

Weight gain attempts and substance use behaviors among adults across five countries



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ABSTRACT

Weight gain attempts are common among adolescents, yet a paucity of research has explored these behaviors among adults, particularly in relation to substance use behaviors. To address this gap in the literature, pooled data from the 2018 and 2019 International Food Policy Study ($N = 42,108$) were analyzed. The association of weight gain attempts in the past 12 months with four important and relatively common substance use behaviors (alcohol use, binge-drinking, cigarette smoking, marijuana use) was examined using multiple modified Poisson regression analyses that adjusted for theoretically relevant covariates. Among men and women, weight gain attempts were associated with a higher likelihood of cigarette smoking in the past 30 days, marijuana use in the past 12 months, and binge-drinking one or more times per month in the past 12 months among men only. Among women, weight gain attempts were associated with a lower likelihood of alcohol use one or more times per month in the past 12 months. Our findings contribute to the literature demonstrating that substance use behaviors are more prevalent among adults who report weight gain attempts in a large international sample.

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1. Introduction

Although studies of eating disorders and body image that have investigated efforts to change body weight have historically focused predominantly on weight loss, more recently research has begun to investigate intentional attempts to gain weight. This broadening of the focus of research on weight change strategies is consistent with sociocultural pressures to adhere to specific shape and weight ideals (Ata et al., 2015; Donovan et al., 2020; Tylka, 2011, 2021), which include a male body ideal characterized by lean, muscular “bulk” (Baghurst et al., 2006; Murray et al., 2017; Pope et al., 2017) and a fit/athletic, toned muscular female body ideal (Gruber, 2007; Rodgers

et al., 2018), which, for both ideals, a gain in weight (i.e., muscle) is required. While much of this emerging literature has investigated adolescent and young adult samples (Minnick et al., 2020; Nagata et al., 2018, 2019; Solmi et al., 2020), recent research highlights that adults across the life course may engage in weight gain attempts, although prevalence is higher in younger adult age groups (Ganson, Nagata, et al., 2021). Moreover, across these samples, weight gain attempts are more common in males compared to females ranging from 10% to 30% for males and 4–6% for females (Ganson, Nagata, et al., 2021; Minnick et al., 2020; Nagata et al., 2018; Nagata, Murray, et al., 2019; Solmi et al., 2020).

Notably, evidence from the eating disorder and body image literatures has repeatedly shown that disordered eating behaviors and unhealthy weight control strategies are associated with various adverse psychosocial and physical outcomes, and the co-occurrence of other forms of psychopathology and maladaptive behaviors is

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common (Bahji et al., 2019; Jenkins et al., 2011; Westmoreland et al., 2016). Among these co-occurring behaviors are various forms of substance use, including alcohol use, cigarette smoking, and marijuana use (Bahji et al., 2019; Ganson, Lavender, et al., 2021; Ganson, Murray, et al., 2021; Ganson, Rodgers, et al., 2021; Solmi et al., 2016; Udo & Grilo, 2019). Research has emphasized that impulsivity, emotion regulation difficulties, and reward sensitivity may underpin these relationships (Aldao et al., 2010; Bahji et al., 2019; Gross, 1998; Joyner et al., 2019; Neuser et al., 2020). For example, engaging in behaviors intended for weight gain (e.g., excessive weight training, rigid protein-oriented dietary practices, use of appearance- and performance-enhancing substances) and substance use behaviors (e.g., alcohol use, cigarette smoking, marijuana use) both may represent strategies to manage emotions and can be driven by impulsivity and/or reward seeking. Additionally, research has underscored the use of cigarettes as a means to control weight via suppressing appetite and catalyzing metabolism (Solmi et al., 2016). Relatedly, there is a relationship between excessive alcohol consumption and disordered eating and weight control behaviors commonly known as food and alcohol disturbance (Barry & Piazza-Gardner, 2012; Eisenberg & Fitz, 2014; Rancourt et al., 2020).

While not an official diagnosis, food and alcohol disturbance may also be characterized by compensatory behaviors (e.g., restrictive dieting, compulsive exercise) intended to offset the caloric intake of alcohol use and/or increase the effect of alcohol intoxication (Choquette et al., 2018). Within the context of muscularity-oriented behaviors (i.e., weight gain attempts) (Murray et al., 2016) and the drive for muscularity, food and alcohol disturbance-related behaviors may be influenced by a desire to develop and display one's masculinity, particularly among male-identifying individuals (i.e., weight gain attempts and increased alcohol consumption confirm one's performance of masculine norms) (Palermo et al., 2020). Furthermore, the use of certain substances may support eating behaviors focused on the development of muscle mass and tone. For example, in the context of a “bulking” and “cutting” cycle, marijuana could be used to stimulate appetite to support the bulking phase, whereas cigarettes may be used to suppress appetite during the cutting phase.

The majority of emerging literature on weight gain attempts has focused on sociodemographic correlates, however the nature and prevalence of substance use behaviors among individuals who endorse weight gain attempts is currently unclear. This relationship is important to further characterize given the high prevalence of alcohol use, cigarette smoking, and marijuana use, particularly in high- and middle-income countries (World Health Organisation, 2016, 2018, 2019), and the well-recognized deleterious health effects and global burden of disease associated with these behaviors (Rehm et al., 2009; United States Department of Health and Human Services, 2014; Volkow et al., 2014; World Health Organisation, 2016). Therefore, the aim of this study was to evaluate the association between weight gain attempts and substance use behaviors in a large international sample including participants from Canada, Australia, the United Kingdom (UK), the United States (US), and Mexico. It was hypothesized that there would be significant positive associations between weight gain attempts and each form of substance use behavior investigated in this study. This hypothesis is grounded in prior research and theory underscoring the overlaps between affective and personality trait tendencies (e.g., impulsivity, emotion regulation) and problematic behavioral patterns (e.g., food and alcohol disturbance) related to eating disorder and muscularity-oriented behaviors and substance use behaviors.

2. Methods

2.1. Participants

Data from two survey years (2018; 2019) of the International Food Policy Study (IFPS) were analyzed. IFPS is an annual repeat cross-sectional survey conducted in Australia, Canada, Mexico, the UK, and the US. These five countries were selected based on similarities in their culture, language, and food systems, as well as their policy environment. Participants were recruited via Nielsen Consumer Insights Global Panel and their partners' panels; thus, participants were voluntarily enrolled in the panel for research-related purposes. Email invitations with unique survey links were sent to a non-probability sample (i.e., not necessarily nationally representative) of panelists within each country after targeting for demographic groups (i.e., age and sex). Additionally, participants were recruited to meet specific quotas, such as a proportion of respondents with low education resembling the population distribution in each country. Data were collected via web-based surveys with adults aged 18 years and older. Potential respondents were screened for eligibility and age and sex quota requirements. Respondents provided informed consent and received remuneration in accordance with their panel's typical incentive structure (e.g., points-based or monetary rewards, chances to win prizes). Surveys were conducted in English in Australia and the UK; Spanish in Mexico; English or French in Canada; and English or Spanish in the US. The study received ethics clearance through the University of Waterloo Research Ethics Committee (ORE# 30829).

A total of 28,684 participants completed the 2018 survey and 29,290 participants completed the 2019 survey. A total of 5860 and 8322 respondents were excluded from 2018 and 2019, respectively, due to the following reasons: region was missing, ineligible or had an inadequate sample size (i.e., Canadian territories); invalid response to a data quality question; survey completion time under 15 min; and/or invalid responses to at least three of 20 open-ended measures. The rates for completed and retained surveys, calculated as the percentage of participants who were invited out of those who completed the survey and were retained in the final sample, were 5.2% for 2018 and 2.9% for 2019. The American Association for Public Opinion Research cooperation rate #2, calculated as the percentage of participants who completed the survey out of those eligible participants who accessed the survey link (American Association for Public Opinion Research, 2016), was 69.2% in 2018 and 60.1% in 2019. The final samples for the 2018 and 2019 survey years were 22,824 and 20,968, respectively. A full description of the study methods and participants can be found elsewhere (International Food Policy Study, 2021a, 2021b). A total of 1684 participants were surveyed both years. Data from those participants were retained from the 2018 survey year resulting in a final total sample of 42,108 unique participants (mean age 45.5 years, standard deviation 16.7).

2.2. Measures

2.2.1. Weight gain attempts

The presence or absence of weight gain attempts was assessed using the question, “During the past 12 months have you tried to... gain weight?”. This measure aligns with prior published research operationalizing weight gain attempts (Ganson, Nagata, et al., 2021; Minnick et al., 2020; Nagata, Bibbins-Domingo, et al., 2019; Solmi et al., 2020).

2.2.2. Substance use variables

Alcohol use was assessed using the question, “In the last 12 months, how often did you have a drink of alcohol that was more than just a sip? A DRINK means: 1 regular sized bottle, can, or draft of beer; 1 glass of wine; 1 bottle or can of cooler; 1 shot of liquor (rum, whiskey, etc.); or 1 mixed drink (1 shot of liquor with pop, juice, energy drink, etc.)... (1) I have never drank alcohol; (2) I did not drink alcohol in the last 12 months; (3) I have only had a sip of alcohol; (4) Less than once a month; (5) Once a month; (6) 2 or 3 times a month; (7) Once a week; (8) 2 or 3 times a week; (9) 4–6 times a week; (10) Every day; (11) I do not know”. To align with prior research (Grucza et al., 2018; Schulenberg et al., 2019), responses were dichotomized to reflect less than once per month vs. once a month or more.

Binge drinking was assessed using the question, “In the last 12 months, how often did you have [“5” if male / “4” if female] drinks of alcohol or more on one occasion? A DRINK means: 1 regular sized bottle, can, or draft of beer; 1 glass of wine; 1 bottle or can of cooler; 1 shot of liquor (rum, whiskey, etc.); or 1 mixed drink (1 shot of liquor with pop, juice, energy drink, etc.)... (1) I have never done this; (2) I did not have [5/4] or more drinks on one occasion in the last 12 months; (3) Less than once a month; (4) Once a month; (5) 2–3 times a month; (6) Once a week; (7) 2–5 times a week; (8) Daily or almost daily; (9) I do not know.” In alignment with prior research (Grucza et al., 2018; Schulenberg et al., 2019), responses were dichotomized to reflect less than once per month vs. once a month or more. This question was only asked of participants who reported drinking more than a sip of alcohol in the past 12 months.

Cigarette use was assessed using the question, “Have you smoked cigarettes in the past 30 days?... (1) No; (2) Yes, occasionally; (3) Yes, every day.” In alignment with previous research (Schulenberg et al., 2019), responses were dichotomized to reflect no cigarette smoking vs. any cigarette smoking.

Marijuana use was assessed using the question, “In the last 12 months, how often did you use marijuana or cannabis (a joint, pot, weed, hash)?... (1) I have never used marijuana; (2) I have used marijuana but not in the last 12 months; (3) Less than once a month; (4) Once a month; (5) 2 or 3 times a month; (6) Once a week; (7) 2 or 3 times a week; (8) 4–6 times a week; (9) Every day; (10) Don't know.” In alignment with previous research (Schulenberg et al., 2019), responses were dichotomized to reflect less than monthly marijuana use vs. monthly or more marijuana use.

2.2.3. Covariates

Age, sex, race/ethnicity, and education were based on self-report. Sex was assessed using the question, “What sex were you assigned at birth, meaning on your original birth certificate?” Response options included “male” and “female”. Race/ethnicity was categorized into “majority,” “minority,” and “not stated” groups as per census questions asked in each country. Education was categorized as “low,” “medium,” or “high” according to country-specific criteria of the highest level of formal education attained. These categorizations of race/ethnicity and education are consistent with prior IFPS research (Forde et al., 2019; Ganson, Nagata, et al., 2021; Kwon et al., 2019; Vanderlee et al., 2021). Body mass index (BMI) was calculated using self-reported height and weight measurements according to each country's measurement unit (e.g., pounds, feet and inches, and converted to kilograms/meters²; (Centers for Disease Control and Prevention, 2020). Self-rated mental health was assessed using the question, “In general, would you say your mental health is. Poor; Fair; Good; Very good; Excellent; Don't know” (Ganson, Nagata, et al., 2021).

Table 1

Characteristics of men and women from the 2018 and 2019 International Food Policy Study (N = 42,108).

	Men n = 20,641 M (SD)/%	Women n = 21,467 M (SD)/%	p ^a
Age	45.2 (16.8)	45.8 (16.7)	< 0.001
BMI (kg/m ²)	26.8 (5.1)	26.6 (6.1)	< 0.001
Race/ethnicity ^b			.006
Majority group	77.8%	79.3%	
Minority group	21.0%	19.5%	
Not stated	1.2%	1.2%	
Education ^c			< .001
Low	40.9%	45.1%	
Medium	21.4%	22.2%	
High	37.3%	32.4%	
Not stated	0.4%	0.4%	
Self-rated mental health			< 0.001
Poor	6.0%	7.4%	
Fair	14.2%	17.5%	
Good	30.5%	33.4%	
Very good	29.1%	26.6%	
Excellent	18.9%	14.3%	
Don't know	1.2%	0.8%	
Country			.047
Canada	20.1%	19.3%	
Australia	18.5%	17.8%	
United Kingdom	22.0%	22.0%	
United States	20.1%	20.6%	
Mexico	19.3%	20.3%	
Survey year			.547
2018	54.3%	54.0%	
2019	45.7%	46.0%	
Weight gain attempts, past 12 months	10.4%	5.5%	< 0.001
Alcohol use, ≥ 1 time per month, past 12 months	56.5%	45.4%	< 0.001
Binge-drinking, ≥ 1 time per month, past 12 months	42.0%	31.4%	< 0.001
Any cigarette smoking, past 30 days	26.9%	22.7%	< 0.001
Marijuana use, ≥ 1 time per month, past 12 months	11.8%	7.2%	< 0.001

Note: Percentages are weighted using preconstructed sample weights.

BMI = Body mass index; M = Mean; SD = Standard deviation.

^a Differences between sexes determined using adjusted *F*, a variant of the second-order Rao-Scott adjusted χ^2 statistic.

^b Race/ethnicity categories in each country as per census questions asked in each country: Australia: majority = only speaks English at home, minority = speaks a language besides English at home; Canada: majority = “White (European descent)”, minority = any other race/ethnicity; Mexico: majority=nonindigenous, minority = indigenous; United Kingdom: majority = “White”, minority = any other race/ethnicity; United States: majority = “White”, minority=any other race/ethnicity.

^c Education was categorized as “low” (i.e., completed secondary school or less), “medium” (i.e., some postsecondary qualifications), or “high” (i.e., university degree or higher) according to country-specific criteria of the highest level of formal education attained.

2.3. Analysis plan

Descriptive statistics were calculated to provide an overview of the sample characteristics. Unadjusted percent of substance use behaviors by weight gain attempts was estimated, as well as substance use behaviors among those who report weight gain attempts by country. All differences between groups were determined using adjusted *F*, a variant of the second-order Rao-Scott adjusted χ^2 statistic. Multiple modified Poisson regression analyses with robust error variance (Zou, 2004) were conducted and prevalence ratios (PR), which is analogous to risk ratios when using cross-sectional data, with corresponding 95% confidence intervals (CI) were used to examine the associations of weight gain attempts with substance use behaviors among men and women adjusting for the covariates.

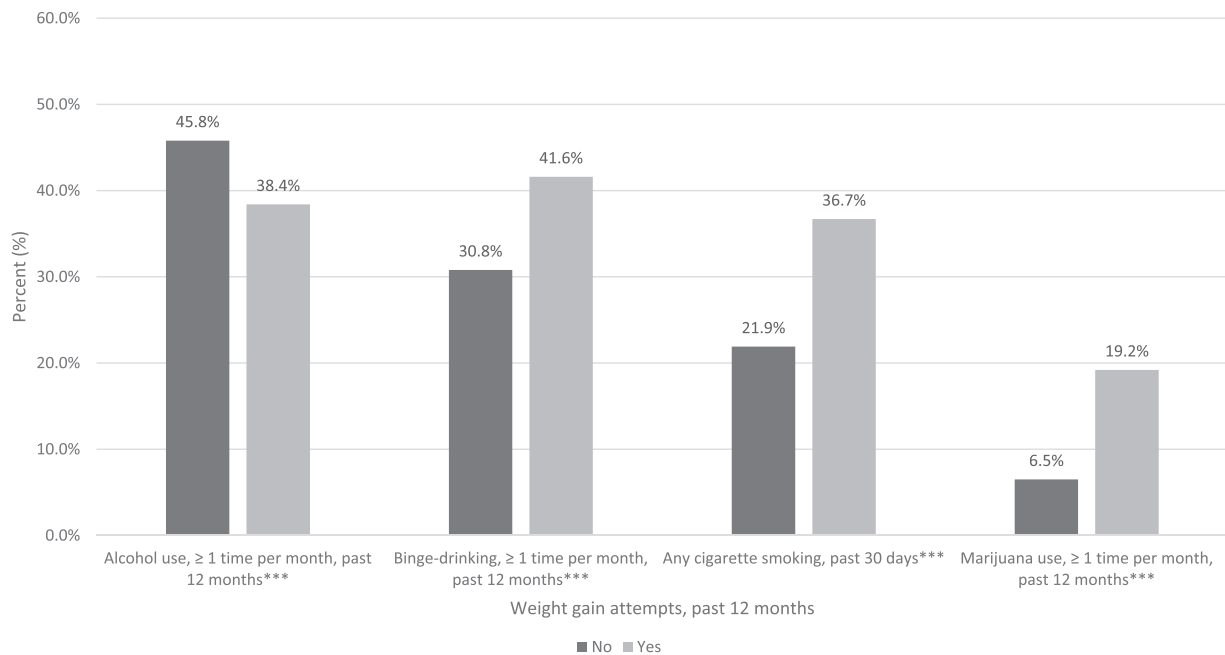


Fig. 1. Unadjusted percent of substance use behaviors by weight gain attempts among women from the 2018 and 2019 International Food Policy Study. Note: Percentages are weighted using preconstructed sample weights and show percent of those who report each substance use behavior by weight gain attempts (no vs. yes). Differences between weight gain attempts (no vs. yes) determined using adjusted F , a variant of the second-order Rao-Scott adjusted χ^2 statistic. *** $p < .001$.

All analyzes were stratified by sex given prior theoretical and empirical research on weight gain attempts and substance use behaviors (Calzo et al., 2013; Ganson, Nagata, et al., 2021; Minnick et al., 2020; Murray et al., 2016; Nagata, Bibbins-Domingo, et al., 2019; Nolen-Hoeksema, 2004; Solmi et al., 2020). All analyzes included post-stratification sample weights constructed using a raking algorithm with population estimates from the census in each country based on age group, sex, region, ethnicity (except in Canada) and education (except in Mexico). Analyzes were conducted using Stata 17.

3. Results

Sample characteristics are displayed in Table 1. Compared to women, men reported significantly (all $p < .001$) higher prevalence of weight gain attempts in the past 12 months (men: 10.4%; women: 5.5%), alcohol use one or more times per month in the past 12 months (men: 56.5%; women: 45.4%), binge drinking one or more times per month in the past 12 months (men: 42.0%; women: 31.4%), any cigarette smoking in the past 30 days (men: 26.9%; women: 22.7%), and marijuana use one or more times per month in the past 12 months (men: 11.8%; women: 7.2%).

Among women, there were significant differences in percent of substance use behaviors by weight gain attempts (Fig. 1). Alcohol use (one or more times per month) was more common among women who reported no weight gain attempts (45.8%) compared to those who reported weight gain attempts (38.4%, $p = .001$). Conversely, binge-drinking one or more times per month (41.6% vs. 30.8%), any cigarette smoking (36.7% vs. 21.9%), and marijuana use one or more times per month (19.2% vs. 6.5%) were significantly (all $p < .001$) more common among women who reported weight gain attempts compared to those who did not. This pattern was similar among men (Fig. 2). Specifically, alcohol use (one or more times per month) was significantly more common among men who reported no weight gain attempts (57.4%) compared to those who reported weight gain attempts (49.4%, $p < .001$). Conversely, binge-drinking one or more times per month (53.6% vs. 40.8%), any cigarette smoking (38.9% vs. 25.5%), and marijuana use one or more times per month (25.4% vs.

10.2%) were significantly (all $p < .001$) more common among men who reported weight gain attempts compared to those who did not.

The percent of substance use behaviors among participants who reported weight gain attempts are displayed by country in Figs. 3 and 4. Among women who reported weight gain attempts (Fig. 3), significant differences across countries were observed ($p < .001$) for marijuana use. For example, marijuana use one or more times per month was significantly more common in women who reported weight gain attempts from Canada (30.1%) compared to those from Mexico (8.6%). No other significant differences in substance use behaviors across countries were found. Among men who reported weight gain attempts (Fig. 4), significant differences across countries were observed for binge-drinking ($p = .002$) and marijuana use ($p < .001$). For example, binge-drinking one or more times per month was significantly more common in men who reported weight gain attempts from the UK (61.3%) compared to those from Canada (42.8%), and marijuana use one or more times per month was significantly more common in men who reported weight gain attempts from Canada (37.8%) compared to those from Mexico (11.8%). All other substance use behaviors did not significantly differ by country.

Adjusted analyses showed significant associations between weight gain attempts and substance use behaviors among women and men (Table 2). Among women, weight gain attempts were associated with lower likelihood of alcohol use one or more times per month (PR 0.84, 95% CI 0.77–0.93) and higher likelihood of any cigarette smoking (PR 1.49, 95% CI 1.32–1.67) and marijuana use one or more times per month (PR 1.77, 95% CI 1.48–2.12). Among men, weight gain attempts were associated with higher likelihood of binge-drinking one or more times per month (PR 1.11, 95% CI 1.03–1.18), any cigarette smoking (PR 1.35, 95% CI 1.24–1.47), and marijuana use one or more times per month (PR 1.47, 95% CI 1.30–1.66).

4. Discussion

The aim of this study was to determine the association between weight gain attempts and substance use behaviors in a large sample of participants from five high- and middle-income countries.

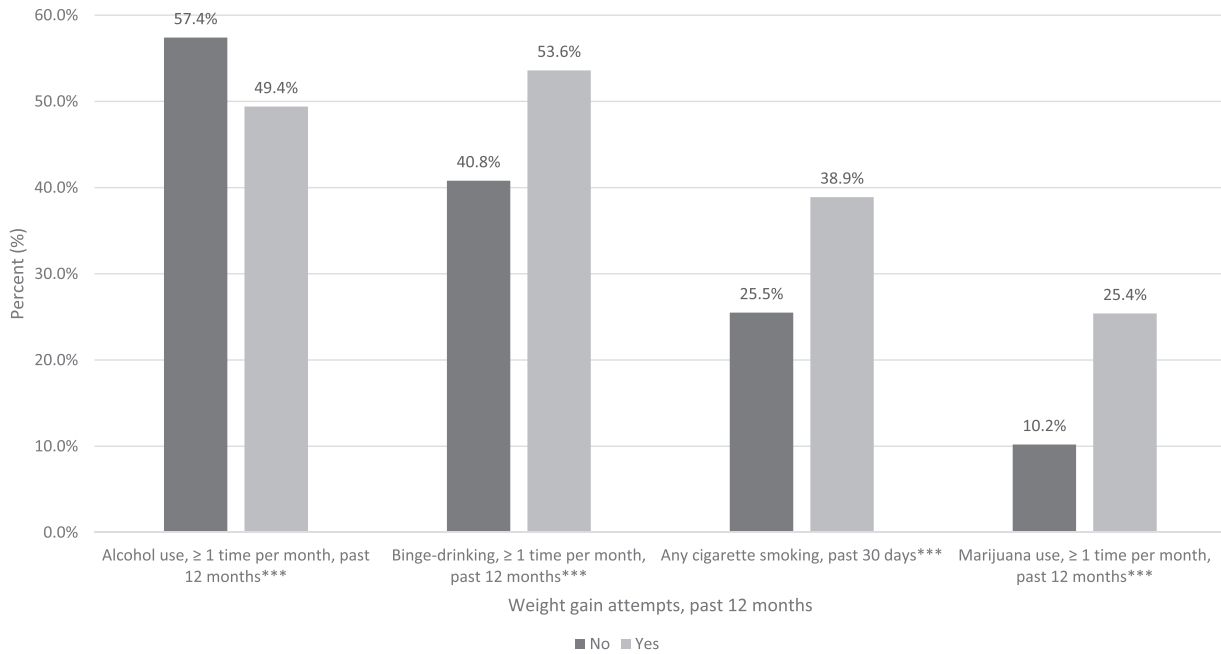


Fig. 2. Unadjusted percent of substance use behaviors by weight gain attempts among men from the 2018 and 2019 International Food Policy Study. Note: Percentages are weighted using preconstructed sample weights and show percent of those who report each substance use behavior by weight gain attempts (no vs. yes). Differences between weight gain attempts (no vs. yes) determined using adjusted *F*, a variant of the second-order Rao-Scott adjusted χ^2 statistic. *** $p < .001$.

Findings partially confirm the study hypotheses. Except for alcohol use, which was more common among those who reported no weight gain attempts, men and women who reported weight gain attempts in the past 12 months exhibited significantly higher unadjusted prevalence of binge-drinking one or more times per month, any cigarette smoking, and marijuana use one or more times per month. Specifically, while adjusting for covariates, women who reported weight gain attempts were more likely to report any cigarette smoking and marijuana use one or more times per month, whereas men who reported weight gain attempts were more likely to report

binge-drinking one or more times per month, any cigarette smoking, and marijuana use one or more times per month. Further, the prevalence of substance use behaviors in those who reported weight gain attempts varied by country of residence. Finally, women who reported weight gain attempts were less likely to report alcohol use one or more times per month. These findings may be indicative of variable cultural influences in relation to substance use behaviors (e.g., high prevalence of binge-drinking in the UK; Osborne & Cooper, 2019) and regulation of substances (e.g., federal legality of marijuana in Canada, legality of marijuana in a number of U.S. states).

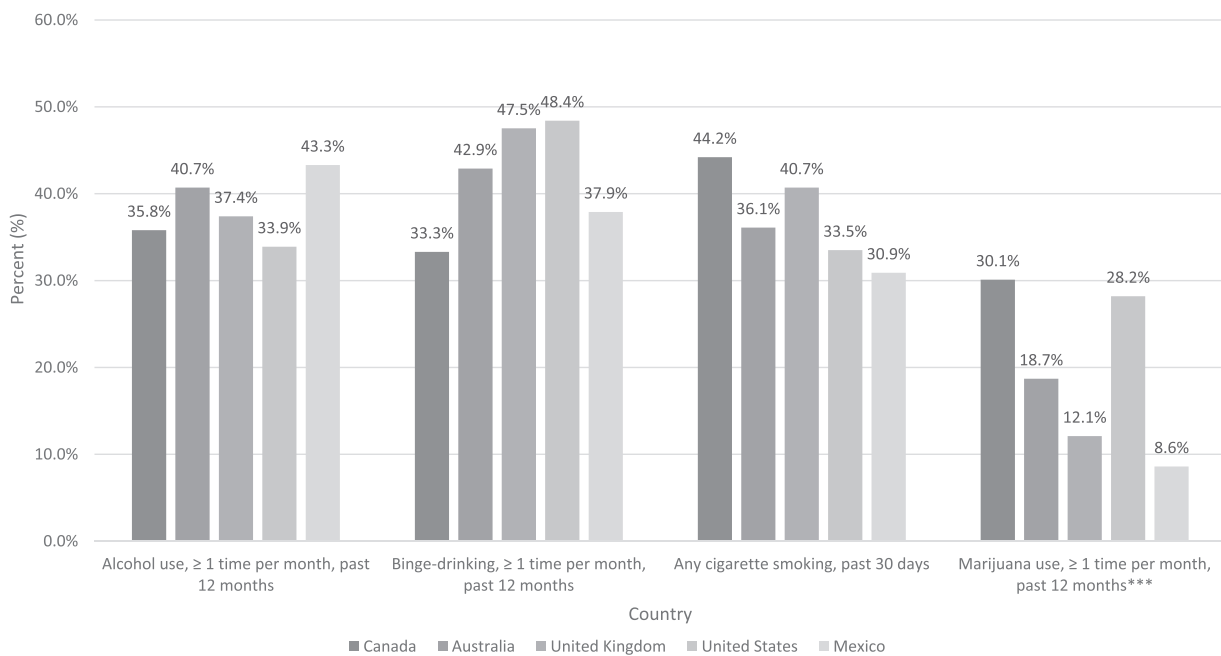


Fig. 3. Unadjusted percent of substance use behaviors among women who report weight gain attempts in the past 12 months by country from the 2018 and 2019 International Food Policy Study. Note: Percentages are weighted using preconstructed sample weights and show percent of those who reported each substance use behavior and weight gain attempts by country. Differences between country determined using adjusted *F*, a variant of the second-order Rao-Scott adjusted χ^2 statistic. *** $p < .001$.

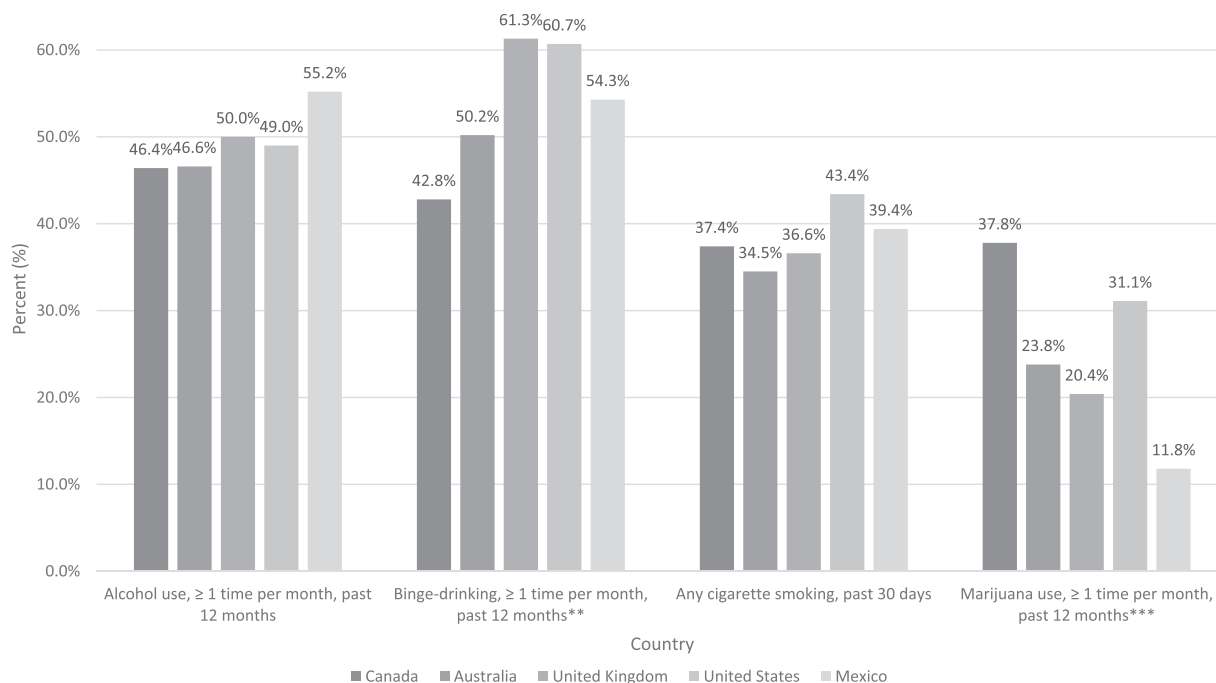


Fig. 4. Unadjusted percent of substance use behaviors among men who report weight gain attempts in the past 12 months by country from the 2018 and 2019 International Food Policy Study. Note: Percentages are weighted using preconstructed sample weights and show percent of those who reported each substance use behavior and weight gain attempts by country. Differences between country determined using adjusted *F*, a variant of the second-order Rao-Scott adjusted χ^2 statistic. ** $p < .01$ *** $p < .001$.

Empirical findings and conceptual theories described in prior research offer potential explanations for current findings regarding substance use behaviors among participants who report weight gain attempts. First, difficulties with emotion regulation and elevated trait tendencies for impulsivity and sensation seeking are key constructs implicated in the onset and/or maintenance of substance use behaviors, as well as disordered eating and weight control behaviors (Aldao et al., 2010; Bahji et al., 2019; Brockmeyer et al., 2014; Gross, 1998; Joyner et al., 2019; Neuser et al., 2020). Thus, in the context of body dissatisfaction and striving to achieve a specific body ideal, which is often unrealistic and extraordinary difficult to achieve or maintain for the average person, substance use behaviors may be a means to attenuate distress associated with such attempts. Relatedly, the relationship between weight gain attempts and binge-drinking among men may be explained by notions of hegemonic masculinity. For example, men may use their (muscular) bodies as means to visibly promote traits such as toughness, dominance, and strength to others (Connell & Messerschmidt, 2005; Lefkowich et al.,

2017; Levant, 1996). Similarly, displays of masculinity are associated with binge-drinking (Peralta et al., 2010) and substance use is considered an accepted masculine emotion regulation strategy (Nolen-Hoeksema, 2004). Interestingly, however, the findings among women may be less clearly interpreted in the context of body image concerns, particularly because women who reported weight gain attempts were less likely to report alcohol use. In fact, the unadjusted prevalence of alcohol use was higher among those not reporting weight gain attempts. For women, the purpose of weight gain attempts may be geared towards achieving the fit and toned body ideal that includes visible muscle yet little body fat (Bozsik et al., 2018). Thus, the lower likelihood of alcohol use among women may be due to not wanting to consume the macronutrients associated with regular alcohol use, which may be seen to undermine such appearance goals. Additional investigation of the potential attitudes and motivations underlying this finding among women is warranted. Second, substances with appetite suppressant qualities, such as cigarettes, may be used to assist with weight control and to

Table 2
Associations between weight gain attempts and substance use behaviors among men and women from the 2018 and 2019 International Food Policy Study ($N = 42,108$).

	Alcohol use, ≥ 1 time per month, past 12 months		Binge-drinking, ≥ 1 time per month, past 12 months		Any cigarette smoking, past 30 days		Marijuana use, ≥ 1 time per month, past 12 months	
	PR (95% CI) ^a	<i>p</i>	PR (95% CI) ^b	<i>p</i>	PR (95% CI) ^c	<i>p</i>	PR (95% CI) ^b	<i>p</i>
Women ($n = 21,467$)								
Weight gain attempts, past 12 months	0.84 (0.77–0.93)	.001	1.01 (0.89–1.14)	.917	1.49 (1.32–1.67)	< 0.001	1.77 (1.48–2.12)	< 0.001
Men ($n = 20,641$)								
Weight gain attempts, past 12 months	0.97 (0.92–1.03)	.328	1.11 (1.03–1.18)	.003	1.35 (1.24–1.47)	< 0.001	1.47 (1.30–1.66)	< 0.001

Note: All analyzes are weighted using preconstructed sample weights. The PR in each cell represents the abbreviated output from a series of Poisson regression models with robust error variance specifying weight gain attempts as the independent variable and substance use behaviors as the dependent variables. Thus, the table represents the outputs from 8 Poisson regression models in total.

Boldface indicates statistical significance $p < .05$.

PR = Prevalence ratio; CI = Confidence interval.

^a Adjusted for age, body mass index, race/ethnicity, education, self-rated mental health, any cigarette smoking, past 30 days, country, survey year.

^b Adjusted for age, body mass index, race/ethnicity, education, self-rated mental health, any cigarette smoking, past 30 days, any alcohol use, ≥ 1 time per month, past 12 months, country, survey year.

^c Adjusted for age, body mass index, race/ethnicity, education, self-rated mental health, any alcohol use, ≥ 1 time per month, past 12 months, country, survey year.

stimulate metabolism (Solmi et al., 2016). In the context of weight gain attempts that align with the pursuit of a lean and muscular body type, cigarette use may be used as part of a “cutting” cycle, whereby one decreases caloric and specific macronutrient intake to reduce body fat and enhance muscular definition (Murray et al., 2017). Thus, using cigarettes to suppress appetite may support restricted dietary intake. Conversely, the connection between weight gain attempts and binge-drinking may be evidence of food and alcohol disturbance (Barry & Piazza-Gardner, 2012; Eisenberg & Fitz, 2014; Rancourt et al., 2020), whereby men engage in weight gain behaviors (e.g., weight lifting) in response to their consumption of alcohol to compensate for the caloric intake. Overall, findings suggest that individuals who engage in weight gain attempts have a greater propensity for also engaging in health-related risk behaviors, such as substance use behaviors. This aligns theoretically with problem behavior theory, which describes the clustering of engagement in social and behavioral problems (Jessor & Jessor, 1977).

This study is the first known to identify associations between weight gain attempts and substance use behaviors among adults across five middle- and high-income countries. These findings have important implications for health care professionals and future research, across an array of distinct cultural settings. First, despite representing a lower proportion of those who report weight gain attempts, women in this study who reported weight gain attempts had greater effect sizes, compared to men, with substance use behaviors, including cigarette smoking and marijuana use. Thus, along with the links between substance use and weight loss efforts identified in prior studies, health care professionals should consider screening for substance use behaviors among women who report weight change efforts of any kind (i.e., loss or gain). Second, given the high prevalence and greater likelihood of binge-drinking, cigarette smoking, and marijuana use among men who report weight gain attempts, it is imperative that health care professionals screen for and provide guidance on the health effects of these substance use behaviors among men reporting a desire to gain weight. This is particularly important given the significant burden of disease associated with problematic alcohol use (Rehm et al., 2009), the health effects of cigarette smoking (United States Department of Health and Human Services, 2014), and overall higher prevalence of marijuana use in the general population (Schulenberg et al., 2019; World Health Organisation, 2016). Indeed, the health effects of binge-drinking and cigarette smoking may be exacerbated by problematic engagement in muscularity-oriented behaviors for the purposes of weight gain (i.e., excessive exercise, performance-enhancing substance use, restrictive dieting, and caloric overconsumption).

The current findings also point to several areas that warrant further investigation. First, future research will be needed to identify the underlying mechanisms that explain the associations between weight gain attempts and substance use behaviors among women, such as emotion regulation difficulties, personality/temperament-based constructs (impulsivity, sensation seeking), or other theoretically relevant constructs (e.g., beliefs about the importance of and adherence to feminine vs. masculine norms). Second, future studies should explore the prospective relationships between weight gain attempts and substance use behaviors, as well as the specific motivations for substance use behaviors among individuals who endorse attempts to gain weight. Finally, given the differing prevalence of substance use behaviors (i.e., binge-drinking and marijuana use) among men and women who report weight gain attempts by country, future research in countries with higher prevalence may be useful to further identify and characterize patterns of behavior to inform screening and intervention protocols.

A major strength of this study is the large, diverse, and international sample, which provides for greater overall generalizability of the findings to populations from multiple middle- and high-income countries. However, certain limitations also should be noted. First,

the samples from each country were not necessarily nationally representative based on the sampling strategy used (i.e., a non-probability sample of panelists) and specific exclusion criteria (i.e., excluding certain locations in specific countries, sampling based on education level) may have impacted generalizability. Furthermore, participant response rates were relatively low. However, analyses were weighted to maximize external validity and the sample profiles show good comparability on dietary and sociodemographic variables with population-estimates. Second, the primary study variables were based on single items, however these items mirror benchmark national monitoring surveys. This limits the level of specificity with which these behaviors are assessed, and additional elements such as purpose, type, and underlying motivation, which should be investigated in future research. Third, given the large sample size, we were adequately powered to detect small effect sizes, and some of the effect sizes found were modest in magnitude, such as the association between weight gain attempts and binge drinking. Therefore, associations found in this study should be interpreted with the overall modest effect sizes in mind. Lastly, the data were cross-sectional in nature, thus precluding the ability to identify prospective relationships.

5. Conclusions

The findings from this study showed that weight gain attempts were associated with substance use behaviors in an international sample of men and women. Both men and women who reported weight gain attempts were more likely to also report cigarette smoking and marijuana use, while men were also more likely to also report binge-drinking. These findings add to a growing literature on weight gain attempts among adults, emphasizing the need for more research on this behavior to inform health care and public health endeavors.

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CRedit authorship contribution statement

Kyle T. Ganson: Conceptualization, Data curation, Formal analysis, Methodology; Visualization; Writing - original draft; Writing - review & editing, **Jason M. Nagata:** Conceptualization; Methodology; Writing - review & editing, **Rachel F. Rodgers:** Writing - review & editing, **Mitchell L. Cunningham:** Writing - review & editing, **Jason M. Lavender:** Writing - review & editing, **Stuart B Murray:** Writing - review & editing, **David Hammond:** Supervision; Writing - review & editing.

Declarations of Interest

All authors report none.

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References

- Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion-regulation strategies across psychopathology: A meta-analytic review. *Clinical Psychology Review*, 30(2), 217–237. <https://doi.org/10.1016/j.cpr.2009.11.004>
- American Association for Public Opinion Research. (2016). *American Association for Public Opinion Research. Standard definitions: Final dispositions of case codes and outcome rates for surveys*. (9th Edition).
- Ata, R. N., Schaefer, L. M., & Thompson, J. K. (2015). Sociocultural theories of eating disorders. *The Wiley handbook of eating disorders* (pp. 269–282). <https://doi.org/10.1002/9781118574089.ch21>
- Baghurst, T., Hollander, D. B., Nardella, B., & Haff, G. G. (2006). Change in sociocultural ideal male physique: An examination of past and present action figures. *Body Image*, 3(1), 87–91. <https://doi.org/10.1016/j.bodyim.2005.11.001>
- Bahji, A., Nadeem, M., Hudson, C. C., Nadkarni, P., Macneil, B. A., & Hawken, E. (2019). Prevalence of substance use disorder comorbidity among individuals with eating disorders: A systematic review and meta-analysis. *Psychiatry Research*, 273(October 2018), 58–66. <https://doi.org/10.1016/j.psychres.2019.01.007>
- Barry, A. E., & Piazza-Gardner, A. K. (2012). Drunkorexia: Understanding the co-occurrence of alcohol consumption and eating/exercise weight management behaviors. *Journal of American College Health*, 60(3), 236–243. <https://doi.org/10.1080/07448481.2011.587487>
- Bozskik, F., Whisenhunt, B. L., Hudson, D. L., Bennett, B., & Lundgren, J. D. (2018). Thin is in? Think again: The rising importance of muscularity in the thin ideal female body. *Sex Roles*, 79(9–10), 609–615. <https://doi.org/10.1007/s11199-017-0886-0>
- Brockmeyer, T., Skunde, M., Wu, M., Bresslein, E., Rudofsky, G., Herzog, W., & Friederich, H. C. (2014). Difficulties in emotion regulation across the spectrum of eating disorders. *Comprehensive Psychiatry*, 55(3), 565–571. <https://doi.org/10.1016/j.comppsy.2013.12.001>
- Calzo, J. P., Corliss, H. L., Blood, E. A., Field, A. E., & Austin, S. B. (2013). Development of muscularity and weight concerns in heterosexual and sexual minority males. *Health Psychology*, 32(1), 42–51. <https://doi.org/10.1037/a0028964>
- Centers for Disease Control and Prevention. (2020). *Assessing your weight*.
- Choquette, E. M., Rancourt, D., & Kevin Thompson, J. (2018). From fad to FAD: A theoretical formulation and proposed name change for “drunkorexia” to food and alcohol disturbance (FAD). *International Journal of Eating Disorders*, 51(8), 831–834. <https://doi.org/10.1002/eat.22926>
- Connell, R. W., & Messerschmidt, J. W. (2005). Hegemonic masculinity rethinking the concept. *Gender and Society*, 19(6), 829–859. <https://doi.org/10.1177/0891243205278639>
- Donovan, C. L., Uhlmann, L. R., & Loxton, N. J. (2020). Strong is the new skinny, but is it ideal? A test of the tripartite influence model using a new measure of fit-ideal internalisation. *Body Image*, 35, 171–180. <https://doi.org/10.1016/j.bodyim.2020.09.002>
- Eisenberg, M. H., & Fitz, C. C. (2014). “Drunkorexia”: Exploring the who and why of a disturbing trend in college students’ eating and drinking behaviors. *Journal of American College Health*, 62(8), 570–577. <https://doi.org/10.1080/07448481.2014.947991>
- Forde, H., White, M., Levy, L., Greaves, F., Hammond, D., Vanderlee, L., ... Adams, J. (2019). The relationship between self-reported exposure to sugar-sweetened beverage promotions and intake: Cross-sectional analysis of the 2017 international food policy study. *Nutrients*, 11(12), <https://doi.org/10.3390/nu1123047>
- Ganson, K. T., Murray, S. B., & Nagata, J. M. (2021). Associations between eating disorders and illicit drug use among college students. *International Journal of Eating Disorders*, 54(7), 1127–1134. <https://doi.org/10.1002/eat.23493>
- Ganson, K. T., Rodgers, R. F., Murray, S. B., & Nagata, J. M. (2021). Prevalence and demographic, substance use, and mental health correlates of fasting among U.S. college students. *Journal of Eating Disorders*, 9(1), 88. <https://doi.org/10.1186/s40337-021-00443-3>
- Ganson, K. T., Lavender, J. M., Rodgers, R. F., Cunningham, M., & Nagata, J. M. (2021). Compulsive exercise and vaping among a sample of U.S. college students aged 18–26 years. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*. <https://doi.org/10.1007/s40519-021-01251-z>
- Ganson, K. T., Nagata, J. M., Lavender, J. M., Rodgers, R. F., Cunningham, M., Murray, S. B., & Hammond, D. (2021). Prevalence and correlates of weight gain attempts across five countries. *International Journal of Eating Disorders*, (August), [eat.23595](https://doi.org/10.1002/eat.23595)
- Gross, J. J. (1998). The emerging field of emotion regulation: An integrative review. *Review of General Psychology*, 2(3), 271–299.
- Gruber, A. J. (2007). A more muscular female body ideal. In J. K. Thompson, & G. Cafri (Eds.), *The muscular ideal: Psychological, social, and medical perspectives* (pp. 217–234). American Psychological Association. <https://doi.org/10.1037/11581-011>
- Gruzca, R. A., Sher, K. J., Kerr, W. C., Krauss, M. J., Lui, C. K., McDowell, Y. E., ... Bierut, L. J. (2018). Trends in adult alcohol use and binge drinking in the early 21st-century United States: A meta-analysis of 6 national survey series. *Alcoholism: Clinical and Experimental Research*, 42(10), 1939–1950. <https://doi.org/10.1111/acer.13859>
- International Food Policy Study . (2021a). *Technical report 2018 survey (wave 2)*. (https://foodpolicystudy.com/wp-content/uploads/2021/01/2018-IFPS-Technical-Report_20210115.pdf).
- International Food Policy Study . (2021b). *Technical report 2019 survey (wave 3)*. (http://foodpolicystudy.com/wp-content/uploads/2021/03/2019-IFPS-Technical-Report_20210301.pdf).
- Jenkins, P. E., Hoste, R. R., Meyer, C., & Blissett, J. M. (2011). Eating disorders and quality of life: A review of the literature. *Clinical Psychology Review*, 31(1), 113–121. <https://doi.org/10.1016/j.cpr.2010.08.003>
- Jessor, R., & Jessor, S. L. (1977). *Problem behavior and psychosocial development: A longitudinal study of youth*. Academic Press.
- Joyner, K. J., Bowyer, C. B., Yancey, J. R., Venables, N. C., Foell, J., Worthy, D. A., ... Patrick, C. J. (2019). Blunted reward sensitivity and trait disinhibition interact to predict substance use problems. *Clinical Psychological Science*, 7(5), 1109–1124. <https://doi.org/10.1177/2167702619838480>
- Kwon, J., Cameron, A. J., Hammond, D., White, C. M., Vanderlee, L., Bhawra, J., & Sacks, G. (2019). A multi-country survey of public support for food policies to promote healthy diets: Findings from the International Food Policy Study. *BMC Public Health*, 19(1), 1–10. <https://doi.org/10.1186/s12889-019-7483-9>
- Lefkovich, M., Olliffe, J. L., Hurd Clarke, L., & Hannan-Leith, M. (2017). Male body practices: Pitches, purchases, and performativities. *American Journal of Men's Health*, 11(2), 454–463. <https://doi.org/10.1177/1557988316669042>
- Levant, R. F. (1996). The new psychology of men. *Professional Psychology: Research and Practice*, 27(3), 259–265. <https://doi.org/10.1037/0735-7028.27.3.259>
- Minnick, C., Raffoul, A., Hammond, D., & Kirkpatrick, S. I. (2020). Intentional weight gain efforts among young Canadian adults aged 17–32 years. *Eating Behaviors*, 38(June), <https://doi.org/10.1016/j.eatbeh.2020.101407>
- Murray, S. B., Griffiths, S., & Mond, J. M. (2016). Evolving eating disorder psychopathology: Conceptualising muscularity-oriented disordered eating. *British Journal of Psychiatry*, 208(5), 414–415. <https://doi.org/10.1192/bjp.bp.115.168427>
- Murray, S. B., Nagata, J. M., Griffiths, S., Calzo, J. P., Brown, T. A., Mitchison, D., ... Mond, J. M. (2017). The enigma of male eating disorders: A critical review and synthesis. *Clinical Psychology Review*, 57(August), 1–11. <https://doi.org/10.1016/j.cpr.2017.08.001>
- Nagata, J. M., Garber, A. K., Tabler, J. L., Murray, S. B., & Bibbins-Domingo, K. (2018). Prevalence and correlates of disordered eating behaviors among young adults with overweight or obesity. *Journal of General Internal Medicine*, 33(8), 1337–1343. <https://doi.org/10.1007/s11606-018-4465-z>
- Nagata, J. M., Murray, S. B., Bibbins-Domingo, K., Garber, A. K., Mitchison, D., & Griffiths, S. (2019). Predictors of muscularity-oriented disordered eating behaviors in U.S. young adults: A prospective cohort study. *International Journal of Eating Disorders*, (February), 1–9. <https://doi.org/10.1002/eat.23094>
- Nagata, J. M., Bibbins-Domingo, K., Garber, A. K., Griffiths, S., Vittinghoff, E., & Murray, S. B. (2019). Boys, bulk, and body ideals: Sex differences in weight-gain attempts among adolescents in the United States. *Journal of Adolescent Health*, 64(4), 450–453. <https://doi.org/10.1016/j.jadohealth.2018.09.002>
- Neuser, M. P., Kühnel, A., Svaldi, J., & Kroemer, N. B. (2020). Beyond the average: The role of variable reward sensitivity in eating disorders. *Physiology and Behavior*, 223(April), Article 112971. <https://doi.org/10.1016/j.physbeh.2020.112971>
- Nolen-Hoeksema, S. (2004). Gender differences in risk factors and consequences for alcohol use and problems. *Clinical Psychology Review*, 24(8), 981–1010. <https://doi.org/10.1016/j.cpr.2004.08.003>
- Osborne, B., & Cooper, V. (2019). *Health survey for England 2017: Adult health related behaviours*. (<https://files.digital.nhs.uk/E3/BBA634/HSE2017-Adult-Health-Related-Behaviours-rep-v2.pdf>).
- Palermo, M., Choquette, E. M., Ahlich, E., & Rancourt, D. (2020). Food and alcohol disturbance by athlete status: The roles of drive for thinness, drive for muscularity, and sex. *Journal of American College Health*, 0(0), 1–8. <https://doi.org/10.1080/07448481.2020.1713791>
- Peralta, R. L., Steele, J. L., Nofziger, S., & Rickles, M. (2010). The impact of gender on binge drinking behavior among U.S. College students attending a Midwestern university: An analysis of two gender measures. *Feminist Criminology*, 5(4), 355–379. <https://doi.org/10.1177/1557085110386363>
- Pope, H. G., Khalsa, J. H., & Bhasin, S. (2017). Body image disorders and abuse of anabolic-androgenic steroids among men. *JAMA - Journal of the American Medical Association*, 317(1), 23–24. <https://doi.org/10.1001/jama.2016.17441>
- Rancourt, D., Ahlich, E., Choquette, E. M., Simon, J., & Kelley, J. (2020). A comparison of food and alcohol disturbance (FAD) in sorority and non-sorority women. *Journal of American College Health*, 0(0), 1–4. <https://doi.org/10.1080/07448481.2020.1740233>
- Rehm, J., Mathers, C., Popova, S., Thavorncharoensap, M., Teerawattananon, Y., & Patra, J. (2009). Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. *The Lancet*, 373(9682), 2223–2233. [https://doi.org/10.1016/S0140-6736\(09\)60746-7](https://doi.org/10.1016/S0140-6736(09)60746-7)
- Rodgers, R. F., Franko, D. L., Lovering, M. E., Luk, S., Pernal, W., & Matsumoto, A. (2018). Development and validation of the female muscularity scale. *Sex Roles*, 78(1–2), 18–26. <https://doi.org/10.1007/s11199-017-0775-6>
- Schulenberg, J. E., Johnston, L. D., O'Malley, P. M., Bachman, J. G., Miech, R. A., & Patrick, M. E. (2019). Monitoring the Future. *College Students & Adults Ages*, 19–60. (<http://monitoringthefuture.org/pubs.html#monographs>).
- Solmi, F., Sharpe, H., Gage, S. H., Maddock, J., Lewis, G., & Patalay, P. (2020). Changes in the prevalence and correlates of weight-control behaviors and weight perception in adolescents in the UK, 1986–2015. *JAMA Pediatrics*, 1–10. <https://doi.org/10.1001/jamapediatrics.2020.4746>
- Solmi, M., Veronese, N., Sergi, G., Luchini, C., Favaro, A., Santonastaso, P., ... Stubbs, B. (2016). The association between smoking prevalence and eating disorders: A systematic review and meta-analysis. *Addiction*, 111(11), 1914–1922. <https://doi.org/10.1111/add.13457>

- Tylka, T. L. (2011). Refinement of the tripartite influence model for men: Dual body image pathways to body change behaviors. *Body Image*, 8(3), 199–207. <https://doi.org/10.1016/j.bodyim.2011.04.008>
- Tylka, T. L. (2021). Models of body image for boys and men. In J. M. Nagata, T. A. Brown, S. B. Murray, & J. M. Lavender (Eds.). *Eating disorders in boys and men* (pp. 7–20). Springer International Publishing. https://doi.org/10.1007/978-3-030-67127-3_2
- Udo, T., & Grilo, C. M. (2019). Psychiatric and medical correlates of DSM-5 eating disorders in a nationally representative sample of adults in the United States. *International Journal of Eating Disorders*, November 2018, 42–50. <https://doi.org/10.1002/eat.23004>
- United States Department of Health and Human Services. (2014). *The health consequences of smoking—50 years of progress a report of the surgeon general. A report of the surgeon general*, 1081.
- Vanderlee, L., White, C. M., Kirkpatrick, S. I., Rynard, V. L., Jáuregui, A., Adams, J., ... Hammond, D. (2021). Nonalcoholic and alcoholic beverage intakes by adults across 5 upper-middle- and high-income countries. *Journal of Nutrition*, 151(1), 140–151. <https://doi.org/10.1093/jn/nxaa324>
- Volkow, N. D., Baler, R. D., Compton, W. M., & Weiss, S. R. B. (2014). Adverse health effects of marijuana use. *New England Journal of Medicine*, 370(23), 2219–2227. <https://doi.org/10.1056/NEJMra1402309>
- Westmoreland, P., Krantz, M. J., & Mehler, P. S. (2016). Medical complications of anorexia nervosa and bulimia. *American Journal of Medicine*, 129(1), 30–37. <https://doi.org/10.1016/j.amjmed.2015.06.031>
- World Health Organisation . (2016). *The health and social effects of nonmedical cannabis use*. (<https://www.who.int/teams/mental-health-and-substance-use/alcohol-drugs-and-addictive-behaviours/drugs-psychoactive/cannabis>).
- World Health Organisation . (2018). *Global status report on alcohol and health 2018*. (<https://www.who.int/publications/i/item/9789241565639>).
- World Health Organisation. (2019). *WHO global report on trends in prevalence of tobacco use*. Third edition. (<https://www.who.int/publications/i/item/who-global-report-on-trends-in-prevalence-of-tobacco-use-2000-2025-third-edition>).
- Zou, G. (2004). A modified poisson regression approach to prospective studies with binary data. *American Journal of Epidemiology*, 159(7), 702–706. <https://doi.org/10.1093/aje/kwh090>