Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Psychological distress and its association with intake of sugar-sweetened beverages, discretionary foods, and alcohol in women during the COVID-19 pandemic in Australia

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ABSTRACT

Objectives: This study aimed to explore psychological distress, lifestyle, and demographic factors, as well as their relationship to discretionary choices in women of reproductive age during the coronavirus disease 2019 pandemic in Australia.

Methods: Reproductive-aged women (18–50 y) in Australia participated in a national online survey. Psychological distress score (using a validated 10-item Kessler Psychological Distress Scale questionnaire) was the primary exposure of interest, and key outcomes were frequencies of discretionary choices (sugar-sweetened beverages [SSBs], alcohol, and discretionary foods). Sociodemographic and physical activity data were also collected. Logistic regression was used to report adjusted odds ratio (aOR) and 95% confidence interval to predict SSBs (less than weekly; most days/daily), total discretionary foods (none/<2 times/d; ≥3 times/d), and alcohol use (never/less than monthly; most weeks/daily).

Results: A total of 1005 women were included in the study, of whom 40% had a high level of psychological distress. Women with high psychological distress (aOR: 1.96; 95% CI, 1.32–2.91) and those who gained weight during the pandemic (aOR: 1.71; 95% CI, 1.10–2.65) were more likely to consume discretionary foods ≥3 times/d. There was no association between psychological distress and SSB intake or alcohol; however, Australian, New Zealander, or Pacific Islander background (aOR: 1.68; 95% CI, 1.21–2.33) and more hours of sitting time (aOR: 1.88; 95% CI, 1.07–3.29) were associated with SSB consumption on most days/daily. Older age (aOR: 1.70; 95% CI, 1.00–2.89), higher household income (aOR: 1.44; 95% CI, 1.08–1.92), and moderate or high physical activity (aOR: 1.75; 95% CI, 1.10–2.80) were associated with alcohol intake on most weeks/daily.

Conclusions: Public health messaging to promote healthy eating should take into account the effect of psychological distress on health behavior. Messages aimed at maintaining a positive relationship between food intake and mental wellbeing, particularly among vulnerable groups, are warranted.

Introduction

The current COVID-19 pandemic is caused by the novel coronavirus, severe acute respiratory syndrome coronavirus type 2, and was identified first in Wuhan, China in December 2019. COVID-19

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was declared a global pandemic by the World Health Organization in March 2020. In Australia, the virus first peaked across numerous states in the first quarter of 2020 [1].

During the pandemic, social distancing and lockdown restrictions affected a range of behavioral factors. In particular, the public health emergencies resulting from COVID-19 negatively affected mental health and psychological distress [2,3]. In the United States, levels of psychological distress were higher during the pandemic compared with two years prior [4]. In the United Kingdom, higher levels of anxiety (21%–37%) were reported during the pandemic in 2020 compared with 2019 [5]. Data from Australian surveys conducted during the pandemic found that around one-fifth of 320 health care workers self-reported moderate-to-severe symptoms of depression, anxiety, and posttraumatic stress disorder [6], with significantly higher scores in one or more psychological distress states found for women and those age 18 to 45 y [7]. The social effect of the COVID-19 pandemic has also been considerable, including employment instability, financial insecurity, increased isolation, loneliness, fear, anxiety, and depression [8].

A recurring finding in cross-sectional studies is that women are most greatly affected physically and psychologically by the COVID-19 pandemic compared with men [9,10]. In addition to having worse mental health [11,12], women across the reproductive age group also face challenges with diet, physical activity [13], and household food insecurity [14]. Furthermore, changes in behavioral factors during the COVID-19 pandemic and lockdown include increased intake of total food consumption, decreased adherence to a healthy diet, and increased snacking [15]. Additionally, food intake was reportedly increased because of emotional eating as a means of comfort and to feel better in response to anxious states [16,17], with higher levels of this reported behavior in women [16].

Given the effect of COVID-19 social distancing and isolation measures, along with the far-reaching economic consequences, exploring lifestyle factors in women of reproductive age is important. Moreover, the indication that discretionary choices increased during the pandemic presents the need to better understand relationships between discretionary choices and psychological stress. Therefore, this study aimed to explore psychological distress, lifestyle, and demographic factors and their relationship with discretionary choices in women of reproductive age (18–50 y) during the COVID-19 pandemic in Australia.

Methods

Study design and population

This study was an Australia-wide cross-sectional study using data collected through an anonymous online survey between October 15 and November 7, 2020 (Suppl. File 1). At this time, Victoria was in their second lockdown, and restrictions were easing throughout the rest of Australia. The survey was designed to explore food insecurity, diet and physical activity behaviors, weight changes, psychological distress, and infant feeding during the COVID-19 pandemic. Women of reproductive age (18–50 y) who resided in Australia were invited via e-mail to complete an online survey, including a series of multiple-choice and short-answer questions. E-mails were sent to women by a cross-panel market research provider (Online Research Unit) with a well-established database of 400 000 members until the target sample size was reached. There are approximately 5 million women in Australia age 15 to 50 y; thus, to conduct a survey with an approximate margin of error of 1% with a 99% confidence interval (CI), a sample size of approximately 1000 responses was required.

To ensure the study population was broadly representative of women in the Australian population according to the Australian Bureau of Statistics by age and location of residence (state/territory), these demographic characteristics of the study population were examined on days 4 and 5 after recruitment commenced to allow for targeted recruitment of underrepresented groups [18]. Although the resulting sample may not be representative across all population characteristics, this approach is widely accepted to obtain a sample broadly consistent with population proportions on predefined characteristics [19].

After online consent, participants were asked to complete the anonymous 10-min online survey and were reimbursed in line with ISO 26362 and industry requirements. The study was approved by the Monash University Human Research Ethics Committee (MUHREC project: 25941).

Assessment of population characteristics

The survey included multiple-choice or short-answer questions to assess participant age group, residential location (state/territory), cultural or ethnic background, the highest level of completed education, employment status before the pandemic, changes in employment status since the pandemic, living circumstances, and annual household income before tax. The level of lockdown restriction was determined based on metropolitan versus regional areas during the 3 mo leading up to the survey [20]. Self-reported height and weight were used to calculate body mass index (BMI) and categorized as underweight (<18.5 kg/m^2), normal weight (18.5–25 kg/m^2), overweight (25–29.9 kg/m^2), or obese (≥30 kg/m^2).

Dietary survey questions were developed based on the Irish National COVID-19 Food Survey and adapted to Australian settings using the Australian Guide to Healthy Eating to collect information on the consumption of sugar-sweetened beverages (SSBs), alcohol, and total discretionary foods. The frequency of discretionary food intake was obtained through multiple choice questions of 1 to 2 times per day, 3 to 5 times per day, 5 to 7 times per day, 7 to 10 times per day, >10 times per day, do not eat every day, never, and I do not know. Frequency of discretionary foods was then binary coded into none/<2 times per day (i.e., never, do not eat every day, and 1–2 times/d) and ≥3 times/d (i.e., 3–5, 5–7, 7–10, or >10 times/d) to align with the Australian Guide to Healthy Eating discretionary food recommendations for women of <2.5 times per day [21,22].

The frequency of SSB intake was obtained using multiple-choice options: <1 time per week, 1 to 3 times per week, 4 to 6 times per week, more than once a day, never, and I do not know. SSB frequency was then binary coded into less than weekly (i.e., never and <1 time/wk) and most days/daily (i.e., 1–3 or 4–6 times/wk, more than once a day) based on median intake. Frequency of alcohol consumption was obtained through multiple-choice options (2–3 times/wk, 2–4 times/wk, ≥4 times/mo, monthly or less, never, and I do not know/prefer not to answer), and collapsed into never/less than monthly (i.e., never and monthly or less) and most weeks/daily (i.e., 2–4 times/mo, 2–3 or ≥4 times/wk). Responses of I do not know or I prefer not to answer were excluded from the binomial logistic regression. Fruit and vegetables serving numbers were self-reported (as continuous variables) with outliers deemed as values >3 times the 75th percentile, as per Yaroch et al. [23], and later replaced with an imputed value.

Physical and sedentary activity

The Active Australia Survey, a validated questionnaire on physical activity and sedentary behavior, was used to assess frequency of physical and sedentary activity [24]. Women were asked to report the frequency and total minutes spent during the last week on walking briskly, moderate and vigorous leisure activities, and vigorous household or garden chores. Physical activity outliers were identified by summing total moderate leisure and vigorous leisure frequencies, and marked as missing if the sum was >56 occasions. Total metabolic minutes per week (MET.min/wk) was calculated by summing the products of each type of physical activity with its metabolic equivalent value (MET.min/wk = [weekly walking minutes × 3.33] + [weekly moderate leisure minutes × 3.33] + [weekly vigorous leisure × 6.66] + [weekly vigorous chores × 6.66]) [25]. Total MET.min/wk were categorized as none or very low (<33.3 MET.min/wk), low (33.3–500 MET.min/wk), moderate (500–1000 MET.min/wk), or high (≥1000 MET.min/wk) level of physical activity categories [26].

Sedentary behavior was defined by the total duration (h/min/d) of sitting time during transport, work, watching television, computer use, and other activities on work- and nonworkdays. The total time was categorized into quartiles of 0 to 3, 4 to 7, 8 to 11, and 12 to 15 h. Any total sitting of h/min/d >16 h or 960 min were considered outliers and treated as missing data [27].

Psychological distress

Psychological distress level was assessed using the validated self-administered 10-item Kessler Psychological Distress Scale (K10) questionnaire. Individuals reported depressive and anxiety symptoms experienced during the last 4 wk with a five-level response: None of the time, a little of the time, some of the time, most of the time, and all the time. Total K10 score was obtained by summing the item responses [28], and binary coded as low (<22) or high (≥22) levels of psychological distress.

Statistical analyses

The data were analyzed using the R statistical software (R Core Team, 2020). Descriptive statistics were produced reporting the frequency of responses across key variables and mean (standard deviation [SD]) unless otherwise specified. Outliers were recoded as not applicable values for current height, current weight, and BMI based on biologically plausible height and weight ranges, as per Cheng et al.

[29] (i.e., ≥111.8 cm and ≤228.6 cm [height], ≥24.9 kg and ≤453.6 kg [weight], and ≥12 and ≤70 BMI).

Missing data for the predictor variables were managed by using multiple imputations with the Multivariate Imputations by Chained Equation package in R [30]. We assumed that the data were missing at random. Patterns of missingness in the data were inspected before multiple imputations were computed. This procedure produced 30 imputed data sets with 10 iterations, each according to recommendations for the number of iterations [31]. All key variables associated with missingness were imputed in the imputation model, except for outcome variables. Similarly, outcome variables were not used as imputer variables. The Predictive Mean Matching algorithm from the Multivariate Imputations by Chained Equation R package was used to impute missing values, using a linear regression model to impute missing values for continuous variables (or logistic regression model for categorical variables) and a randomly generated value using observed data [32]. Categorical variables were recoded based on the imputed values (e.g., BMI categories using imputed current height and current weight values).

Logistic regression was used to report unadjusted and adjusted odds ratios to predict the following outcomes: SSBs (less than weekly; most days/daily), total discretionary foods (none/<2 times/d; ≥3 times/d), and alcohol (never/less than monthly; most weeks/daily). Univariate modelling included the following predictor variables: Psychological distress (K10), age, annual household income before tax (in AU$), ethnicity, BMI, weight status, employment status change, current living circumstances, lockdown restrictions, fruit portions number, vegetable portions number, physical activity category, and work- and nonworkday sitting hours categories (Table 1). Regression models were fitted to each of the imputed data sets, and model estimates were pooled using the rules by Rubin et al. [33] to provide an overall estimate. Variables selected to go into the multivariable regressions were sociodemographic and lifestyle variables related to food intake. An alpha level of 0.05 was used for statistical significance.

Results

Participant characteristics

The sociodemographic characteristics of the 1005 women who participated in the study are shown in Table 1. The majority of women (67.4%) were age 25 to 44 y and lived in New South Wales (30.9%) or Victoria (27.7%). More than half identified as Australian, New Zealander, or Pacific Islander, 25.2% as European or North American, and 13.1% as Asian. At the time of the survey, 24.0% of women lived under lockdown restrictions and 40.5% were identified to have a high level of psychological distress (Table 1).

The mean BMI was 25.7 kg/m^2 (SD: 6.3 kg/m^2; n = 716), of whom 41.7% were overweight or obese. Less than one-half of women self-reported to have no, very low, or a low level of physical activity (Table 1). The mean number of sitting hours on a work- and nonworkday were 8.1 h (SD: 4.1 h) and 7.0 h (SD: 3.6 h), respectively, with around 60% and 40% of women reporting to spend 8 to 15 h of sitting in the respective work- and nonworkday (Table 1).

Around half of all women reported consuming SSBs most days/daily and alcohol most weeks/daily. In addition, 14.5% of women consumed discretionary choices ≥3 times per day (Table 1). Women consumed an average of 1.7 (SD: 1.0) and 2.5 (SD: 1.3) servings per day of fruits and vegetables, respectively.

Psychological distress and association with discretionary choices

A summary of the effect of psychological distress on SSBs, total discretionary foods, and alcohol is reported in Figure 1. Compared with women with a low level of psychological distress (score <22), those with a high level of psychological distress had near doubled odds (OR: 1.96; 95% confidence interval, 1.32–2.91) of reporting increased total discretionary foods. There was no association between psychological stress and SSBs or alcohol.

Table 1
Sociodemographic and lifestyle characteristics of participants

Characteristic	Frequency, n (%)
Age, y (n = 1005)	
18–24	158 (15.7)
25–34	349 (34.7)
35–44	329 (32.7)
45–50	169 (16.8)
State of residency (n = 1005)	
Queensland	198 (19.7)
New South Wales	311 (30.9)
Victoria	278 (27.7)
Northern Territory	3 (0.3)
Western Australia	97 (9.7)
Tasmania	29 (2.9)
South Australia	68 (6.8)
Australian Capital Territory	21 (2.1)
Ethnicity (n = 960)	
European or North American	242 (25.2)
Australian, New Zealander, or Pacific Islander	561 (58.4)
Other*	31 (3.2)
Asian	126 (13.1)
Annual household income before tax, AU$ (n = 865)	
0–99 999	436 (50.4)
≥100 000	429 (49.6)
Current living circumstances (n = 996)	
Own home	492 (49.4)
Rented home or emergency accommodation	306 (30.7)
Living with family	198 (19.9)
Lockdown restrictions	
Yes (Metropolitan Melbourne)	241 (24.0)
No	764 (76.0)
Employment status change (n = 1004)	
Yes	252 (25.1)
No	752 (74.9)
Body mass index, kg/m^2 (n = 716)	
<18.5	33 (4.6)
18.5–25	384 (53.6)
25–30	157 (21.9)
≥30	142 (19.8)
Weight change status (n = 967)	
Stayed the same	400 (41.4)
Gained	400 (41.4)
Lost	167 (17.3)
Physical activity, metabolic min/wk (n = 1003)	
<33.3	116 (11.6)
<500	310 (30.9)
500–1000	215 (21.4)
≥1000	362 (36.1)
Workday sitting, h/d (n = 835)	
0–3	136 (16.3)
4–7	205 (24.6)
8–11	329 (39.4)
12–15	165 (19.8)
Nonworkday sitting, h/d (n = 918)	
0–3	162 (17.6)
4–7	401 (43.7)
8–11	246 (26.8)
12–15	109 (11.9)
Sugar-sweetened beverages (n = 967)	
Less than weekly	521 (53.9)
Most days/daily	446 (46.1)
Total discretionary foods (n = 978)	
None/<2 times/d	836 (85.5)
≥3 times/d	142 (14.5)
Alcohol use (n = 985)	
Never/less than monthly	502 (51.0)
Most weeks/daily	483 (49.0)
10-item Kessler Psychological Distress Scale score (n = 983)	
<22	585 (59.5)
≥22	398 (40.5)

*African, Middle Eastern, American, and Caribbean Islander

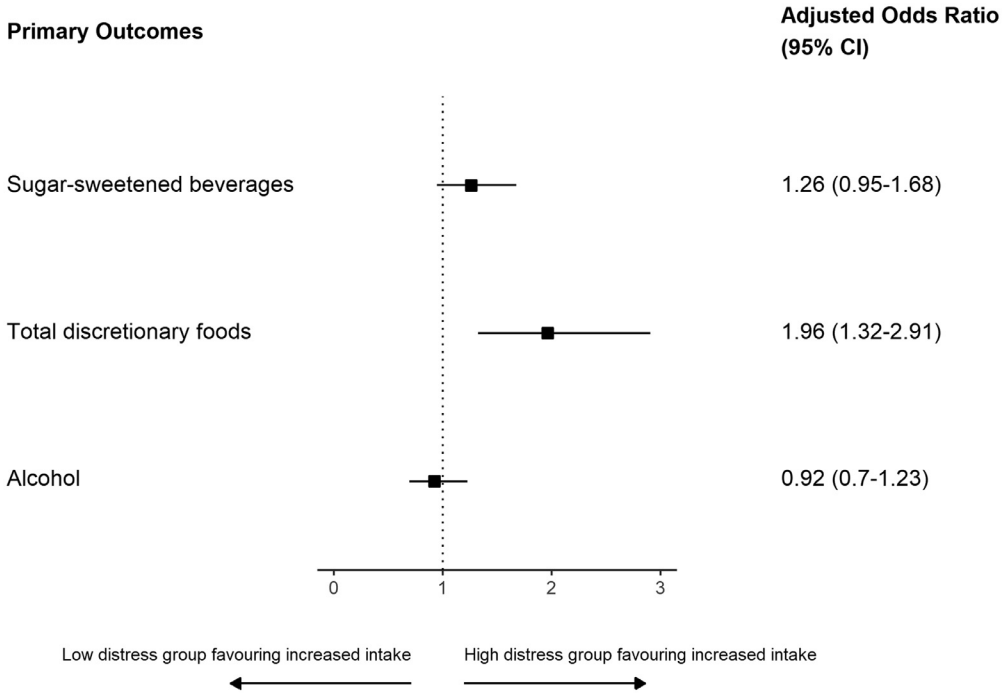

Fig. 1. Summary of effect of psychological distress on three outcomes. Extracting odds ratio for psychological distress (low <22 [reference]; high 22+) from three separate multivariate models, there is a significant result for total discretionary foods (i.e., those with high-level distress had almost double odds of reporting increased total discretionary foods).

Characteristics and association with discretionary choices

Sugar-sweetened beverages

The association between characteristics of the women' and consumption of SSB in the unadjusted and adjusted analyses are reported in Table 2. In the multivariable regression analyses, compared with the reference groups, Australian, New Zealander, or Pacific region women and those who reported 12 to 15 h of sitting on a nonworkday were more likely to consume SSBs most days/daily. Comparatively, older women, women with a higher annual household income, and women with a high level of physical activity were less likely to consume SSBs most days/daily (Table 2).

Total discretionary foods

Table 3 shows the association between women's characteristics and the consumption of total discretionary foods for both the unadjusted and adjusted analyses. In the multivariable regression analyses, compared with the reference groups, women with high psychological distress and those who gained weight during the pandemic had a higher likelihood of consuming discretionary foods ≥3 times per day. Compared with women who reported sitting 0 to 3 h per day, those who reported 4 to 7 h or 8 to 11 h sitting in a workday had lower odds of consuming total discretionary foods ≥3 times per day.

Alcohol

The association between women's characteristics and the consumption of alcohol in the unadjusted and adjusted multivariable regression analyses is reported in Table 4. Older women (age 45–50 y), those who reported a higher annual household income (≥100 000 AU$), and those who reported moderate or high physical activity were more likely to consume alcohol most weeks/daily. Asian women, women who lived under lockdown restriction versus no lockdown, and those with obesity compared with normal weight were less likely to consume alcohol most weeks/daily (Table 4).

Discussion

In this cross-sectional survey conducted during the COVID-19 pandemic in Australia, a high level of psychological distress was associated with the consumption of discretionary foods ≥3 times per day, but not alcohol consumed most weeks or daily. The relationship between psychological distress and SSBs was not as clear, because a significant univariate association appeared to disperse when adjusting for other factors in the multivariable analysis. Low levels of physical activity and more sitting time were associated with the consumption of SSBs, but gaining weight during the pandemic was associated with a higher intake of discretionary foods.

To our knowledge, this is the first study to report on the association between psychological distress and discretionary foods during the COVID-19 pandemic in reproductive-age women in Australia. We also report that gaining weight during the pandemic was associated with higher intakes of discretionary foods. These findings add to studies conducted internationally that demonstrated positive associations between increased consumption of poor food choices and psychological stress during the pandemic [34–36]. Higher stress scores during the pandemic have also been associated with increased energy intake [37], with other studies linking increased hunger with weight gain [38]. Discretionary foods typically high in energy, saturated fatty acids, sugar, and sodium, contribute to proinflammatory pathways [39], and such dietary patterns are associated with a higher incidence of depressive symptoms [40,41].

Furthermore, negative emotions affect food choices through neurobiological processes [42] and altered hippocampal function [43]. However, these relationships are not unique to the pandemic [44]. Current and past findings on psychological distress and poor

Table 2
Association between participant characteristics and consumption of sugar-sweetened beverages

Characteristic	Unadjusted OR (95% CI)	Adjusted* OR (95% CI)
Psychological distress		
Low	Ref	Ref
High	1.42 (1.10–1.84)†	1.26 (0.95–1.68)
Age, y		
18–24	Ref	Ref
25–34	0.86 (0.58–1.26)	0.91 (0.58–1.41)
35–44	0.85 (0.58–1.26)	0.81 (0.50–1.31)
45–50	0.59 (0.38–0.93)‡	0.58 (0.34–1.00)‡
Ethnicity		
European or North American	Ref	Ref
Australian, New Zealander, or Pacific Islander	1.71 (1.25–2.34)§	1.68 (1.21–2.33)†
Other	1.55 (0.73–3.30)	1.36 (0.62–3.00)
Asian	1.43 (0.92–2.22)	1.30 (0.81–2.09)
Annual household income before tax, AU$		
0–99 999	Ref	Ref
≥100 000	0.61 (0.47–0.80)§	0.68 (0.51–0.91)‡
Current living circumstances		
Own home	Ref	Ref
Rented home or emergency accommodation	1.04 (0.77–1.39)	0.86 (0.62–1.19)
Living with family	1.41 (1.01–1.98)‡	1.18 (0.78–1.78)
Lockdown restrictions		
No	Ref	–
Yes (Metropolitan Melbourne)	0.88 (0.65–1.19)	–
Employment status change		
No	Ref	–
Yes	1.15 (0.86–1.54)	–
Body mass index, kg/m^2		
Normal weight	Ref	Ref
Underweight	1.01 (0.50–2.06)	0.86 (0.41–1.80)
Overweight	1.25 (0.87–1.79)	1.21 (0.82–1.78)
Obese	1.42 (0.99–2.04)	1.25 (0.83–1.88)
Weight change status		
Stayed the same	Ref	Ref
Gained	1.20 (0.91–1.60)	1.12 (0.81–1.53)
Lost	1.00 (0.69–1.45)	1.00 (0.67–1.48)
Fruit serving number	0.96 (0.83–1.11)	–
Vegetable serving number	0.90 (0.81–1.00)‡	0.97 (0.86–1.08)
Physical activity, metabolic min/wk		
None or very low	Ref	Ref
Low	0.82 (0.53–1.28)	0.82 (0.51–1.30)
Moderate	0.67 (0.42–1.06)	0.66 (0.40–1.09)
High	0.44 (0.29–0.69)§	0.47 (0.29–0.76)†
Workday sitting, h/d		
0–3	Ref	Ref
4–7	0.89 (0.57–1.40)	0.93 (0.58–1.51)
8–11	0.71 (0.47–1.06)	0.75 (0.48–1.19)
12–15	0.91 (0.58–1.44)	0.86 (0.51–1.45)
Nonworkday sitting, h/d		
0–3	Ref	Ref
4–7	0.94 (0.64–1.37)	1.11 (0.73–1.69)
8–11	1.07 (0.71–1.60)	1.26 (0.80–2.00)
12–15	1.66 (1.00–2.73)‡	1.88 (1.07–3.29)‡

CI, confidence interval; OR, odds ratio; Ref, reference
*Adjusted for age, ethnicity, current living circumstances, annual household income before tax, physical activity category, workday sitting hours category, non-workday sitting hours category, weight change status, body mass index, and psychological distress
†$P < 0.05$
‡$P < 0.01$
§$P < 0.001$

Table 3
Association between participant characteristics and consumption of total discretionary foods

Characteristic	Unadjusted OR (95% CI)	Adjusted* OR (95% CI)
Psychological distress		
Low	Ref	Ref
High	2.17 (1.50–3.12)†	1.96(1.32–2.91)†
Age, y		
18–24	Ref	Ref
25–34	0.97 (0.58–1.62)	1.21 (0.67–2.18)
35–44	0.89 (0.52–1.51)	1.14 (0.60–2.20)
45–50	0.58 (0.30–1.12)	0.82 (0.38–1.77)
Ethnicity		
European or North American	Ref	Ref
Australian, New Zealander, or Pacific Islander	1.51 (0.95–2.40)	1.53 (0.94–2.48)
Other	0.88 (0.25–3.13)	1.06 (0.28–4.00)
Asian	1.30 (0.69–2.47)	1.31 (0.66–2.60)
Annual household income before tax, AU$		
0–99 999	Ref	Ref
≥100 000	0.64 (0.44–0.94)‡	0.69 (0.45–1.06)
Current living circumstances		
Own home	Ref	Ref
Rented home or emergency accommodation	1.28 (0.85–1.93)	1.04 (0.66–1.64)
Living with family	1.47 (0.93–2.33)	1.36 (0.78–2.37)
Lockdown restrictions		
No	Ref	–
Yes (Metropolitan Melbourne)	1.22 (0.81–1.83)	–
Employment status change		
No	Ref	Ref
Yes	1.48 (1.00–2.17)‡	1.31 (0.86–2.00)
Body mass index, kg/m^2		
Normal weight	Ref	Ref
Underweight	1.03 (0.38–2.81)	0.89 (0.32–2.52)
Overweight	0.97 (0.58–1.64)	0.84 (0.47–1.48)
Obese	1.57 (0.97–2.54)	1.37 (0.79–2.38)
Weight change status		
Stayed the same	Ref	Ref
Gained	1.87 (1.25–2.81)§	1.71 (1.10–2.65)‡
Lost	0.88 (0.47–1.62)	0.76 (0.40–1.45)
Fruit serving number	1.06 (0.87–1.29)	–
Vegetable serving number	0.95 (0.81–1.12)	–
Physical activity, metabolic min/wk		
None or very low	Ref	Ref
Low	0.98 (0.52–1.85)	1.18 (0.60–2.32)
Moderate	1.52 (0.80–2.89)	1.91 (0.95–3.82)
High	0.89 (0.48–1.67)	1.37 (0.68–2.73)
Workday sitting, h/d		
0–3	Ref	Ref
4–7	0.57 (0.32–1.01)	0.52‡ (0.28–0.97)
8–11	0.50 (0.29–0.84)§	0.49‡ (0.28–0.88)
12–15	0.78 (0.43–1.40)	0.73 (0.39–1.37)
Nonworkday sitting, h/d		
0–3	Ref	
4–7	0.76 (0.46–1.28)	–
8–11	0.81 (0.46–1.40)	–
12–15	1.24 (0.66–2.33)	–

CI, confidence interval; OR, odds ratio; Ref, reference
*Adjusted for age, ethnicity, current living circumstances, annual household income before tax, physical activity category, workday sitting hours category, nonworkday sitting hours category, weight change status, body mass index, and psychological distress
†$P < 0.05$
‡$P < 0.01$
§$P < 0.001$

dietary behavior suggest a bidirectional relationship between mental health and food intake. From the current cross-sectional survey, we do not know whether psychological stress increased in women compared with before the pandemic; thus, if our findings of a relationship between psychological distress and discretionary food intake was amplified during lockdown is unclear. However, given that 40% of women in our study had a high level of psychological distress, which is slightly higher than a smaller (33%) sample of Australian adults during the COVID-19 pandemic [45], but much higher than the 17% reported in women age 18 to 55 y from Australian population data from 2014 to 2015 [46], suggesting that

Table 4
Association between participant characteristics and alcohol consumption

Characteristic	Unadjusted OR (95% CI)	Adjusted* OR (95% CI)
Psychological distress		
Low	Ref	Ref
High	0.81 (0.62–1.04)	0.92 (0.70–1.23)
Age, y		
18–24	Ref	Ref
25–34	0.96 (0.66–1.41)	0.93 (0.60–1.43)
35–44	1.21 (0.82–1.77)	1.15 (0.71–1.85)
45–50	1.91 (1.22–2.97)†	1.70 (1.00–2.89)‡
Ethnicity		
European or North American	Ref	Ref
Australian, New Zealander, or Pacific Islander	0.79 (0.58–1.07)	0.81 (0.59–1.12)
Other	0.42 (0.19–0.92)‡	0.50 (0.22–1.10)
Asian	0.26 (0.16–0.42)§	0.28 (0.17–0.47)§
Annual household income before tax, AU$		
0–99 999	Ref	Ref
≥100 000	1.58 (1.21–2.07)§	1.44 (1.08–1.92)‡
Current living circumstances		
Own home	Ref	Ref
Rented home or emergency accommodation	0.78 (0.58–1.04)	0.90 (0.65–1.24)
Living with family	0.61 (0.44–0.86)†	0.72 (0.48–1.08)
Lockdown restrictions		
No	Ref	Ref
Yes (Metropolitan Melbourne)	0.75 (0.56–1.01)	0.73 (0.53–1.00)
Employment status change		
No	Ref	–
Yes	1.01 (0.76–1.34)	–
Body mass index, kg/m^2		
Normal weight	Ref	Ref
Underweight	0.64 (0.33–1.28)	0.83 (0.41–1.69)
Overweight	1.10 (0.77–1.56)	0.96 (0.65–1.41)
Obese	0.77 (0.53–1.11)	0.68 (0.45–1.02)
Weight status		
Stayed the same	Ref	–
Gained	0.88 (0.67–1.17)	–
Lost	0.94 (0.65–1.35)	–
Fruit serving number	0.91 (0.79–1.05)	–
Vegetable serving number	1.11‡ (1.00–1.23)	1.02 (0.91–1.14)
Physical activity, metabolic min/wk		
None or very low	Ref	Ref
Low	0.93 (0.59–1.44)	1.00 (0.63–1.60)
Moderate	1.51 (0.94–2.40)	1.59 (0.97–2.61)
High	1.89 (1.22–2.91)†	1.75 (1.10–2.80)‡
Workday sitting, h/d		
0–3	Ref	–
4–7	1.10 (0.71–1.71)	–
8–11	1.07 (0.71–1.61)	–
12–15	1.28 (0.81–2.01)	–
Nonworkday sitting, h/d		
0–3	Ref	–
4–7	0.98 (0.67–1.43)	–
8–11	1.02 (0.68–1.53)	–
12–15	1.00 (0.60–1.65)	–

CI, confidence interval; OR, odds ratio; Ref, reference
*Adjusted for age, ethnicity, current living circumstances, annual household income before tax, physical activity category, workday sitting hours category, nonworkday sitting hours category, weight change status, body mass index, and psychological distress
†$P < 0.05$
‡$P < 0.01$
§$P < 0.001$

higher intakes of discretionary choices may be a coping strategy for psychological distress and, for some women, perpetuating weight gain during the pandemic.

Psychological distress was not associated with a higher consumption of alcohol. This is in contrast to three other Australian studies conducted during the pandemic that showed that increased alcohol was associated with increased depression and anxiety [7,47], higher psychological distress, and higher levels of fear of COVID-19 [45]. Often, alcohol consumption is reported as a coping mechanism for psychological factors, including alleviating stress [48]. Different types of stressors have been linked to increased alcohol intake, such that heavier drinking was most strongly connected to childcare stressors among women in Australia, but more commonly associated with job loss or reductions in paid employment hours for men [49].

Social isolation, concomitant with changes in employment status or future insecurity, may also elicit an increase in alcohol intake in vulnerable individuals [50]. During the pandemic in Australia, alcohol stores were considered essential services, and did not close. Interestingly, Australian population data report no clear patterns of the effects of COVID-19 restrictions on alcohol and other drug consumption, with many people reporting unchanged levels of consumption [51]. Furthermore, the closure of licensed premises and social distancing measures appear to have reduced harmful alcohol consumption in younger drinkers, particularly young women [52]. Nevertheless, despite the inconsistent relationships between psychological stress and alcohol in our study and compared with other studies, alcohol is recognized as an underreported item among men and women of different ages [53,54], and people do not often adjust their responses to account for standard drink units [55,56]. These factors may partly explain our findings. Strategies to reduce alcohol use during COVID-19 restrictions should be targeted at those who already have higher levels of psychological stress, and effects of change in alcohol use during the COVID-19 pandemic on mental health are needed.

We report that a longer duration of sitting time was associated with higher SSB intake, but older women, higher physical activity, and higher income were associated with lower consumption of SSB. Among U.S. adults during the pandemic, similar associations were reported, with drinking more SSBs associated with being younger, having less education, lower household income, and being obese [57]. A qualitative study in young adults in Australia reported replacing meals with beverages or snacks, which may have been a way to manage financial instability and food insecurity [58]. Another study in Norway reported an association between high-sugar foods and beverages in those with psychological distress [59], but the relationship we detected with psychological distress was no longer significant after adjusting for confounders, which may be due to underreporting of SSBs more broadly [60,61]. The high proportion of younger women with significant psychological distress warrants further research on the direct and indirect effect of psychological burden on health behaviors in this group.

This study adds to the growing body of literature investigating diet and lifestyle factors during the COVID-19 pandemic, and contributes to the knowledge regarding the association of these factors with psychological distress. We calculated our sample size based on the current population of women in Australia age 15 to 50 y, with a small margin of error of 1%. This small percentage indicates that responses from our sample likely well reflect the views of the overall population. Limitations include that this cross-sectional survey was not specifically designed to examine changes in diet and lifestyle factors, nor psychological distress, over the course of the pandemic, but rather we captured a snapshot of current effects. As stated in our subsequent paper on pregnancy intention and psychological distress [62], we determined the level of pandemic restrictions based on location. Although there was a clear distinction in the level of viral transmission rates and lockdown restrictions in metropolitan Melbourne compared with all other regions in Australia during the months leading up to and during the survey, other factors related to living in metropolitan Melbourne, diet and lifestyle factors, and psychological distress may explain our findings.

Conclusions

Higher levels of psychological distress were associated with a higher intake of discretionary foods and SSBs, but not alcohol. After adjusting for confounders, only the association between psychological distress and discretionary food intake remained significant. Although these findings were reported to occur during the COVID-19 pandemic, they reflect consistent relationships outside such a circumstance. Public health messaging promoting healthy eating should take into account the effect of psychological distress on health behavior. Messages aimed at maintaining a positive relationship between food intake and mental wellbeing, particularly among vulnerable groups, are warranted. Further studies on the relationship between psychological well-being and food intake would be helpful.

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Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.nut.2022.111794.

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