of their parental homes into the university town, which, along with other reasons such as contact restrictions and the closure of restaurants and bars, limited their involvement in the university "drinking culture." Not having to leave the home for participation in online courses, contact restrictions in sports clubs, and closed fitness centers may have negatively affected the level of physical activity. The pandemic may also have promoted unhealthy eating if students eat out of boredom or for coping with negative emotions (Maierhofer, 2022). During the pandemic, it may also have been more difficult to form expectations about health behaviors in the near future as changes in contact restrictions were difficult to foresee.

Reports indicate less-than-ideal health behaviors among first-semester German university students before COVID-19-related restrictions were introduced (Busse et al., 2021). While limited research investigated the health behaviors of students during versus before pandemic-related constraints, available studies yielded diverse outcomes. For instance, a cross-sectional study investigating engagement in health risk behaviors before and during the COVID-19 pandemic among German university students found that binge drinking as well as physical activity significantly decreased compared to pre-pandemic levels (Busse et al., 2021), while another study found increases in unhealthy eating among a German student sample (Palmer et al., 2021). Moreover, longitudinal findings among a sample of first-semester university students during the first lockdown in Germany showed that current and expected food consumption and physical activity became healthier over the first semester and that current and expected alcohol use increased (Gesualdo & Pinquart, 2023). Further research is needed to understand differences in health behaviors of first-semester students in Germany during and following the COVID-19 pandemic and associated restrictions.

The Present Study

In a previous cross-sectional study conducted during the first surge of COVID-19 restrictions in Germany (Gesualdo & Pinquart, 2021), we investigated current and expected health behaviors of first-semester students. As, due to restrictions imposed by the COVID-19 pandemic, the circumstances under which this study was conducted did not reflect the typical circumstances that students experience during their first semester at university, we repeated the study after COVID-19 restrictions where mostly lifted. The main purpose of the present study is to compare results of these two investigations among first-semester students undergoing different transitions to university (i.e., with and without COVID-19 restrictions). Given the significance of healthy behaviors in promoting overall well-being, understanding the behaviors of first-semester German university students is essential for preventing future health risks among this population. By examining student's food consumption patterns, physical activity levels, and alcohol use as well as related expectations, this study provides insight into potential areas for health promotion and intervention among university students. Moreover, the current study includes data simultaneously on food consumption, physical activity and alcohol use, whereas most available studies mainly

collected data only on one of these aspects. Expected behavior has also not been assessed in available studies on the effects of the pandemic. It is plausible that if students are aware of pandemic-related restrictions, they might also expect to eat less healthy foods (e.g., increased consumption of "comfort foods", Palmer et al., 2021), be less physically active and drink less alcohol in the next few months, especially if they expect the pandemic to persist during this time interval. Furthermore, a larger percentage of students in the first cohort (during lockdown) remained in their parents' homes, not needing to be in the university town, resulting in an expectation that, due to persistence of restrictions, peer contact would remain restricted and perhaps unhealthier expectations about health behaviors during the pandemic may have been present (i.e., consumption of unhealthy foods, lower physical activity, reduced opportunity for drinking). Therefore, typical behaviors during the first semester might not have manifested to the extent they did before COVID-19.

Consequently, the following hypotheses are proposed:
1) First-semester students during the COVID-19 restrictions will show less healthy eating patterns (current and expected) compared to first-semester students following the COVID-19 restrictions.
2) First-semester students during the COVID-19 restrictions will show lower engagement in physical activity (current and expected) compared to first-semester students following the COVID-19 restrictions.
3) First-semester students during the COVID-19 restrictions will show lower consumption of alcohol (current and expected) compared to first-semester students following the COVID-19 restrictions.

METHODOLOGY

Ethical approval was granted by the Ethics Committee at the University of Marburg (case number 2020-79k). Data from two cross-sectional studies were included in the present comparative study. German university students who were at least 18 years old and who were undergoing their first semester at university were recruited to participate via email. Data was collected during the first weeks of the first semester to ensure that the behaviors measured were not yet highly influenced by the start of university. Participants were initially provided with details about the study, and upon understanding, they completed a consent form and responded to the online questionnaire. As compensation, participants were given the option to either receive course credits or enter a raffle for a gift card.

Data for the first study were collected during the first surge of COVID-19 restrictions in Germany (i.e., November to December 2020), while data for the second study were collected after restrictions related to COVID-19 were, in the most part, lifted (October to November 2023). To translate the instruments from English to German, we followed the guidelines proposed by Brislin (1970).

Measures

Demographics. Participants were asked various questions related to their sociodemographic characteristics. These questions included age, gender (male, female, non-binary), and whether they moved out of their parents' home. To ensure the anonymity of participants and mitigate the risk of reidentification, specific information regarding national or ethnic backgrounds was not assessed.

Food Consumption. To evaluate food consumption patterns, all seven items from the Centers for Disease Control and Prevention's National College Health Risk Behavior Survey (NCHRBS; Douglas et al., 1997) pertaining to eating behaviors were utilized. These items covered the consumption of both healthy and unhealthy foods, including fruits, vegetables, high-fat and high-sugar foods, hamburgers, hot dogs or sausages, fried potatoes or potato chips, cookies, and doughnuts. Two additional items were incorporated to evaluate the consumption of specific food items commonly consumed by students, including pizza, sweets, and chocolate. Participants indicated the frequency of consumption on a Likert scale ranging from 0 times a day to 3 or more times a day for the past month. Higher scores represented higher levels of unhealthy food consumption. The internal reliability analysis yielded a Cronbach's coefficient of $\alpha = .83$ for the cohort during COVID-19 lockdown and of $\alpha = .79$ for the cohort after COVID-19 restrictions, indicating good reliability (George & Mallery, 2003). Additionally, modified versions of these nine items were used to assess participants' expectations of food consumption during their first semester at university, demonstrating an internal consistency of $\alpha = .75$ during COVID-19 lockdown and of $\alpha = .70$ after COVID-19 restrictions.

Physical Activity. To evaluate current physical activity levels, four out of the five physical activity items from the NCHRBS (Douglas et al., 1997) were included in the questionnaire. Participants indicated the frequency of engaging in vigorous or moderate physical activity, stretching exercises, strengthening exercises, and walking or cycling on a weekly basis for the past month using a Likert scale ranging from 0 to 7 times a week. Higher scores reflected higher levels of physical inactivity. The internal consistency analysis yielded a Cronbach's coefficient of $\alpha = .74$ during COVID-19 lockdown and of $\alpha = .76$ after COVID-19 restrictions, indicating acceptable reliability. Additionally, modified versions of these four items were used to assess participants' expectations of physical activity during their first semester at university, showing an internal consistency of $\alpha = .73$ and of $\alpha = .77$, respectively.

Alcohol Consumption. To gather information about drinking behavior, three items were adapted from the Alcohol Use Disorders Identification Test (AUDIT; Saunders et al., 1993). The first item asked participants to report the number of days in the past month they consumed alcohol, allowing for a range from zero to thirty-one. The second item assessed the number of standard drinks consumed on a typical drinking occasion, with participants providing a specific quantity. The product of these two items represented a quantity-frequency index (number of drinks consumed per month). The third item measured the frequency of consuming five or more standard drinks (for males) or four or more standard drinks (for females) on a drinking occasion. Participants provided

responses on a Likert scale, ranging from never to weekly. Those who reported consuming five or more drinks (for males) or four or more drinks (for females) on a drinking occasion weekly were classified as binge drinkers. Since there are no standardized methods for measuring binge drinking in sexual minority groups, the criteria for binge episodes in non-binary individuals were based on the male threshold. This decision was influenced by research indicating that a larger proportion of non-binary individuals are assigned male at birth compared to binary individuals (Todd et al., 2019). Modified versions of these three items were used to assess participants' expectations of drinking behavior during their first semester at university.

Statistical Analysis

The data analysis was performed using the software IBM SPSS Statistics version 27. A significance level of 5% was utilized to determine the presence of statistically significant findings. Baseline differences in age were analyzed using an independent *t*-test. Chi-square analyses were performed to explore potential sex differences and differences based on whether participants' hometown was in Germany or abroad. All hypotheses were investigated using independent samples *t*-tests to assess differences in current and expected health behavior means between cohorts.

RESULTS

The sample during the COVID-19 restrictions consisted of $N = 208$ participants ($M_{age} = 20.90$, $SD = 4.10$; 15.9% males, 82.7% females, 1.4% diverse) after excluding $n = 4$ participants as outliers due to reported extreme levels of drinking. The sample following the COVID-19 restrictions consisted of $N = 171$ participants ($M_{age} = 21.15$, $SD = 1.73$; 28.1% males, 70.8% females, 1.2% diverse) after excluding $n = 6$ participants as outliers due to reported extreme levels of drinking. No significant differences between samples were found regarding age, sex, or being from Germany or abroad.

Cohort Differences in Current and Expected Health Behaviors

Food Consumption. Participants during the COVID-19 restrictions reported higher levels of current unhealthy food consumption ($M = 19.59$, $SD = 2.66$) and expected unhealthy eating ($M = 19.16$, $SD = 2.66$) than participants post COVID-19 restrictions ($M = 17.64$, $SD = 4.75$ for current and $M = 15.55$, $SD = 3.27$ for expected unhealthy food consumption). The independent samples *t*-test indicated a significant difference in mean scores between cohorts for current, $t(377) = 5.05$, $p < .001$, Cohen's $d = .51$, and for expected unhealthy eating, $t(377) = 11.85$, $p < 0.001$, Cohen's $d = 1.21$.

Physical Activity. Participants during COVID-19 restrictions reported a mean score of $M = 23.10$ ($SD = 5.93$) for current and of $M = 21.75$ ($SD = 5.86$) for expected unhealthy physical activity, which was significantly higher than among participants post COVID-19 restrictions ($M = 12.31$ ($SD = 4.89$) and $M = 14.02$ ($SD = 4.72$), respectively; $t(377) = 19.07$, $p < .001$, Cohen's $d = 1.98$

and $t(377) = 13.93$, $p < 0.001$, Cohen's $d = 1.45$, respectively). The results indicate higher levels of current and expected physical inactivity during COVID-19 restrictions.

Alcohol Use. Among participants during COVID-19 restrictions, the mean score for the number of drinks consumed per month was $M = 9.69$ ($SD = 13.48$) for current behavior and of $M = 9.97$ ($SD = 12.51$), for expected behavior. Scores were lower than among participants post COVID-19 restrictions ($M = 15.25$, $SD = 16.16$, for current and $M = 13.87$, $SD = 14.12$ for expected behavior) . The independent samples *t*-test showed a significant difference in mean scores between cohorts ($t(377) = -3.65$, $p < .001$, Cohen's $d = .37$ for current behavior and $t(377) = -2.85$, $p = 0.005$, Cohen's $d = .29$ for expected behavior).

Moreover, participants during the restrictions reported mean numbers of $M = 1.95$ ($SD = 0.91$) current and $M = 1.85$ ($SD = 0.92$) of expected binge drinking episodes within a month during COVID-19 restrictions. Scores were higher ($M = 2.14$ ($SD = 0.89$) for current and for expected behavior $M = 2.18$ ($SD = 0.87$)) post COVID-19 restrictions. The independent samples *t*-test revealed a significant difference in mean scores between cohorts ($t(377) = -2.08$, $p = 0.04$, Cohen's $d = 0.21$ for current behavior and $t(377) = -3.61$, $p < 0.001$, Cohen's $d = 0.37$ for expected behavior). The results suggest higher scores of current and expected heavy and binge drinking post COVID-19 restrictions.

DISCUSSION

The present study examined health behaviors of first-semester university students in Germany during and following the COVID-19 restrictions. Specifically, we assessed patterns related to food consumption, physical activity, and alcohol use. Findings provide noteworthy distinctions between cohorts that were assessed during the COVID-19 restrictions and in the subsequent post-restriction period.

Consistent with Hypothesis 1 and Hypothesis 2, students during COVID-19 restrictions reported higher levels of current and expected unhealthy food consumption and sedentary behaviors compared to students post-COVID-19 restrictions. These findings align with previous research suggesting a potential link between pandemic-related stressors and altered eating and physical activity patterns (Busse et al., 2021; Maierhofer, 2022; Palmer et al., 2021). The observed higher levels of unhealthy behaviors among the cohort during the restrictions may represent a response to increased stress, boredom, or changes in routine brought by the circumstances. Lockdowns and restrictions may have disrupted the development of routines that are typical for first-semester students, leading to irregular food consumption patterns (e.g., increased consumption of comfort foods) and lower physical activity (e.g., prevalence of online courses that required minimal movement for attendance). In addition, this cohort may have expected that the unhealthy habits experienced during the pandemic could persist at least in the short term due to not foreseeing the end of the restrictions in the near future. As the situation stabilized or restrictions were, at least

mostly, lifted, present and expected health behaviors of the second cohort seemed to be no longer influenced by the pandemic.

In line with Hypothesis 3, participants during COVID-19 restrictions reported lower actual and expected alcohol consumption compared to those post-COVID-19 restrictions. Results suggest a shift in drinking patterns and expectations, with students consuming more drinks per month and having more expectations to binge drink on a drinking occasion after the lifting of restrictions. Findings corroborate reports by Rubio and colleagues (2023), indicating that, in general, university students consumed less alcohol and reduced binge drinking during the pandemic. Living with parents, restrictions of peers contact, and not being at the university town may have provided fewer opportunities for alcohol use during the pandemic. Moreover, the restrictive measures and limited social interactions imposed by the pandemic likely contributed to lower alcohol consumption. In addition, the prospect of an extended period without significant changes in restrictions and circumstances may have fostered a mindset among participants during the pandemic, wherein they anticipated reduced social activities and, consequently, less expectations to consume alcohol. The cohort after the restrictions may have shown more alcohol consumption as a result of returning to a semblance of normalcy. With increased time spent with peers, lack of contact restrictions, and being in the university town, the post-restriction cohort likely encountered more social opportunities that promoted alcohol consumption. Furthermore, shifts in perceptions of the virus's danger, anticipated social reintegration, and a heightened aspiration to engage in social activities could have contributed to higher alcohol consumption and more expectations to drink. As such, these contextual factors can be relevant for understanding the complex dynamics that shape alcohol-related behaviors during and after periods of significant disruption.

While our study provides valuable insights, it is important to acknowledge several limitations that may impact the interpretation of results. First, the reliance on self-report measures, though commonly employed, introduces the potential for response bias. Second, analyzing data from only one point of measurement per cohort did not allow for testing whether changes in COVID-19 restrictions predicted change in health behaviors within individuals. Although the pandemic provided a “natural experiment” on effects of restrictions, caution is needed when making direct cause-and-effect conclusions. Third, the generalizability of our findings is constrained by the specific demographic and context of first-semester students. Additionally, the higher representation of female participants may limit the applicability of our results to a broader population.

Implications to Research and Practice

In terms of practical implications, the findings of this study have implications for researchers, practitioners, and policymakers alike. Researchers could use this study as a basis for developing more targeted interventions aimed at promoting healthy behaviors among university students, taking into account the unique challenges posed by the COVID-19 pandemic. Practitioners, such as university health services and counseling centers, could utilize the insights gained from this

research to tailor their support services to better meet the needs of students. Policymakers may consider incorporating recommendations from this study into broader public health initiatives aimed at addressing the health impacts of the pandemic on young adults.

To effectively address these concerns, multifaceted strategies should be implemented, incorporating innovative approaches and interventions. For healthy eating, universities could implement nutrition education programs, providing students with accessible and practical information about balanced diets, meal planning, and cooking skills. In promoting physical activity, universities may consider integrating virtual fitness classes or apps into their curriculum, making it easier for students to engage in exercise from their place of residence. Regarding alcohol use, targeted interventions may involve the implementation of campaigns that emphasize responsible drinking, risk awareness, and coping mechanisms for stress or social pressure.

CONCLUSION

The present study sheds light on the influence of COVID-19 restrictions on the health behaviors of first-semester university students. The findings highlight distinct patterns in food consumption, physical activity, and alcohol use between cohorts assessed during and after the restrictions. As such, the importance of proactive measures to promote healthy behaviors among university students, particularly amidst pandemic-related challenges, is highlighted. Given the inconsistent cohort differences, differential strategies are needed to facilitate healthy behaviors during restrictive circumstances. Contextual factors shaping alcohol-related outcomes during periods of disruption should be addressed. By addressing these concerns through multifaceted approaches, students can be effectively supported in maintaining healthy lifestyles during and beyond the pandemic. Researchers, practitioners, and policymakers can utilize these insights to develop targeted interventions and support services tailored to the needs of students.

Future Research

In moving forward, cohort-sequential designs that compare longitudinal change of different cohorts who experience an event at a different time are needed. Said studies would allow to capture changes over time, offering a more extensive perspective on health behaviors changes in response to external factors. Additionally, there is a compelling need for interventions aimed at promoting healthier eating and physical activity habits, especially in challenging circumstances like those imposed by a pandemic. The implementation of randomized control trials could provide robust evidence for the effectiveness of such interventions and strategies in promoting health in such circumstances. Finally, further investigating specific factors influencing unhealthy behaviors during restrictive circumstances would be beneficial, such as mandatory distance education. Gaining a deeper understanding of these factors can inform targeted prevention strategies, paving the way for more effective public health initiatives. Finally, we propose that future studies address the following questions: a) how can interdisciplinary collaboration between public health, education, and psychology fields enhance our understanding of effective interventions tailored to

support student health during times of crisis? b) how can technology and digital platforms be leveraged to implement and sustain these interventions in the long term, ensuring accessibility and effectiveness for diverse student populations?

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