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The Interrelationships Between Food Choice Motives, Food Insecurity, and Substance Use Among US College Students

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THE INTERRELATIONSHIPS BETWEEN FOOD CHOICE MOTIVES, FOOD INSECURITY, AND SUBSTANCE USE AMONG US COLLEGE STUDENTS

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Introduction

College students' health has long been an important area of focus for campuses nation- and worldwide. Colleges have worked to protect the health of their students by making resources--including counseling centers, food assistance programs, and wellness centers--more accessible. Even with the myriad of resources made available to students at the collegiate level, students continue to face obstacles, especially in overcoming challenges related to health and overall lifestyle during the transition to and their time enrolled in college. This research study examined the gap in literature for motivators of food choice among food insecure individuals and substance users within the college population. The questions researched in this study are: Is there a difference in the relative rank importance of FCM within individual groups? Is there a relationship between FI intensity and food choice motives (FCM) among college students? Is there a relationship between SU intensity and FCM among college students? Does FI or SU occur first within the college population? Based on the results, potential strategies to influence food choice to improve diet quality among these groups may be implemented to improve health and wellness.

Literature Review

Overall dietary quality tends to decline after students transition to college, and the dietary patterns developed during this period may translate into dietary habits in adulthood.[1,2] Many of the foods college students consume tend to be of poor nutritional quality and are more likely to be high in fat, sugar, and salt.[2,3] Additionally, many students' diets lack adequate consumption of fruits, vegetables, whole grains, and low-fat dairy foods[2-4]; there is also a higher consumption of fast food, sweetened beverages, and snacks higher in sodium and sugar than in any other age group, exceeding dietary recommendations and contributing to weight gain and other long-term and chronic health risks.[2] Food insecurity (FI), substance use (SU), and food choice motives (FCM) may all impact dietary choices, ultimately influencing overall diet quality.

FCM influences dietary quality, as the motivation for eating or rejecting certain foods can impact the foods actually consumed, contributing to an altered dietary pattern that can impact long-term health. Food choices among college students are based on a variety of factors. Many students choose foods based on college campus food availability, but many students are not satisfied with the food options or affordability of foods on-campus and are less likely to choose foods for reasons pertaining to health and health benefits.[1,2,5] Additionally, student food choices are often influenced by familiarity of foods, usually influenced by family and cultural food choices.[1,3] Packaging of foods may also influence students' food choices. For instance, students may be more likely to consume foods that are labeled as "locally-sourced" and "organic," while being less likely to consume foods labeled as "low-fat"[6]; however, the majority of college students cited "high-fat" as being the primary reason why they would consider a food to be unhealthy, followed by high calorie content, high sodium, and high sugar, respectively.[3] Other factors that may determine food choices in students include taste of the foods, hedonic properties, influence of peers, satiety-inducing effects of the foods for extended periods of time due to the busy

schedules of students, stress, and marketing/advertising of foods.[1-3,7] Motivators for food choices among college students generally include perceived health of the foods, taste, shelf-stability, and convenience, while barriers for food choices included inconvenience, lack of time, decreased quality, poor taste, and price.[1-3]

FI is characterized by the limited access to a stable and sufficient food supply and poor access to safe, nutritious, healthful foods that are able to be procured safely and in a socially acceptable manner.[8-16] FI individuals also generally have less access to food and may experience poor variety of foods in the diet, inability to afford food, and increased intakes of nutrient-poor and calorie-dense meals.[8-10,17,18] FI affects 14-67% of college students.[11,13,17,19,,20] Effects of FI range from disrupted eating patterns, malnutrition, impaired cognitive function, impaired immunity, weight gain, development of mood disorders, and development of chronic conditions like obesity.[5,9,11-13,15,18-25] Among increased risk for these complications, FI college students are also more likely to develop behavioral and mental issues, have lower academic performance, have decreased concentration and attention span, and drop out of college.[5,10,13,15,17,18-20]

The relationship between FI and FCM has been studied more recently. Those affected by FI often consume less fruit, vegetables, low-fat foods, whole grains, and meat than their food secure counterparts.[9,16,26] Foods typically consumed by FI individuals generally include more processed, calorie-dense, nutrient poor, and shelf-stable foods that are more convenient, inexpensive, and take less time to prepare.[16,18] Factors that may influence food choice in FI individuals include cost, access to information about foods and meals, overall health, and obtainment method (e.g., food pantries).[16,18]

College students are among the groups most at risk for substance use and tend to use substances at greater rates and in greater amounts than non-college peers and individuals from other age groups.[24,26-30] The adverse effects of substance use in college students include poorer academic performance, development of mental health disorders and chronic diseases, unhealthy relationships with others, dependence, coma, and death.[4,25-29,31-42] Students may use substances as a coping mechanism for emotional regulation or as a way to socialize with peers based on perceived norms.[26,27,29-31,33,35,43-48] Use of certain drugs, such as cocaine and heroin, has been linked to drug-induced anorexia and prioritization of drugs and alcohol over food, leading to malnutrition.[24,48,49]

FCM among SU populations has not been extensively studied, with most studies investigating differences in food choice and FCM within recovering SU individuals. Those in recovery may consume foods and drinks high in caffeine, sugar, salt, and/or fat in order to replace the desire for drugs or mimic blood sugar spikes with foods that provide them with a similar sensation in the reward pathway of the brain, minimizing the cravings for the substance(s) of abuse and symptoms of withdrawal.[24] Dietary patterns for recovering substance users typically include increased consumption of inexpensive, processed, calorie-dense, and nutrient-poor foods.[24,48] Those recovering from SU are often less likely to consume fresh fruits and vegetables, low-fat dairy, lean meats, and whole grains.[24,50] Barriers related to food choice in individuals recovering from SU include low income, nutritional knowledge deficit, and inadequate assistance from food

programs.[24,49] Among college students specifically, students—especially those who met criteria to be considered binge drinkers—were more likely to have and act upon food cravings; these students generally consumed higher amounts of junk food and fast food and were much less likely to consume fruits and vegetables, possibly indicating that taste could be a motivation.[4] This is likely due to the different food options available during the times when college students tend to drink, usually later in the evening when only fast-food restaurants are open, limiting the types of food available and increasing likelihood of consuming high-fat foods.[4]

Additionally, the causal directionality within the relationship between FI and SU has not yet been determined despite a well-established relationship. FI individuals may turn to substances to curb appetite and cope with their experiences with FI, while substance users may spend more income on substances and not have enough money for an adequate and balanced diet.[8,11,22,25,51] Drug binges also lead to altered eating cues.[51] As a result of SU related to FI, malnutrition and poor mental health already experienced from poor access to nutritious foods may be exacerbated.[8,51] Understanding the causal relationship could help assistance programs for FI and/or SU incorporate preventative tactics.

Methods

2.1 - Research Question 1 - Relative rank importance of FCM within individual groups

2.1.1 *Data collection* FCM data was collected using a 26 item Food Choice Motives (FCM) Questionnaire (Table 1, appendix). Participants rated the importance of each FCM item on a 7-point Likert scale.

2.1.2 *Data analysis* Scores across nine separate categories for FCM were analyzed within individual groups using Friedman's two-way analysis of variance, and rank importance within groups was analyzed using Dunn-Bonferroni post hoc nonparametric tests in SPSS. Alpha was set at $p<0.05$ to conclude statistical significance.

2.2 - Research Question 2 - The effect of FI degree on FCM importance

2.2.1 *Data collection* FI data was collected using the USDA 6-item Food Security Survey Module (FSSM). Raw scores of 0 to 6 were collected, with scores of 2-6 indicating FI.

2.2.2 *Data analysis* Correlation between FI intensity and FCM importance was analyzed using Pearson correlation in SPSS for the FI students and FI+SU students only. Alpha was set at $p<0.05$ to conclude statistical significance.

2.3 - Research Question 3 - The effect of SU degree on FCM importance

2.3.1 *Data collection* SU data was determined as alcohol use and other substance use. Alcohol use was assessed with the 10-item Alcohol Use Disorders Identification Test (AUDIT). Other substance use was assessed by using the Extended Drug Use Disorders Identification Test (DUDIT-E). Participants were categorized as being substance users if their AUDIT score was 8 or greater or if their DUDIT-E score was 6 or greater for males or 2 or greater for females.

2.3.2 *Data analysis* Scores across nine separate categories for FCM were used to assess correlation between SU and FCM importance using Pearson correlation in SPSS for the SU students and FI+SU students only. Alpha was set at $p<0.05$ to conclude statistical significance.

2.4 - Research Question 4 - Exploratory investigation of directionality for FI and SU

2.4.1 *Data collection* Directional relationship between food insecurity and substance use was assessed by asking the following questions: “At what age do you first remember not having enough to eat or worrying about not having enough to eat?” and “At what age did you first begin using substances (i.e., alcohol, cannabis/marijuana, cocaine, amphetamines, hallucinogens, designer drugs, opioids, prescription drugs not prescribed to you, nicotine/tobacco)?”

2.4.2 *Data analysis* Ages of first experiences with FI and SU were compared using a two-tailed, paired t-test in the FI+SU college student group only. Alpha was set at $p<0.05$ to conclude statistical significance.

Results

Demographics

734 participants (n=536 male, 23.98 ± 2.66 years) across the United States completed the survey (Table 2, appendix). 144 participants (19.6%) were affected by FI only, 380 participants (51.8%) were affected by SU only, 110 participants (15.0%) were affected by FI+SU, and 100 participants (13.6%) were affected by neither.

3.1. Relative Rank Importance of FCM within Individual Groups

The distributions for all categories were not the same in the FI only group, so the null hypothesis from Friedman’s two-way analysis of variance was rejected (p=0.003). There were significant differences with familiarity of foods being less important than sensory appeal, environmental impact, organic, and health & nutrition, though these differences were insignificant after using the adjusted significance value with Bonferroni correction (p>0.05, Table 3, appendix).

The distributions for all categories were not the same in the SU only group, so the null hypothesis was rejected ($p<0.001$). Price was less important than animal ethics ($p=0.019$), contamination ($p=0.019$), environmental impact ($p=0.011$), sensory appeal ($p=0.003$), health & nutrition ($p=0.002$), and organic motives ($p<0.001$). Familiarity was less important than environmental impact ($p=0.049$), sensory appeal ($p=0.016$), health and nutrition ($p=0.013$), and organic ($p<0.001$) motives. Local and small-scale production was less important than sensory appeal ($p=0.034$), health and nutrition ($p=0.027$), and organic ($p<0.001$) motives. Animal ethics contamination, and environmental impact was less important than organic motives ($p=0.012$, $p=0.012$, $p=0.021$, respectively). However, organic motives were only significantly more important than familiarity, price, and local and small-scale production after using the Bonferroni correction ($p=0.001$, $p=0$, $p=0.002$, respectively).

The distributions for all categories for the FI+SU and Neither groups were the same, so the null hypothesis is accepted ($p=0.398$ and $p=0.123$, respectively).

3.2. Effect of FI Intensity on FCM Importance

FI only participants indicated significant differences for all categories of FCM as the degree of FI increased ($p<0.001$, Table 4, appendix).

Participants affected by FI+SU showed significant differences in the degree of FI and in importance rating for contamination ($p<0.001$), environmental impact ($p<0.001$), familiarity ($p<0.001$), health and nutrition ($p=0.028$), local and small-scale production ($p=0.007$), and organic ($p<0.001$) motives.

3.3. Effect of SU Intensity on FCM Importance

Participants affected by SU only showed significant positive correlations for all FCM and alcohol ($p<0.001$, Table 5, appendix), cannabis, amphetamines, cocaine, opiates, hallucinogens, thinners & related drugs, GHB & related drugs, pills (sleeping and calming), and pills (pain relief) ($p<0.001$, Table 6, appendix). There were significant positive correlations for tobacco and all FCM except health and nutrition and organic motives within the SU only group ($p<0.05$).

In the FI+SU group, there were significant negative correlations with alcohol and health and nutrition and sensory appeal; cannabis and health and nutrition; opiates and health and nutrition; hallucinogens and health and nutrition and organic; thinners & related drugs and contamination, environmental impact, health and nutrition, price, and sensory appeal; GHB & related drugs and contamination, health and nutrition, price, and sensory appeal; pills (pain relief) and health and nutrition; and tobacco and contamination, environmental impact, health and nutrition, price, and sensory appeal ($p<0.05$).

3.4. Exploratory Investigation of Directionality for FI and SU

The mean age of first experience with SU was 20.2 years (SD ± 2.6 years), while FI occurred significantly earlier at 18.8 years (SD ± 2.7 $p<0.001$, Figure 1, appendix). FI occurred from 9 years before to 5 years after the first experience with SU.

Discussion

This study explored the relationship between FI intensity and FCM scores, the relationship between SU intensity and FCM scores, relative rank importance of FCM categories within groups (i.e., rank differences in FI only; rank differences in SU only; rank differences in FI+SU; rank differences in Neither), and ages of first experiences with FI and SU within the FI+SU group to explore causal directionality of FI and SU.

4.1. Relative Rank Importance of FCM within Individual Groups

Significant differences among motives were only observed in the SU group, with organic as the highest, significantly more than price, familiarity, and local/small-scale production. There were no significant differences in the rankings for FCM in FI only, FI+SU, and Neither.

In other studies, FI individuals have chosen foods based on convenience, price, and overall health impacts.[16,18] This aligns with the findings of this study, where price and health and nutrition were important (i.e., overall rating between “agree” and “strongly agree” for importance). The importance ratings were also similar for the rest of the motives, with all motives being rated as a 6 (“agree”) or higher.

In previous studies, SU individuals have been found to place greater importance on hedonic attributes of foods, price, and convenience and less importance on health and nutrition.[24,50,51] The findings do not fully align with the results of this study, as price was ranked the lowest in importance; however, sensory appeal was ranked among the highest of motives but was not found to be significantly more important than other FCM categories, which were all rated between “somewhat agree” and “agree.” Additionally, the organic motive was significantly higher than price, local and small-scale production, and familiarity of foods in SU only individuals in this study. In another study analyzing various food marketing techniques among college students, foods labeled as “ locally sourced” and “organic” were more likely to be chosen by students in general[6]; however, this could only partially explain the SU only group placing more importance on organic attributes than with local and small-scale attributes, as this study investigated the college population as a whole, not factoring in SU or FI statuses.

Food choice has not been extensively studied specifically for individuals who are simultaneously affected by FI and SU. However, it is likely that factors impacting the importance of FCM in FI only individuals and SU only individuals would also be present in FI+SU FCM importance. This

could explain the similarity in scores between SU only and FI+SU groups, despite a comparison between groups not being possible given the non-normal distribution. Given that previous studies have indicated that individuals affected by SU or FI place importance on price, health, and sensory appeal, this could potentially translate to individuals who are affected by both SU and FI.[16,18,24,51,52] Overall importance for all FCM categories in FI+SU was between "somewhat agree" and "agree," with no motive being more important than the others.

While this study found no significant differences in ranking for each FCM category in the group affected by neither FI nor SU, all motives were rated fairly high, with overall ratings of "somewhat agree" to "agree" for all categories. This aligns with the findings from previous studies investigating food choices among college students in general, which have found that students place importance on selecting foods based on price, familiarity, support for foods that are locally sourced, organic, and hedonic properties.[1,5,6]

4.2. Effect of FI Intensity on FCM Score

Importance of each FCM category increased with FI degree for FI participants. This observation was less pronounced when SU was also present (FI+SU), as only six of the nine FCM categories were significant for FI+SU.

The experience of FI includes a cycle of fluctuating availability, where individuals experience decreased intake, have poor diet quality, and experience increased worry, anxiety, pride, disinhibition, binge eating behaviors, weight self-stigma, and powerlessness as a result.[53-56] This relationship could also potentially be bidirectional, as individuals with increased levels of anxiety are at increased risk for FI and those experiencing FI may develop anxiety symptoms.[53-60] FCM importance increases as FI intensity increases, possibly due to food obsessive behaviors. This could be one mechanism for possibly explaining the relationship between increased severity of FI and higher FCM scores in the FI only group for all categories between all groups.

As intensity of FI increases, so does the importance of all FCM categories in FI only individuals, possibly due to food obsession in the form of preoccupation, anxiety, and other behaviors in FI only individuals; however, this relationship is less pronounced when SU is also present, indicating that physiological effects of SU may mitigate the effects of FI food obsession. Previous research has found that individuals affected by SU may prioritize the sensation of a high or a buzz over food in general, leading to apathetic attitudes, especially toward food, and anorexic behaviors.[21,29,30,38,50,53-55,62] This could provide a partial explanation as to why the presence of SU may mitigate food obsessive behaviors commonly experienced in the presence of FI.

4.3. Effect of SU Intensity on FCM Importance

As SU increased, FCM importance increased for all substances and FCM categories except tobacco with organic and health and nutrition motives in the SU only group. As SU increased in the FI+SU group, there was a decrease in importance of several FCM categories with many of the substances.

In previous studies, SU has been associated with decreased motivation and increased apathy toward activities of daily living and task completion.[62] However, other studies have also found that there is no difference in apathy and motivation in individuals affected by SU and those who are not.[62] To explain why the SU only group displayed increased importance of FCM as SU increased, previous studies have found that substance users may exhibit compensatory behaviors to mitigate the effects of SU.[63] For example, one study found that alcohol dependent substance users may exhibit compensatory effects after experiencing their binge drinking, in addition to offsetting their increased intake of foods after using appetite stimulants.[63] Compensatory behaviors may be a result of self-perceived health status' impact on overall wellbeing.[64] Within the SU only group, there is potential that their own self-perceived health statuses, which were not explored in this study, could be impacting the importance placed on their food choices.[64] That is, as SU increases, their recognition of how SU impacts their overall well-being increases, leading them to place more importance on FCM that could influence their dietary quality; this could possibly be due to understanding SU is harmful to overall wellbeing but simultaneously being unwilling to change SU behaviors. These mechanisms could potentially explain why FCM importance increases as SU increases, as individuals affected by SU could exhibit compensatory effects, unaltered motivational levels, or the impact of self-perceived health statuses.

While FCM were positively correlated for nearly all FCM categories and substances in SU only, the relationship was inverted and less pronounced with FI was also present. As previously mentioned, the effects of FI may lead to food obsessive behaviors in individuals affected by greater FI intensity.[21,29,30,38,50,53-60,65,66] As SU increases, FCM importance decreases, which has been explained in literature as psychological impacts of SU including apathy and lack of motivation.[21,49,50,61-64] However, as SU decreases, the impacts of FI may be more prevalent and may lead to greater negative experiences of FI sensed by FI+SU individuals, relating more to food-related anxiety and higher importance placed on FCM as a result. Given that many individuals affected by FI and SU commonly use appetite suppressants (e.g., tobacco, stimulants, and hallucinogens), the increased use of these substances may mitigate the effects of FI felt by FI+SU individuals, consequently decreasing the effects of food obsession and importance. Additionally, as FI+SU individuals use more appetite stimulants, they may experience more effects of FI (e.g., heightened senses of hunger) and place more importance on food choices as a result of increased experiences with FI and food obsessive behaviors, as their SU type and frequency may not effectively mitigate the effects felt from FI.

4.4. Exploratory Investigation of Directionality for FI and SU

Age of first experience was observed to be lower with FI than with SU by approximately 1.4 years among FI+SU individuals. There are several possible explanations for this. Children generally may have less access to substances, but FI can affect any household, individual, and demographic, with childhood FI being the most severe form of FI directly affecting young children as well as others in their household.[57] Moreover, college is a time when students may use their newfound independence to begin experimenting with sex, drugs, and alcohol, which they may not have been exposed to as much prior even though they may have experienced FI prior to or during their transition.[31,47,48,] This was similarly found in another study, which indicated that binge drinking and other SU had higher occurrences in young adults who were also affected by FI; however, this same study found that differences in the frequency and type of SU was not a cause for insufficient funds to purchase food.[56] Other studies suggest that FI individuals may turn to substances to curb appetite and to cope with their experiences related to FI, such as poor mental health and stigmatization of requiring food assistance.[8,11,22,25,51] For example, cigarettes are commonly used among the FI population and provide roughly 15 to 60 minutes of appetite suppression.[24]Consequently, those with more severe experiences of FI (i.e., very low food security) have much greater odds for SU than FI individuals who may experience low food security or marginal food security.[8] Within the population of individuals 30 years of age and younger specifically, there has been an association between FI and SU, with FI individuals being more likely than food secure counterparts to use and become dependent upon certain substances, potentially suggesting that experiences with FI may be a driving force for indirectly encouraging SU.[8,11,22,25]

In contrast, other studies have found that SU individuals may spend more income on substances and not have enough money for an adequate and balanced diet.[8,11,22,25] Additionally, substance using young adults may experience an increased appetite depending on the substance type and frequency, increasing the body's signals to consume more, thus heightening the experiences of FI for the individual.[51] Use of specific substances like amphetamines have also been linked to disordered eating patterns and an increased intake of high-calorie and sugary foods and beverages, leading to poor oral health that can prevent consumption, further contributing to inadequate diet and increased experiences with FI in FI+SU individuals.[51] Consequently, there may be a bidirectional relationship between FI and SU, though this requires further exploration.

Implications for Future Research and Practice

This study is among the first to analyze FCM for college students that are FI only, SU only, FI+SU, and Neither. Additionally, this study collected preliminary data for future studies to determine the directionality of SU and FI. Results from this project will lay the foundation for designing resources for college students, especially students facing obstacles related to FI and SU.

Significant differences among FCM importance were observed in the SU group only, with organic as the highest, significantly more than price, familiarity, and local/small-scale

production. As intensity of FI increases, so does the importance of all FCM categories in FI only individuals, possibly due to food obsessive behaviors in FI only individuals; however, this relationship is less pronounced when SU is also present, indicating that physiological effects of SU may mitigate the effects of FI food obsession. As SU increases, FCM importance increases for nearly all FCM categories for all substances except tobacco in the SU only group. As SU increases in the FI+SU group, FCM importance decreases for several FCM categories with different substances. Age of first experience was lower with FI than with SU by approximately 1.4 years. However, this is only exploratory data and is documented to add to discussion on future studies attempting to determine causal directionality of FI and SU.

Understanding differences in FCM importance can help college campuses and healthcare professionals understand how best to influence students in improving dietary quality and overall health based on FI and SU statuses, which can influence dietary habits that translate into adulthood and future generations. This provides healthcare professionals and colleges with opportunities to educate on healthy habits that address FI, SU, and FCM. Additionally, since FI generally occurred before SU among college students, food assistance programs should begin implementing strategies to prevent SU in the future. However, more research is needed, especially for establishing causal directionality for FI+SU.

Health education specialists, registered dietitians (RDNs), and food scientists all have important roles in influencing student health. Health education specialists (CHES) assess the overall needs of specific communities and populations, with students being included as a population. Based on the prevalence of FI and SU from our findings, CHES could have an important role in working with the college institutions and other programs to influence policies, create programs, and develop education events for supporting students affected by FI and/or SU. RDNs also have an essential role in influencing students' choices and access to resources. Because many health issues can develop as a result of FI and SU, dietitians can help mitigate the effects of these health issues and can determine specific needs of individuals affected by FI and SU. Moreover, dietitians can influence public policy, connect students to specific resources for FI and SU, impact the food that is available to students on campus and in the surrounding communities, and incorporate community nutrition education and other community strategies to improve the health of all college students, especially those that are affected by FI and/or SU. Finally, food scientists also have an important role in influencing college students' health and wellness. Based on the foods that are commonly available to FI students in food assistance programs, food scientists can work to increase the shelf stability of healthful foods while also maintaining an optimal level of nutrition. Additionally, food scientists can incorporate the values of students when making food choices by working to implement more environmentally friendly and efficient strategies for food production that would then influence the prices of foods to the consumers, reduce the levels of preservatives and additives, and promote the health and nutrition of the foods that students find to be pleasing and will be more likely to eat.

Strengths and Limitations

There were several strengths to this study. There was a large sample size, especially for the SU and FI+SU groups. Given the variety of substances included in the DUDIT-E questionnaire that were included for SU analyses, the large sample of SU participants allowed for more accurate results related to SU data. Additionally, the study design included individuals categorized as FI only, SU only, FI+SU, and neither, which accounted for the combined effects of SU and FI within individuals. Currently, there is not much data regarding FCM, especially among SU who are not in recovery or for individuals who are considered to be FI+SU. Another strength was exploring the correlations of FI and SU based on intensities of each variable, rather than only exploring the relationships of FCM and FI scores and FCM and SU scores based on categorical variables. This allowed for an enhanced understanding of the impacts of SU and FI intensities in predicting FCM scores. Finally, this study was among the very first to collect data to specifically explore the directionality of FI and SU by exploring the ages of first incidences with FI and SU in individuals affected by both.

Despite the strengths of this study, there were also several limitations. Little variance was seen in FCM scores based on individual groups, possibly due to the sample population of students being more uniform than the general population. Consequently, these findings may not translate to the general population as accurately. Another limitation was with the study design. The FCM Questionnaire's use may not have allowed for accurate interpretation of the results within groups, as this may have not been its intended use; rather, it has previously been used to compare motives between groups. However, given the non-normal distributions of the data that rendered ANOVA tests inaccurate, its use was changed for the study. Another limitation of the study was that self-perceived health status, which is generally accepted as a fairly strong predictor of both short- and long-term health, was not included in the survey despite its potential to explain the results more. Finally, there were several limitations to the exploratory data collection for the relationship between FI and SU. Ages of first experience were only asked to the FI+SU participants, who were classified as such given their FI and SU responses for the past 12 months. Lifetime FI and SU should have been used rather than solely from the past year. Finally, this study did not further explore cause and effect questions to better establish directionality for future studies. More research is needed to explore the interrelationships between FCM, FI, and SU, as well as for determining causal directionality of FI and SU.

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Conflicts of Interest

There is no conflict of interest to disclose.

References

1. Vilaro M, Zhou W, Colby S, et al. Development and preliminary testing of the food choice priorities survey (FCPS): Assessing the importance of multiple factors on college students' food choices. *Eval Health Prof*. 2017. doi:10.1177/0163278717735872
2. Schachtner E. Factors affecting food choices among college students. ProQuest Dissertations Publishing Website. https://www-proquest-com.ezproxy.bgsu.edu/docview/1927182260?pq-origsite=summon. Published 2017. Accessed July 26, 2021.
3. Boek S, Bianco-Simeral S, Chan K, Goto K. Gender and race are significant determinants of students' food choices on a college campus. *J Nutr Educ Behav*. 2012;44(4):372-378. doi:10.1016/j.jneb.2011.12.007
4. Sloan Kruger J, Kruger DJ. The impact of alcohol consumption on food choices among college students. *Am J Health Stud*. 2015;30(2):70-73. https://search-ebscohost-com.ezproxy.bgsu.edu/login.aspx?direct=true&db=s3h&AN=109353254&site=ehost-live&scope=site
5. Davison K, Holloway C, Gondara L, Hatcher A. Independent associations and effect modification between lifetime substance use and recent mood disorder diagnosis with household food insecurity. *PLoS One*. 2018;13(1). doi:10.1371/journal.pone.0191072
6. Tannehill J, Tonnessen R, Deinzer J, Policastro P. The influence of specific food labels on college-aged students food choices and taste preferences. *J Acad Nutr Diet*. 2014;114(9):A89. doi:10.1016/j.jand.2014.06.301
7. Saunders D, Ganjavi M. Perceived distress and its relationship to cognition and food choice in college students. *J Acad Nutr Diet*. 2020;120(10):A135. doi:10.1016/j.jand.2020.08.071
8. Whittle H, Sheira L, Frongillo E, et al. Longitudinal associations between food insecurity and substance use in a cohort of women with or at risk for HIV in the United States. *Addiction*. 2018;114(1):127-136. doi:10.1111/add.14418
9. Gulliford M, Mahabir D, Rocke B. Food insecurity, food choices, and body mass index in adults: Nutrition transition in Trinidad and Tobago. *Int J Epidemiol*. 2003;32(3):508-516. doi:10.1093/ije/dyg100
10. Regan E. Food insecurity among college students. *Social Compass*. 2020;14(6). doi:10.1111/soc4.12790
11. Nagata J, Palar K, Gooding K, et al. Food insecurity, sexual risk, and substance use in young adults. *J Adolesc Health*. 2021;68(1):169-177. doi:10.1016/j.jadohealth.2020.05.038
12. Payne-Sturges D, Tjaden A, Caldeira K, Vincent K, Arria A. Student hunger on campus: Food insecurity among college students and implications for academic institutions. *Am J Health Promot*. 2018;32(2):349-354. doi:10.1177/0890117117719620
13. Wood J, Harris III F. Experiences with "acute" food insecurity among college students. *Ed Res J*. 2018:142-145. doi:10.3102/0013189X17752928
14. Vanderbeke M. BGSU fights food insecurity with mobile food pantry. *The BG News*. February 27, 2019. https://www-proquest-com.ezproxy.bgsu.edu/docview/2186030078?pq-origsite=summon. Accessed July 26, 2021.

15. Zein A, Shelnutt K, Colby S, et al. Prevalence and correlates of food insecurity among U.S. college students: A multi-institutional study. *BMC Public Health*. 2019;660. doi:10.1186/s12889-019-6943-6
16. Graham R, Stotle O, Hodgetts D, Chamberlain K. Nutritionism and the construction of 'poor choices' in families facing food insecurity. *J Health Psychol*. 2016;23(14):1863-1871. doi:10.1177/1359105316669879
17. Martinez S, Brown E, Ritchie L. What factors increase risk for food insecurity among college students? *J Nutr Educ Behav*. 2016;48(7):S4. doi:10.1016/j.jneb.2016.04.017
18. Lombe M, Nebbitt V, Sinha A, Reynolds A. Examining effects of food insecurity and food choices on health outcomes in households in poverty. *Soc Work Health Care*. 2015;55(6):440-460. doi:10.1080/00981389.2015.1133469
19. Henry L. Understanding food insecurity among college students: Experience, motivation, and local solutions. *Ann Anthropol Pract*. 2017;41(1):6-19. doi:10.1111/napa.12108
20. Freudenberg N, Goldrick-Rab S, Poppendieck J. College students and SNAP: The new face of food insecurity in the United States. *Am J Public Health*. 2019;109(12):1652-1658. doi:10.2105/AJPH.2019.305332
21. Nikolaus C, Ellison B, Nikols-Richardson S. Are estimates of food insecurity among college students accurate? Comparison of assessment protocols. *PLoS One*. 2019;14(4). doi:10.1371/journal.pone.0215161
22. Bergmans R, Coughlin L, Tomorrow W, Malecki K. Cross-sectional associations of food insecurity with smoking cigarettes and heavy alcohol use in a population-based sample of adults. *Drug Alcohol Depend*. 2019;205. doi:10.1016/j.drugalcdep.2019.107646
23. Food security and nutrition assistance. USDA Economic Research Service Website. https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/food-security-and-nutrition-assistance/. Published December 16, 2020. Accessed July 26, 2021.
24. Gearhart K. Using a household food inventory to assess food variety and availability among mothers in residential substance abuse recovery programs. ProQuest Dissertations Publishing Website. https://www-proquest-com.ezproxy.bgsu.edu/docview/1554342781?pq-origsite=summon. Published 2013. Accessed July 26, 2021.
25. Pryor L, Lioret S, van der Waerden J, Fombonne É, Falissard B, Melchior M. Food insecurity and mental health problems among a community sample of young adults. *Soc Psychiatry Psychiatr Epidemiol*. 2016;51(8):1073-1081. doi:10.1007/s00127-016-1249-9
26. Sigmon S. Additive burdens of malnutrition, poverty, and substance abuse. *Lancet*. 2016;388(10054):1879-1880. doi:10.1016/S0140-6736(16)31814-1
27. DiBello AM, Gonzales R, Young CM, Rodriguez LM, Neighbors C. Blood is thicker than booze: Examining the role of familism and gender in alcohol use and related consequences among Hispanic college students. *J Ethn Subst Abuse*. 2016;15(3):310-324. doi:10.1080/15332640.2015.1044684
28. Woloschuk C, Portillo C, Lerma M, et al. Characteristics associated with marijuana use in Latinx college students. *J Ethn Subst Abuse*. 2020. doi:10.1080/15332640.2020.1808872

29. Locke G, Shilkret R, Everett J, Petry N. Interpersonal guilt and substance use in college students. *Subst Abus*. 2015;36(1):113-118. doi:10.1080/08897077.2014.885482
30. Pittman D, Brooks J, Kaur P, Obasi E. The cost of minority stress: Risky alcohol use and coping-motivated drinking behavior in African American college students. *J Ethn Subst Abuse*. 2019;18(2):257-278. doi:10.1080/15332640.2017.1336958
31. Sumstine S. Racial/ethnic variation in mental health correlates of substance use among college students. *J Ethn Subst Abuse*. 2018;17(2):94-107. doi:10.1080/15332640.2017.1300554
32. Wish E, Fitzelle D, O'Grady K, Hsu M, Arria A. Evidence for significant polydrug use among ecstasy-using college students. *J Am Coll Health.* 2006;55(2):99-104. doi:10.3200/JACH.55.2.99-104
33. Walters K, Bulmer S, Troiano P, Obiaka U, Bonhomme R. Substance use, anxiety, and depressive symptoms among college students. *J Child Adolesc Subst Abuse*. 2018;27(2):103-111. doi:10.1080/1067828X.2017.1420507
34. Pro G, Shaker E, Marzell M. Microaggressions and marijuana use among college students. *J Ethn Subst Abuse*. 2018;17(3);375-387. doi:10.1080/15332640.2017.1288191
35. Dey B. The effects of popular media on college students' attitudes and perceptions of substance abuse treatment. ProQuest Dissertations Publishing Website. https://www-proquest-com.ezproxy.bgsu.edu/docview/1970479147?accountid=26417&pq-origsite=summon. Published 2017. Accessed July 26, 2021.
36. Dennhardt A, Murphy J. Associations between depression, distress tolerance, delay discounting, and alcohol-related problems in European American and African American college students. *Psychol of Addict Behav*. 2011;25(4):595-604. doi:10.1037/a0025807
37. Xingdi H, Primack B, Barnett T, Cook R. College students and use of K2: An emerging drug of abuse in young persons. *Subst Abuse Treat Prev Policy*. 2011;6(16). doi:10.1186/1747-597X-6-16
38. Wade J, Peralta RL. Perceived racial discrimination, heavy episodic drinking, and alcohol abstinence among African American and White college students. *J Ethn Subst Abuse*. 2017;16(2):165-180. doi:10.1080/15332640.2015.1113152
39. Cobb C, Nasim A, Jentink K, Blank M. The role of caffeine in the alcohol consumption behaviors of college students. *Subst Abus*. 2015;36(1):90-98. doi:10.1080/08897077.2013.835763
40. Donaldson C, Siegel J, Crano W. Nonmedical use of prescription stimulants in college students: Attitudes, intentions, and vested interest. *Addict Behav*. 2015;53:101-107. doi:10.1016/j.addbeh.2015.10.007
41. Tam C, Benotsch E, Li X. Sexual enhancement expectancy, non-medical use of prescription drugs, and sexual risk behaviors in college students. *Subst Abus*. 2020. doi:10.1080/08897077.2020.1803177
42. O'Connor-Merrigan M. Faculty attitudes toward addressing mental health conditions and substance abuse among college students. ProQuest Dissertations Publishing Website. https://www-proquest-com.ezproxy.bgsu.edu/docview/1493901080?pq-origsite=summon. Published 2013. Accessed July 26, 2021.

43. Martin R, Chaney B, Vail-Smith K, Gallucci A. Hazardous drinking and weight-conscious drinking behaviors in a sample of college students and college student athletes. *Subst Abus*. 2016;37(3):488-493. doi:10.1080/08897077.2016.1142922
44. Lui P, Zamboanga B, Ertl M, Rodriguez L, Martin J, Gonzales R. Drinking motives, cultural orientations, and alcohol use among Hispanic college students at the US-Mexico border. *J Ethn Subst Abuse*. 2020. doi:10.1080/15332640.2020.1845901
45. Lewis T, Mobley K. Substance abuse and dependency risk: The role of peer perceptions, marijuana involvement, and attitudes toward substance use among college students. *J Drug Educ*. 2016;40(3):299-314. doi:10.2190/DE.40.3.f
46. Lee C, Corte C, Stein K. Relationships between early alcohol experiences, drinker self-schema, and drinking and smoking in college students. *Subst Abus*. 2018;39(4):426-433. doi:10.1080/08897077.2018.1443314
47. Falls B, Wish E, Garnier L, et al. The association between early conduct problems and early marijuana use in college students. *J Child Adolesc Subst Abuse*. 2011;20:221-236. doi:10.1080/1067828X.2011.581900
48. Stolberg V. Compulsive eating and substance abuse factors among African-American community college students. *J Ethn Subst Abuse*. 2003;2(4):77-95. doi:10.1300/j233v02n04_05
49. Shorey R, Stuart G, Anderson S. Early maladaptive schemas among young adult male substance abusers: A comparison with a non-clinical group. *J Subst Abuse Treat*. 2013;44(5):522-527. doi:10.1016/j.jsat.2012.12.001
50. Kerstetter K, Ballis M, Duffin-Lutgen S, Carr A, Behrens A, Kippin T. Sex differences in selecting between food and cocaine reinforcement are mediated by estrogen. *Neuropsychopharmacology*. 2012;37(12):2605-2614. doi:10.1038/npp.2012.99
51. Wall-Bassett E, Robinson M, Knight S, Crozier M. “Moving toward healthy”: Food choices of mothers in substance abuse recovery. *J Nutr Educ Behav*. 2014;46(4):S187. doi:10.1016/j.jneb.2014.04.286
52. Murray S, Peterson C, Primo C, et al. Prevalence of food insecurity and satisfaction with on-campus food choices among Australian university students. *Int J Sustain High Educ*. 2021. doi:10.1108/IJSHE-09-2020-0348
53. Stinson EJ, Votruba SB, Venti C, Perez M, Krakoff J, Gluck ME. Food insecurity is associated with maladaptive eating behaviors and objectively measured overeating. *Obesity*. 2018:26(12):1841-1848. doi: 10.1002/oby.22305
54. Tester J, Land T, Laraia BA. Disordered eating behaviours and food insecurity: A qualitative study about children with obesity in low-income households. *Obes Res Clin Pract*. 2017;10(5):544-552. doi: 10.1016/j.orcp.2015.11.007
55. Lewis EC, Colon-Ramos U, Gittelsohn J, Clay L. Food-seeking behaviors and food insecurity risk during the coronavirus disease 2019 pandemic. *J Nutr Educ Behav*. 2022:54(2):159-171. doi: 10.1016/j.jneb.2021.05.002
56. Larson N, Laska MN, Neumark-Sztainer D. Food insecurity, diet quality, home food availability, and health risk behaviors among emerging adults: findings from the EAT 2010-2018 study. *Am J Public Health*. 2020;110(9):1422-1428. doi: 10.2105/AJPH.2020.305783

57. Becker CB, Middlemass K, Taylor B, Johnson C, Gomez F. Food insecurity and eating disorder pathology. *Int J Eat Disord*. 2017;50(9):1031-1040. doi: 10.1002/eat.22735
58. Maynard MS, Perlman CM, Kirkpatrick SI. Food insecurity and perceived anxiety among adolescents: an analysis of data from the 2009-2010 national health and nutrition examination survey (NHANES). *J Hunger Environ Nutr*. 2019;14(3):339-351. doi: 10.1080/19320248.2017.1393363
59. Coffino JA, Spoor SP, Drach RD, Hormed JM. Food insecurity among graduate students: prevalence and association with depression, anxiety and stress. *Public Health Nutr*. 2021;24(7):1889-1894. doi: 10.1017/S1368980020002001
60. Arenas DJ, Thomas A, Wang J, DeLisser HM. A systematic review and meta-analysis of depression, anxiety, and sleep disorders in US adults with food insecurity. *J Gen Intern Med*. 2019;34(12):2874-2882. doi: 10.1007/s11606-019-05202-4
61. Santolaria-Fernández F, Gómez-Sirvent J, González-Reimers C, et al. Nutritional assessment of drug addicts. *Drug Alcohol Depend*. 1995;38(1):11-18. doi:10.1016/0376-8716(94)01088-3
62. Verdejo-Garcia A, Rivas-Perez C, Lopez-Torrecillas F, Perez-Garcia M. Differential impact on severity of drug use on frontal behavioral symptoms. *Addict Behav*. 2006;31(8):1373-1382. doi: 10.1016/j.addbeh.2005.11.003
63. Petrucci AS, LaFrance EM, Cuttler C. A Comprehensive Examination of the Links between Cannabis Use and Motivation. *Substance use & misuse*. 2020;55(7):1155-1164. doi:10.1080/10826084.2020.1729203
64. Pacheco-Colón I, Coxe S, Musser ED, Duperrouzel JC, Ross JM, Gonzalez R. Is Cannabis Use Associated with Various Indices of Motivation among Adolescents? *Substance use & misuse*. 2018;53(7):1158-1169. doi:10.1080/10826084.2017.1400566
65. Munn-Chernoff MA, Duncan AE, Grant JD, Wade TD, Agrawal A. A Twin Study of Alcohol Dependence, Binge Eating, and Compensatory Behaviors. *J Stud Alcohol Drugs*. 2013;74(5):664-673. doi: 10.15288/jsad.2013.74.664
66. Petraki I, Kapourtzi N, Terzidis A, et al. Living in Roma Settlements in Greece: Self-Perceived Health Status, Chronic Diseases and Associated Social Determinants of Health. *Int J Environ Res*. 2021;18(16):8403. doi: 10.3390/ijerph18168403

Appendix

Table 1: FCM category with individual FCM questionnaire items.

FCM Category	Questionnaire Item: **It is important that the food I eat on a typical day…**
Animal ethics	has been produced in a way that animals have not experienced pain. has been produced in a way that animals' rights have been respected.
Contamination	contains no artificial ingredients. has been produced in a way that limits my exposure to chemicals or pesticides. contains few or no additives.
Environmental Impact	has been produced in a way that limits the amount of energy, land, and water used. limits the impact on the earth's resources. is produced in an environmentally friendly way. is produced in a way that limits the production of waste or pollution.
Familiarity	is like other food I usually eat. is produced in a way that I am familiar with. is like the food I ate when I was a child.
Health & Nutrition	is nutritious. lowers the risk of heart disease, cancer, and other diseases. does not contain a lot of sugar, salt, or fat. contains a lot of fiber, protein, vitamins, or minerals.
Local & Small-Scale Production	is locally produced. supports small-scale producers.
Price	is a good value for money. is not expensive. is cheap.
Sensory Appeal	has a pleasant texture. smells nice. looks nice. tastes good.
Organic	is organically grown.

Table 2: Description of participant characteristics

Characteristics	Frequency	Percent
Total participants	734	100
Food insecure only (FI)	144	19.6
Substance using only (SU)	380	51.8
Food insecure and substance using (FI+SU)	110	15.0
Neither food insecure nor substance using (Neither)	100	13.6
Age		
18-20	98	13.4
21-22	119	16.2
23-25	317	43.2
26-28	157	21.3
29-30	43	5.9
Sex		
Male	536	73.0
Female	197	27.0
Gender		
Male	517	70.4
Female	200	27.2
Transgender	4	0.5
Genderqueer, neither exclusively male or female	8	1.1
Additional gender category or other	2	0.3
Choose not to disclose	3	0.4
Ethnicity		
Hispanic, Latino, or of Spanish origin	147	20.0

Not Hispanic, Latino, or of Spanish origin	558	76.0
Choose not to disclose	29	4.0
Race		
American Indian or Alaska Native	13	1.8
Asian	10	1.4
Black or African American	83	11.3
Native Hawaiian or Pacific Islander	6	0.7
White	599	81.6
Other	2	0.2
Choose not to disclose	23	3.0
Class standing		
Freshman undergraduate	109	14.9
Sophomore undergraduate	61	8.3
Junior undergraduate	243	33.1
Senior undergraduate	247	33.6
Master’s student	68	9.3
PhD student	6	0.8
International student	220	30.0
Domestic student	514	70.0
Relationship status		
Single, never married	464	63.2
Married or in a domestic relationship	212	28.9
Widowed	23	3.1
Divorced	16	2.2
Separated	19	2.6

Income		
$0-9,999	156	21.3
$10,000-24,999	213	29.0
$25,000-49,999	120	16.3
$50,000-74,999	67	9.1
$75,000-99,999	87	11.9
$100,000-149,999	33	4.5
$150,000 and greater	28	3.8
Prefer not to answer	27	3.7
Hours worked per week		
0-9	55	7.5
10-19	88	12.0
20-29	210	28.6
30-39	138	18.8
40-49	152	20.7
50-59	57	7.8
60 or greater	32	4.4
Greek life member		
Yes	341	46.5
No	393	53.5

Table 3: FCM category importance ranking with FI and SU groups using Friedman's two-way analysis, expressed using mean and SD. There was no difference in FCM importance for FI+SU and Neither ($p>0.05$). Values with different letters within a column are significantly different based on adjusted p value using the Bonferroni correction within individual groups.

	FI	SU	FI+SU	Neither
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Animal Ethics	6.50 ± 0.73[a]	5.54 ± 1.21[ab]	5.53 ± 1.06[a]	5.78 ± 0.77[a]
Contamination	6.50 ± 0.68[a]	5.53 ± 1.19[ab]	5.66 ± 0.91[a]	5.79 ± 1.01[a]
Environmental Impact	6.48 ± 0.70[a]	5.53 ± 1.16[ab]	5.69 ± 0.94[a]	5.74 ± 0.89[a]
Familiarity	6.19 ± 0.90[a]	5.44 ± 1.25[a]	5.57 ± 1.00[a]	5.67 ± 0.94[a]
Health & Nutrition	6.52 ± 0.65[a]	5.58 ± 1.17[ab]	5.79 ± 0.87[a]	5.83 ± 0.84[a]
Local & Small-Scale Production	6.49 ± 0.74[a]	5.44 ± 1.28[a]	5.59 ± 0.97[a]	5.71 ± 0.93[a]
Price	6.36 ± 0.91[a]	5.43 ± 1.18[a]	5.72 ± 0.88[a]	5.70 ± 0.83[a]
Sensory Appeal	6.45 ± 0.69[a]	5.58 ± 1.13[ab]	5.61 ± 0.88[a]	5.85 ± 0.81[a]
Organic	6.48 ± 0.83[a]	5.59 ± 1.37[b]	5.69 ± 1.25[a]	5.77 ± 1.17[a]

Table 4: Correlation of degree of FI sum and importance placed on FCM category using Pearson's correlation. Bolded values are significant.

	FI		FI+SU	
	r	*p*	*r*	*p*
Animal Ethics	**0.353**	**<0.001**	0.0176	0.065
Contamination	**0.468**	**<0.001**	**0.318**	**<0.001**
Environmental Impact	**0.520**	**<0.001**	**0.292**	**0.002**
Familiarity	**0.319**	**<0.001**	**0.254**	**0.007**
Health & Nutrition	**0.425**	**<0.001**	**0.209**	**0.028**
Local & Small-Scale Production	**0.381**	**<0.001**	**0.265**	**0.007**
Price	**0.353**	**<0.001**	0.115	0.233
Sensory Appeal	**0.369**	**<0.001**	0.129	0.179
Organic	**0.325**	**<0.001**	**0.381**	**<0.001**

Table 5: Correlation of degree of alcohol SU sum and importance placed on FCM category using Pearson's correlation. Bolded values are significant.

	SU		FI+SU	
Alcohol	*r*	*p*	*r*	*p*
Animal Ethics	**0.330**	**<0.001**	-0.102	0.288
Contamination	**0.345**	**<0.001**	-0.001	0.993
Environmental Impact	**0.381**	**<0.001**	0.013	0.892
Familiarity	**0.388**	**<0.001**	0.15	0.117
Health & Nutrition	**0.321**	**<0.001**	**-0.235**	**0.013**
Local & Small-Scale Production	**0.378**	**<0.001**	0.022	0.819
Price	**0.420**	**<0.001**	-0.148	0.123
Sensory Appeal	**0.337**	**<0.001**	**-0.203**	**0.033**
Organic	**0.318**	**<0.001**	0.003	0.974

Table 6: Correlation of degree of other substance use and importance placed on FCM category using Pearson's correlation. Bolded values are significant.

	SU		FI+SU	
Cannabis	*r*	*p*	*r*	*p*
Animal Ethics	**0.333**	**<0.001**	-0.081	0.4
Contamination	**0.371**	**<0.001**	-0.18	0.06
Environmental Impact	**0.397**	**<0.001**	-0.152	0.112
Familiarity	**0.416**	**<0.001**	-0.034	0.723
Health & Nutrition	**0.356**	**<0.001**	**-0.228**	**0.017**
Local & Small-Scale Production	**0.374**	**<0.001**	-0.064	0.507
Price	**0.426**	**<0.001**	-0.101	0.294
Sensory Appeal	**0.413**	**<0.001**	-0.132	0.171
Organic	**0.331**	**<0.001**	-0.114	0.234
Amphetamines				
Animal Ethics	**0.335**	**<0.001**	0.046	0.632
Contamination	**0.386**	**<0.001**	-0.093	0.336
Environmental Impact	**0.377**	**<0.001**	-0.064	0.504
Familiarity	**0.413**	**<0.001**	0.05	0.606
Health & Nutrition	**0.369**	**<0.001**	-0.149	0.119
Local & Small-Scale Production	**0.411**	**<0.001**	0.001	0.989
Price	**0.419**	**<0.001**	-0.15	0.118
Sensory Appeal	**0.386**	**<0.001**	-0.083	0.387
Organic	**0.337**	**<0.001**	0.034	0.723
Cocaine				
Animal Ethics	**0.332**	**<0.001**	0.097	0.313
Contamination	**0.366**	**<0.001**	-0.06	0.534
Environmental Impact	**0.359**	**<0.001**	0.001	0.995
Familiarity	**0.423**	**<0.001**	-0.054	0.577
Health & Nutrition	**0.346**	**<0.001**	-0.089	0.355
Local & Small-Scale Production	**0.356**	**<0.001**	0.04	0.676
Price	**0.408**	**<0.001**	-0.035	0.72
Sensory Appeal	**0.379**	**<0.001**	-0.147	0.124
Organic	**0.281**	**<0.001**	-0.01	0.916
Opiates				
Animal Ethics	**0.263**	**<0.001**	0.088	0.363
Contamination	**0.283**	**<0.001**	-0.136	0.158
Environmental Impact	**0.312**	**<0.001**	-0.147	0.125
Familiarity	**0.332**	**<0.001**	0.166	0.083

Health & Nutrition	**0.293**	**<0.001**	**-0.268**	**0.005**
Local & Small-Scale Production	**0.307**	**<0.001**	-0.015	0.878
Price	**0.349**	**<0.001**	-0.037	0.699
Sensory Appeal	**0.311**	**<0.001**	-0.176	0.066
Organic	**0.232**	**<0.001**	0.014	0.887

Hallucinogens

Animal Ethics	**0.355**	**<0.001**	0.021	0.826
Contamination	**0.382**	**<0.001**	-0.122	0.205
Environmental Impact	**0.396**	**<0.001**	-0.112	0.243
Familiarity	**0.425**	**<0.001**	-0.08	0.407
Health & Nutrition	**0.350**	**<0.001**	**-0.191**	**0.046**
Local & Small-Scale Production	**0.376**	**<0.001**	-0.102	0.287
Price	**0.405**	**<0.001**	-0.174	0.069
Sensory Appeal	**0.403**	**<0.001**	-0.125	0.191
Organic	**0.314**	**<0.001**	**-0.199**	**0.037**

Thinners & related drugs

Animal Ethics	**0.400**	**<0.001**	-0.097	0.312
Contamination	**0.409**	**<0.001**	**-0.235**	**0.013**
Environmental Impact	**0.421**	**<0.001**	**-0.251**	**0.008**
Familiarity	**0.449**	**<0.001**	-0.013	0.893
Health & Nutrition	**0.381**	**<0.001**	**-0.429**	**<0.001**
Local & Small-Scale Production	**0.411**	**<0.001**	-0.144	0.133
Price	**0.440**	**<0.001**	**-0.194**	**0.042**
Sensory Appeal	**0.426**	**<0.001**	**-0.302**	**0.001**
Organic	**0.338**	**<0.001**	-0.124	0.196

GHB & related drugs

Animal Ethics	**0.350**	**<0.001**	-0.006	0.949
Contamination	**0.418**	**<0.001**	**-0.308**	**0.001**
Environmental Impact	**0.429**	**<0.001**	-0.133	0.167
Familiarity	**0.443**	**<0.001**	-0.124	0.197
Health & Nutrition	**0.393**	**<0.001**	**-0.424**	**<0.001**
Local & Small-Scale Production	**0.406**	**<0.001**	-0.109	0.259
Price	**0.437**	**<0.001**	**-0.239**	**0.012**
Sensory Appeal	**0.420**	**<0.001**	**-0.270**	**0.004**
Organic	**0.353**	**<0.001**	-0.131	0.172

Pills - Sleeping & calming

Animal Ethics	**0.323**	**<0.001**	0.075	0.435

Contamination	**0.363**	**<0.001**	-0.103	0.286
Environmental Impact	**0.380**	**<0.001**	-0.139	0.148
Familiarity	**0.402**	**<0.001**	0.034	0.723
Health & Nutrition	**0.366**	**<0.001**	-0.17	0.075
Local & Small-Scale Production	**0.369**	**<0.001**	-0.045	0.638
Price	**0.419**	**<0.001**	-0.09	0.348
Sensory Appeal	**0.360**	**<0.001**	-0.053	0.579
Organic	**0.311**	**<0.001**	-0.046	0.633
Pills - Pain-relievers				
Animal Ethics	**0.366**	**<0.001**	0.094	0.33
Contamination	**0.415**	**<0.001**	-0.062	0.519
Environmental Impact	**0.420**	**<0.001**	-0.091	0.344
Familiarity	**0.443**	**<0.001**	0.07	0.465
Health & Nutrition	**0.378**	**<0.001**	**-0.221**	**0.02**
Local & Small-Scale Production	**0.415**	**<0.001**	-0.116	0.227
Price	**0.400**	**<0.001**	-0.073	0.447
Sensory Appeal	**0.417**	**<0.001**	-0.125	0.193
Organic	**0.331**	**<0.001**	-0.077	0.424
Tobacco				
Animal Ethics	**0.104**	**0.043**	-0.142	0.138
Contamination	**0.109**	**0.034**	**-0.270**	**0.004**
Environmental Impact	**0.158**	**0.002**	**-0.207**	**0.03**
Familiarity	**0.154**	**0.003**	-0.002	0.987
Health & Nutrition	0.048	0.35	**-0.282**	**0.003**
Local & Small-Scale Production	**0.152**	**0.003**	-0.06	0.535
Price	**0.184**	**<0.001**	**-0.190**	**0.047**
Sensory Appeal	**0.109**	**0.034**	**-0.226**	**0.017**
Organic	0.071	0.165	-0.167	0.081

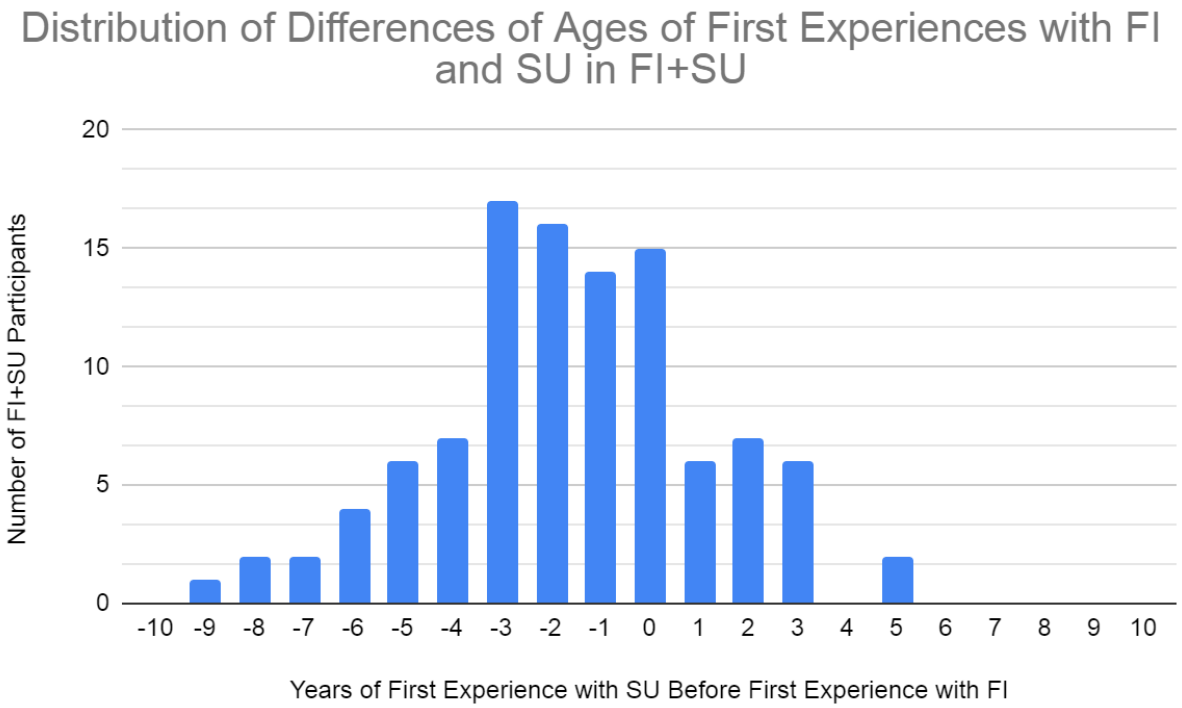

Figure 1: Distribution of the difference between ages of first experiences with FI and SU among FI+SU individuals. Negative numbers indicate that first experience with FI was prior to first experience with SU. Age of first experience with FI was significantly earlier than the age of first experience with SU by an average of 1.4 years (SD ± 2.6 years, $p<0.001$ using a two-tailed, paired t-test).