

Title: Ultra-processed food intake during pregnancy and perinatal depression symptoms: a Mediterranean cohort study

Supplementary Material

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Annex 1. Methods extended

Description of additional covariates

Additional data collected at enrolment (12 weeks of gestation) by trained clinical staff included: civil status (partnered, unpartnered), employment status (active worker, non-worker [including on leave]); neighbourhood-level socioeconomic status measured by Gini coefficient (1) (a measure of income inequality) as well as median income at the census tract where the participant resided; self-reported antidepressant use in the three months before pregnancy (yes, no); maternal physical activity total activity score measured by the Pregnancy Physical Activity Questionnaire (PPAQ) (2). PPAQ is a validated self-report of pregnancy-specific activities to establish physical activity levels in pregnant women, measuring intensity and duration, where higher score overall indicates more physical activity). Vitamin and mineral supplementation (folic acid, iodine, iron, omega-3 fatty acids, vitamin D) were derived from the food frequency questionnaire. Further data collected included: smoking during pregnancy (yes/no); alcohol intake during trimester 2 or 3 of pregnancy (yes/no), any pregnancy or birth complication (from clinical records at birth).

Model imputation

Covariates with missing data were handled using multiple imputation by chained equations, implemented via the mice package (3) in R. The missing data was assumed to be missing at random, such that the probability of missingness depended on observed participant characteristics rather than on the unobserved values themselves (4).

Data was missing for the following variables; BMI at 12 weeks gestation (n=43, 5.9%); PSQI score (n=233, 32.1%); gestational weight gain (n=83, 11.4%); maternal complication during pregnancy (n=48, 6.6%); personal history of mental health problems (n=2, 0.3%) and family history of mental health problems (n=11, 1.5%); depressive symptoms at 20 weeks gestation (SCL-90-R) (n=16, 2.2%); alcohol intake during trimester 2 or 3 (n=124, 17.1%); smoking status (n=18, 2.5%); and self-reported intake of the following supplements: folic acid (n=133, 18.3%), iodine (n=240, 33.1%), iron (n=214, 29.5%), omega-3 fatty acids (n=293, 40.4%), and vitamin D (n=273, 37.6%).

Imputation methods were assigned according to variable type: predictive mean matching for continuous variables, logistic regression for binary variables, and multinomial logistic regression for unordered categorical variables with more than two levels (5). Five imputed datasets were generated (m=5) and estimates were pooled across datasets using Rubin's rules (4).

Exposure and outcome variables were not imputed. The variables included as predictors in the imputation of covariates were: maternal UPF intake percentage, depressive symptoms (continuous EPDS score), maternal age, ethnicity, education level, civil status, employment status, parity, smoking status, physical activity, dietary intake (total daily energy intake, relative Mediterranean diet score, and healthful plant-based diet index), preterm birth, lockdown in pregnancy during the COVID-19 pandemic, and recruitment hospital.

Complete-case analyses yielded effect estimates consistent with those obtained from the pooled multiple imputed datasets for the main model, suggesting that the missing data mechanism did not substantially bias the primary results.

Inverse probability weighting

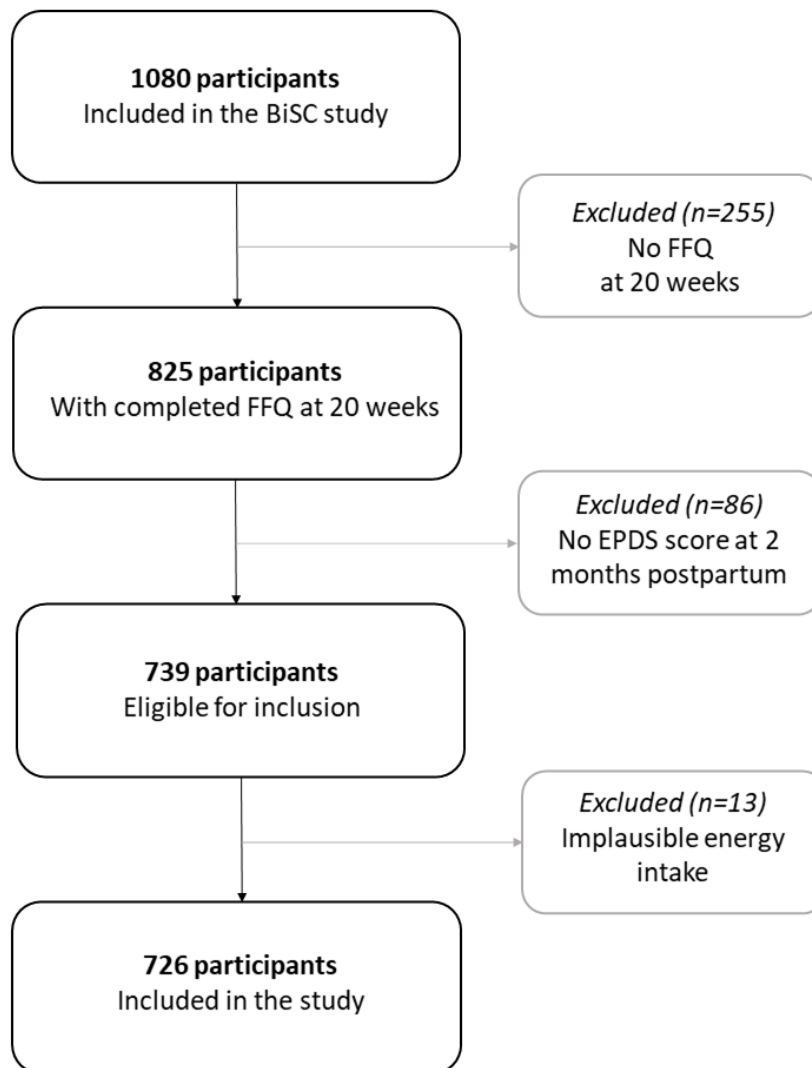
To mitigate potential attrition bias, inverse probability weighting (IPW) was applied (6) to address differences between included and non-included participants. Stabilised propensity scores for study inclusion were estimated using logistic regression models within each of 5 multiply imputed datasets generated using multiple imputation by chained equations (mice)(3). Both the imputation and propensity score models included the following a priori baseline covariates: age, ethnicity, employment, parity and child under 2 years old, median income at the census tract level, smoking status, alcohol consumption during trimester 2 or 3, self-reported history of mental health problems, risk of depression at 20 weeks gestation (SCL-90-R) and sleep quality (Pittsburgh Sleep Quality Index). Predicted probabilities of inclusion (propensity scores) were obtained for each imputed dataset and averaged across imputations. IPWs were then computed as the reciprocal of the averaged inclusion probabilities ($1/\hat{p}$), reflecting the inverse likelihood of being included in the analytic sample. To improve numerical stability and comparability across models, weights were normalised to have a mean of one. These final weights were incorporated into all regression models to account for differential loss to follow-up and potential selection bias.

Mediation analyses

BMI, gestational weight gain, sleep quality, and high depressive symptoms (SCL-R-90) were assessed as potential mediators. For each potential mediator, causal mediation analysis was performed separately within each imputed dataset using the mediation package in R (7), based on the counterfactual framework (8). For each mediator, two linear regression models were specified per imputed dataset: a mediator model where the mediator was modelled as a function of UPF and covariates, and an outcome model, in which EPDS score was modelled as a function of UPF, the mediator, and the same covariates. All models adjusted for maternal age, ethnicity, education, parity, family or personal history of mental health problems, energy intake, hospital recruitment site, and COVID-19 lockdown status.

The mediate function was used to estimate the average causal mediation effect, average direct effect, total effect, and proportion mediated for each of the four models, using a quasi-Bayesian Monte Carlo approximation (1,000 simulations per imputed dataset). Estimates and their associated 95% confidence intervals were averaged across the imputed datasets to produce pooled results for each mediator.

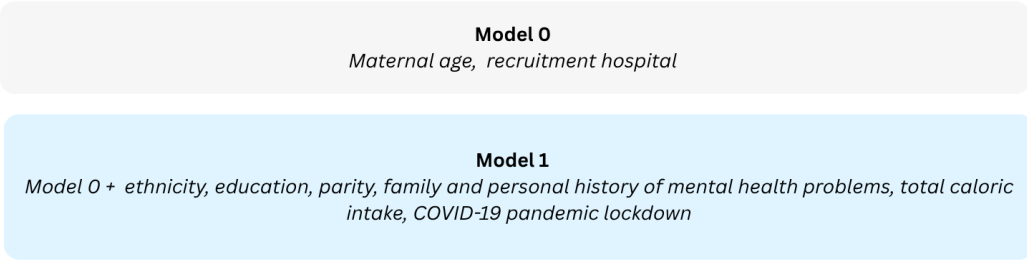
Figure S1. Flow chart of study inclusion



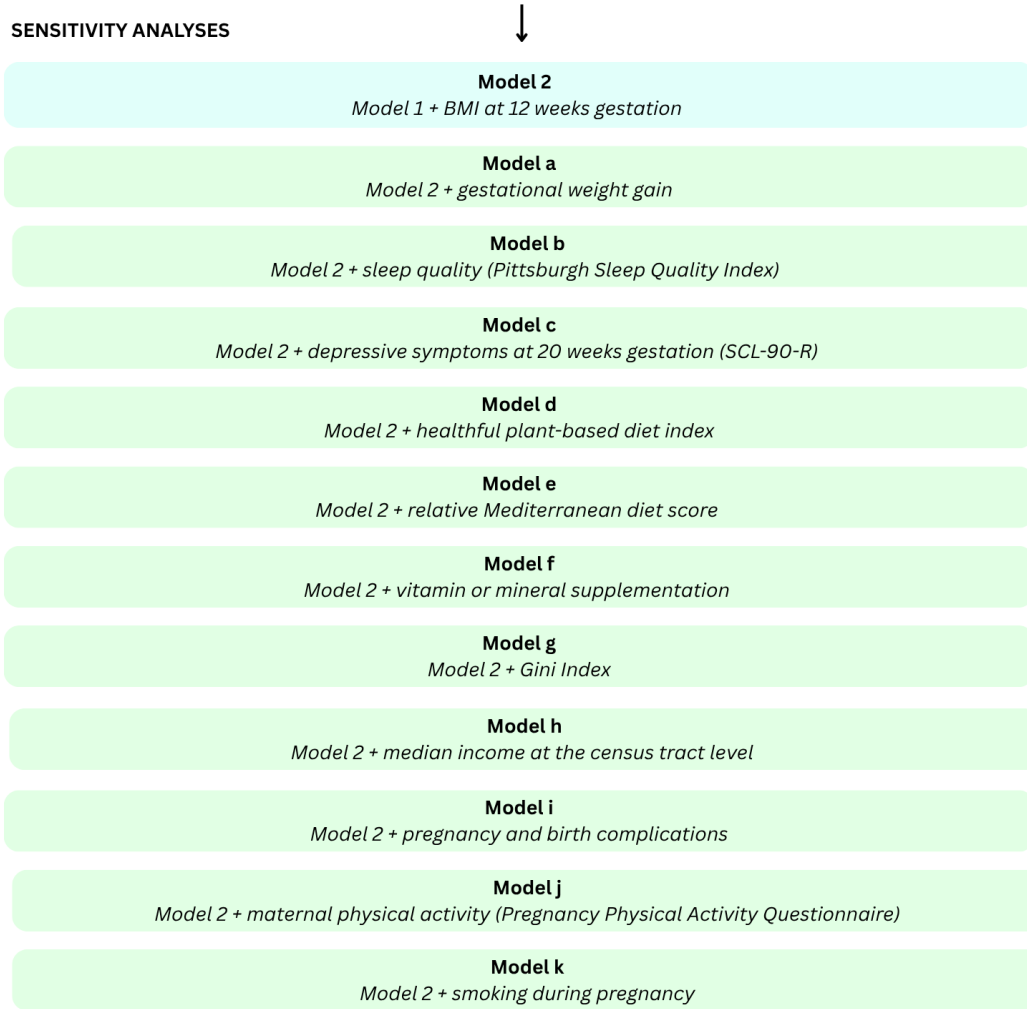
Notes. Abbreviations: BiSC, Barcelona Life Study Cohort; EPDS, Edinburgh Postnatal Depression Scale; FFQ, food frequency questionnaire.

Figure S2. Statistical model overview

MODEL STRUCTURE

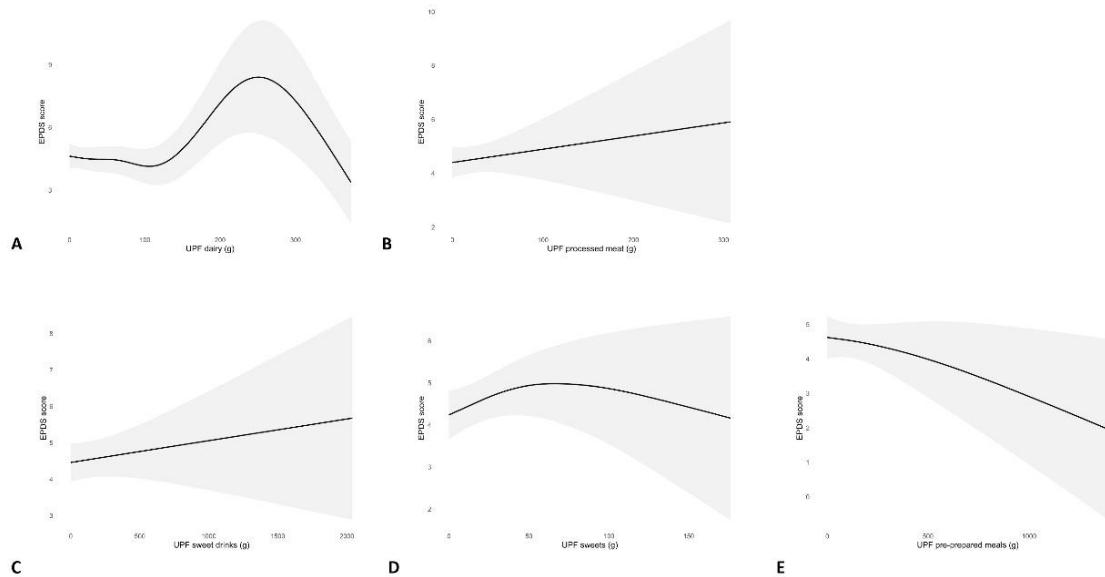


SENSITIVITY ANALYSES



Notes. Model 0; minimally adjusted mode. Model 1; fully adjusted base model. Model 2 adds BMI at 12 weeks gestation to Model 1 and serves as the reference for all further adjusted models.

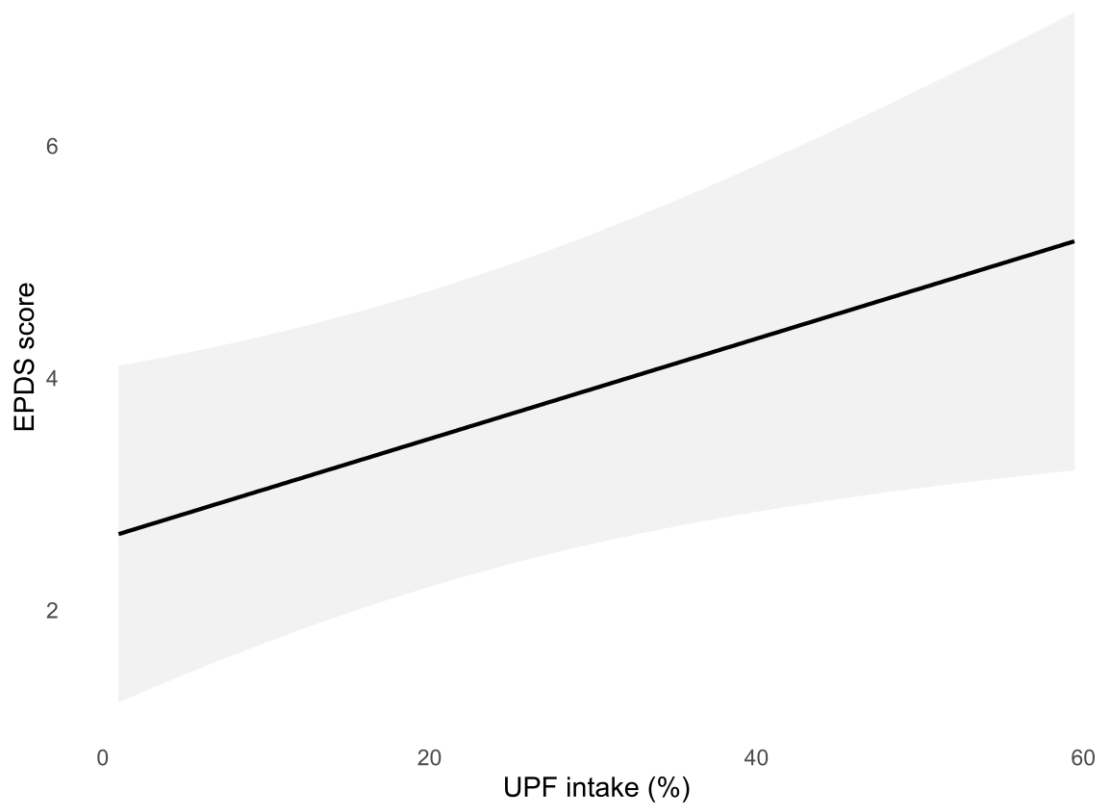
Figure S3. Ultra-processed food absolute intake in pregnancy by subgroup and EPDS score at 2 months postpartum, generalised additive models



Notes. GAM spline (thin-plate regression, $k = 10$, REML). The solid line represents the fitted smooth, with shaded areas indicating 95% confidence intervals. All models adjusted for base model covariates: maternal age, ethnicity, education, parity, family and personal history of mental health problems, total energy intake, hospital recruitment site, and COVID-19 pandemic lockdown. Non-linearity was assessed using a Wald test, reported p -values represent the median p -value across the fitted models. Where there was no statistically significant evidence of a non-linear association ($p \geq 0.05$) and the median EDF ≤ 2 , a GLM with robust standard errors was fitted, and the corresponding β coefficient, 95% CI and p -value were reported. Abbreviations: CI: confidence interval; EPDS, Edinburgh Postnatal Depression Scale; GAM, generalised additive model; GLM, generalised linear model; REML, restricted maximum likelihood; UPF, ultra-processed food. UPF intake measured as grams per day.

(A) UPF dairy intake in grams/day and EPDS score at 2 months postpartum. Median Wald test p -value = 0.031 and median EDF = 4.26 across fitted models. (B) Processed meat intake in grams/day and EPDS score at 2 months postpartum. Median Wald test p -value = 0.799 and median EDF = 1.00 across fitted models. GLM β for a 10 gram/day increase in processed meat intake = 0.05 (95% CI: -0.08 to 0.18), p -value = 0.463. (C) Sweet drinks intake in grams/day and EPDS score at 2 months postpartum. Median Wald test p -value = 0.738 and median EDF = 1.00 across fitted models. GLM β for a 10 grams/day increase in sweet drinks intake = 0.01 (95% CI: -0.01 to 0.02), p -value = 0.411. (D) Sweets intake in grams/day and EPDS score at 2 months postpartum. Median Wald test p -value = 0.173 and median EDF = 1.76 across fitted models. GLM β for a 10 grams/day increase in sweets intake = 0.09 (95% CI: -0.07 to 0.24), p -value = 0.260. (E) Pre-prepared meals in grams/day and EPDS score at 2 months postpartum. Median Wald test p -value = 0.043 and median EDF = 1.29 across fitted models. GLM β for a 10 grams/day increase in pre-prepared meal intake = -0.02 (95% CI: -0.04 to 0.01), p -value = 0.240.

Figure S4. Ultra-processed food intake during pregnancy and EPDS scores at 32 weeks gestation, generalised additive model



Notes. GAM spline (thin-plate regression, $k = 10$, REML). The regression model was adjusted for maternal age, ethnicity, education, parity, family and personal history of mental health problems, total energy intake, hospital recruitment site, and COVID-19 pandemic lockdown. The median Wald test p -value across fitted models = 0.223, and the median effective degrees of freedom = 1.28. Abbreviations: EPDS, Edinburgh Postnatal Depression Scale; REML, restricted maximum likelihood; UPF, ultra-processed food. UPF intake measured as a percentage of total daily food intake by weight.

Table S1. Ultra-processed food items from food frequency questionnaire

UPF items from FFQ	Grouped UPF items	Share relative to total UPF intake
Plant-based drinks Flavoured yogurt Custard or similar Ice cream	Dairy products or similar	9.94 ± 11.19
Cured meats Sausages Pâté Hamburger	Processed meat	10.34 ± 10.19
Regular soft drinks Sugar-free soft drinks Energy drinks Packaged juices	Sweet drinks	31.36 ± 23.86
Sugar-free cereal Maria cookies Chocolate cookies Pastries Chocolate Cocoa powder	Sweets	7.85 ± 7.08
Fish products White bread Frozen French fries Packaged French fries Pizza Margarine Commercial soup or puree Croquettes Empanadas or similar Mayonnaise Tomato sauce Ketchup Sweeteners	Pre-prepared meals	40.51 ± 19.48

Notes. Abbreviations: FFQ, food frequency questionnaire; UPF, ultra-processed food. Values represent relative consumption of total UPF intake. Data are expressed as mean intake of UPF grouped items in % grams/day and standard deviation (SD).

Table S2. Additional characteristics of participants overall and according to the quartiles of ultra-processed food consumption (N = 726)

Characteristic	Overall	Quartiles of UPF intake (min-max values %g/day)				<i>p</i> ^a
		Q1 (1.0 – 11.5)	Q2 (11.5 – 17.9)	Q3 (17.9 – 25.3)	Q4 (25.3 – 59.5)	
n	726	182	181	181	182	
Peripartum depression score 32 weeks pregnant						
EPDS continuous	4 [1 - 6], n = 495	3 [1 - 5.5], n= 127	4 [2 - 6], n= 125	4 [2 - 6], n= 126	4 [2 - 7], n= 117	0.159
EPDS ≥ 11	38 (7.7%)	6 (4.7%)	7 (5.6%)	10 (7.9%)	15 (12.8%)	0.082
EPDS ≥ 13	22 (4.4%)	2 (1.6%)	3 (2.4%)	5 (4.0%)	12 (10.3%)	0.005
Civil Status						
Partnered	707 (97.4%)	178 (97.8%)	180 (98.9%)	177 (97.8%)	172 (95.0%)	0.096
Employment						
Active worker	560 (77.1%)	147 (80.8%)	139 (76.4%)	137 (75.7%)	137 (75.7%)	0.604
Vitamin supplementation ^b						
Yes	516 (71.1%)	135 (74.2%)	121 (66.5%)	137 (75.7%)	123 (68.0%)	0.202
Antidepressant use	15 (2.1%)	0 (0%)	5 (2.7%)	4 (2.2%)	6 (3.3%)	0.065
Depressive symptoms at 20 weeks (SCL-90-R) ^b						
Yes	37 (5.1%)	7 (3.8%)	12 (6.6%)	4 (2.2%)	14 (7.7%)	0.057
No	673 (92.7%)	174 (95.6%)	168 (92.3%)	173 (95.6%)	158 (87.3%)	
Gestational weight gain (kg) ^b	8.3 ± 3.4	8.3 ± 3.4	8.6 ± 3.6	7.7 ± 3.2	8.4 ± 3.4	0.078
Pregnancy and birth complications ^b	135 (18.6%)	36 (19.8%)	25 (13.7%)	43 (23.8%)	31 (17.1%)	0.092
Physical activity: PPAQ score	152.9 [101.6 - 212.7]	137.4 [88.2 - 207.7]	162.5 [107.0 - 222.1]	160.1 [109.3 - 208.4]	144.7 [108.2 - 202.3]	0.428
Sleep quality: PSQI Score ^b	5.3 ± 2.9	4.7 ± 3.0	5.2 ± 2.5	5.7 ± 3.0	5.6 ± 3.1	0.012
Smoking status						
Yes	49 (6.7%)	9 (4.9%)	8 (4.4%)	10 (5.5%)	22 (12.2%)	0.009
Alcohol consumption during trimester 2 or 3						
Yes	35 (4.8%)	4 (2.2%)	5 (2.7%)	15 (8.3%)	11 (6.1%)	0.014

Notes. Abbreviations: EPDS, Edinburgh Postnatal Depression Scale; UPF, ultra-processed food; PPAQ, Pregnancy Physical Activity Questionnaire; PSQI, Pittsburgh Sleep Quality Index; SCL-90-R, Symptom

Checklist-90-Revised. Categorical variables presented as n (%). Continuous variables are presented as median (IQR) for PPAQ, and EPDS, or mean $\pm$ standard deviation for PSQI. Antidepressant use in the 3 months prior to recruitment; self-reported.

*a. Statistical comparisons were performed using the Kruskal-Wallis rank sum test for continuous variables and Pearson's Chi-squared test for categorical variables. P-values < 0.05 are presented in **bold**.*

b. Data was missing for the following variables: self-reported intake of the following supplements: folic acid (n=133, 18.3%), iodine (n=240, 33.1%), iron (n=214, 29.5%), omega-3 fatty acids (n=293, 40.4%), and vitamin D (n=273, 37.6%); depressive symptoms at 20 weeks (SCL-90-R) (n=16, 2.2%); gestational weight gain (n=83, 11.4%); maternal complication during pregnancy (n=48, 6.6%); PSQI score (n=233, 32.1%); alcohol intake during trimester 2 or 3 (n=124, 17.1%); smoking status (n=18, 2.5%);

Table S3. Baseline characteristics of included and excluded BiSC participants

Variable	Total cohort	Included	Excluded	<i>p</i> ^a
n	1080	726	354	
Age	34.4 [31.5, 37.2]	34.9 [32.0, 37.4]	33.9 [30.8, 37.2]	0.015
Ethnicity				< 0.001
European	796 (73.7%)	577 (79.5%)	219 (61.9%)	
Latin American	260 (24.1%)	137 (18.9%)	123 (34.7%)	
Other	24 (2.2%)	12 (1.7%)	12 (3.4%)	
University level education	747 (69.2%)	552 (76.0%)	195 (55.1%)	< 0.001
Active worker (paid)	809 (74.9%)	560 (77.1%)	249 (70.3%)	< 0.001
Civil status – partnered	1043 (96.6%)	707 (97.4%)	336 (94.9%)	0.047
Parity				0.010
Multiparous with child <2	84 (7.8%)	55 (7.6%)	29 (8.2%)	
Multiparous without a child < 2 years	390 (36.1%)	241 (33.2%)	149 (42.1%)	
Nulliparous	606 (56.1%)	430 (59.2%)	176 (49.7%)	
BMI at 12 weeks	23.6 [21.3, 26.2]	23.2 [21.3, 25.7]	23.9 [21.3, 27.5]	0.004
Smoker	83 (7.7%)	49 (6.7%)	34 (9.6%)	0.017
History of mental health problems	107 (9.9%)	72 (9.9%)	35 (9.9%)	1.00
Family history of mental health problems	167 (15.5%)	130 (17.9%)	37 (10.5%)	0.003

Notes. Abbreviations: BiSC, Barcelona Life Study Cohort; BMI, body mass index. Categorical variables presented as n (%). Continuous variables are presented as median (IQR).

a. Statistical comparisons were performed using the Mann-Whitney U test for continuous variables and Pearson's Chi-squared test for categorical variables comparing included and excluded BiSC participants. P-values < 0.05 are presented in **bold**.

Table S4: Diet quality scores (rMED and hPDI) and EPDS score at 2 months post-partum, generalised linear model (n=726)

	β (95% CI) per 1 SD increase in dietary score	<i>p</i>
rMED	-0.11 (-0.38, 0.16)	0.411
hPDI	-0.27 (-0.55, 0.01)	0.056

Notes. Models adjusted for base model covariates: maternal age, ethnicity, education, parity, family and personal history of mental health problems, total energy intake, hospital recruitment site, and COVID-19 pandemic lockdown. Abbreviations: EPDS, Edinburgh Postnatal Depression Scale. hPDI, healthful plant-based diet index; rMED, relative Mediterranean diet score. SD; standard deviation. *P*-values < 0.05 are presented in bold.

Table S5. Logistic regression models examining the association between ultra-processed food intake and EPDS score (≥ 11 and ≥ 13) at 2 months postpartum (N = 726)

Model		10% Increase in UPF			UPF Quartile (min-max values %g/day)					
				Q1 (1.0 - 11.5)	Q2 (11.5 - 17.9)		Q3 (17.9 - 25.3)		Q4 (25.3 - 59.5)	
n				182	181		181		182	
		OR (95% CI)	p		OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
EPDS ≥ 11	Model 0 ^a	1.08 (0.84, 1.39)	0.564	1 (ref)	2.31 (1.01, 5.24)	0.046	1.96 (0.84, 4.54)	0.117	1.55 (0.65, 3.70)	0.327
	Model 1 ^b	1.10 (0.85, 1.43)	0.427	1 (ref)	2.15 (0.93, 4.96)	0.074	1.88 (0.80, 4.45)	0.150	1.58 (0.65, 3.87)	0.316
	Model 2 ^c	1.08 (0.82, 1.41)	0.590	1 (ref)	1.97 (0.85, 4.57)	0.115	1.67 (0.70, 3.98)	0.248	1.44 (0.58, 3.57)	0.427
EPDS ≥ 13	Model 0 ^a	1.22 (0.88, 1.70)	0.241	1 (ref)	4.53 (0.95, 21.50)	0.057	5.38 (1.15, 25.20)	0.033	4.40 (0.92, 21.00)	0.063
	Model 1 ^b	1.25 (0.88, 1.78)	0.206	1 (ref)	4.13 (0.86, 19.90)	0.077	4.79 (1.01, 22.78)	0.049	4.30 (0.88, 21.03)	0.072
	Model 2 ^c	1.23 (0.86, 1.76)	0.252	1 (ref)	3.91 (0.81, 18.90)	0.090	4.44 (0.93, 21.22)	0.062	4.00 (0.81, 19.80)	0.089

Notes. Outcome: EPDS total score ≥ 11 and ≥ 13 at 2 months postpartum. Abbreviations: CI, confidence interval; UPF, ultra-processed food; EPDS, Edinburgh Postnatal Depression Scale; BMI, body mass index. Models fitted using multiple imputation ($m = 5$) with pooled estimates per Rubin's Rules. Odds ratios represent odds of an EPDS score ≥ 11 and ≥ 13 , for a 10% increase in UPF consumption and in each UPF quartile relative to Quartile 1. P-values < 0.05 are presented in **bold**.

a. Adjusted for maternal age and hospital recruitment site

b. Adjusted for maternal age, ethnicity, educational level, parity, family and personal history of mental health problems, total energy intake, hospital recruitment site, and COVID-19 pandemic lockdown

c. Adjusted for model 1 + BMI at 12 weeks gestation

Table S6: Indirect effects of UPF Intake on EPDS score at 2 months postpartum

	Direct effect	Total effect	ACME (95% CI)	Proportion mediated (%)
BMI	0.019 (-0.006, 0.046)	0.021 (-0.005, 0.048)	0.002 (0.000, 0.005)	6.0
Gestational weight gain	0.021 (-0.006, 0.048)	0.021 (-0.005, 0.048)	0.000 (-0.001, 0.001)	0.0
Sleep quality (PSQI)	0.019 (-0.008, 0.045)	0.021 (-0.005, 0.048)	0.002 (-0.002, 0.006)	8.6

Notes. Outcome: EPDS total score at two months postpartum. Abbreviations: ACME, Average Causal Mediation Effects; CI, confidence interval; UPF, ultra-processed food; EPDS, Edinburgh Postnatal Depression Scale; BMI, body mass index; PSQI, Pittsburgh Sleep Quality Index; SCL-90-R, Symptom Checklist 90 Revised. Models fitted using multiple imputation ($m = 5$) with pooled estimates per Rubin's Rules. Adjusted for base model covariates: maternal age, ethnicity, education, parity, family and personal history of mental health problems, total energy intake, hospital recruitment site, and COVID-19 pandemic lockdown.

Table S7. Association between ultra-processed food intake and EPDS score at 2 months postpartum adjusted for additional variables (N = 726)

Model	10% Increase in UPF		UPF Quartile (min-max values %g/day)						
			Q1 (1.0 – 11.5)	Q2 (11.5 – 17.9)		Q3 (17.9 – 25.3)		Q4 (25.3 – 59.5)	
n			182	181		181		182	
	β (95% CI)	p	β (95% CI)	β (95% CI)	p	β (95% CI)	p	β (95% CI)	p
Model 2	0.20 (-0.09, 0.48)	0.180	0 (ref)	0.58 (-0.14, 1.31)	0.113	0.74 (-0.01, 1.49)	0.053	0.77 (0.03, 1.53)	0.042
Model a	0.19 (-0.10, 0.48)	0.188	0 (ref)	0.58 (-0.14, 1.31)	0.114	0.75 (0.00, 1.50)	0.051	0.76 (0.02, 1.50)	0.044
Model b	0.17 (-0.12, 0.46)	0.250	0 (ref)	0.47 (-0.26, 1.19)	0.208	0.49 (-0.27, 1.26)	0.204	0.65 (-0.09, 1.40)	0.085
Model c	0.16 (-0.13, 0.45)	0.269	0 (ref)	0.44 (-0.26, 1.13)	0.218	0.68 (-0.04, 1.40)	0.065	0.64 (-0.09, 1.37)	0.084
Model d	0.13 (-0.19, 0.44)	0.425	0 (ref)	0.52 (-0.22, 1.27)	0.167	0.65 (-0.19, 1.42)	0.098	0.61 (-0.18, 1.41)	0.131
Model e	0.19 (-0.10, 0.48)	0.206	0 (ref)	0.58 (-0.15, 1.31)	0.118	0.74 (-0.02, 1.50)	0.056	0.75 (0.01, 1.50)	0.047
Model f	0.20 (-0.09, 0.49)	0.172	0 (ref)	0.58 (-0.14, 1.31)	0.116	0.74 (-0.01, 1.50)	0.054	0.78 (0.04, 1.52)	0.039
Model g	0.19 (-0.09, 0.48)	0.189	0 (ref)	0.58 (-0.11, 1.50)	0.115	0.74 (-0.01, 1.50)	0.053	0.75 (0.02, 1.50)	0.044
Model h	0.18 (-0.10, 0.46)	0.218	0 (ref)	0.58 (-0.14, 1.30)	0.112	0.71 (-0.04, 1.46)	0.062	0.75 (-0.01, 1.51)	0.045
Model i	0.19 (-0.09, 0.48)	0.185	0 (ref)	0.57 (-0.15, 1.30)	0.121	0.75 (-0.01, 1.50)	0.052	0.76 (0.02, 1.50)	0.044
Model j	0.17 (-0.12, 0.46)	0.257	0 (ref)	0.55 (-0.18, 1.28)	0.138	0.61 (-0.14, 1.37)	0.112	0.70 (-0.05, 1.44)	0.067
Model k	0.20 (-0.08, 0.49)	0.164	0 (ref)	0.55 (-0.18, 1.28)	0.137	0.66 (-0.09, 1.42)	0.086	0.78 (0.04, 1.52)	0.038

Notes. Outcome: EPDS total score at two months postpartum. Abbreviations: CI, confidence interval; UPF, ultra-processed food; EPDS, Edinburgh Postnatal Depression Scale; BMI, body mass index. Models fitted using multiple imputation ($m = 5$) with pooled estimates per Rubin's Rules. β coefficients represent absolute change in EPDS score on the response scale (Gaussian GLM). P-values < 0.05 are presented in **bold**. Model 2 (for reference); adjusted for maternal age, ethnicity, educational level, parity, family and personal history of mental health problems, total energy intake, BMI, hospital recruitment site, and COVID-19 pandemic lockdown.

- a. Adjusted for model 2 + gestational weight gain
- b. Adjusted for model 2 + Pittsburgh Sleep Quality Index
- c. Adjusted for model 2 + depressive symptoms at 20 weeks (SCL-90-R)
- d. Adjusted for model 2 + healthful plant-based diet index
- e. Adjusted for model 2 + relative Mediterranean diet score
- f. Adjusted for model 2 + vitamin or mineral supplementation

- g. Adjusted for model 2 + Gini index*
- h. Adjusted for model 2 + median income at the census tract level*
- i. Adjusted for model 2 + pregnancy and birth complications*
- j. Adjusted for model 2 + smoking status*
- k. Adjusted for model 2 + physical activity*

Table S8. Association between ultra-processed food intake and EPDS score at 2 months postpartum across adjusted models excluding history or family history of mental health problems (n = 555)

Model	10% Increase in UPF			UPF Quartile (min-max values %g/day)						
				Q1 (1.0 – 11.5)	Q2 (11.5 – 17.9)		Q3 (17.9 – 25.3)		Q4 (25.3 – 59.5)	
n				145	135		132		143	
	β (95% CI)	<i>p</i>	Variation in β (%)	β (95% CI)	β (95% CI)	<i>p</i>	β (95% CI)	<i>p</i>	β (95% CI)	<i>p</i>
Model 0 ^a	0.17 (-0.14, 0.48)	0.287	-19.0	0 (ref)	0.57 (-0.25, 1.38)	0.172	0.82 (-0.05, 1.70)	0.065	0.56 (-0.22, 1.35)	0.160
Model 1 ^b	0.18 (-0.13, 0.48)	0.251	-14.3	0 (ref)	0.63 (-0.18, 1.44)	0.126	0.84 (-0.03, 1.71)	0.059	0.63 (-0.15,1.41)	0.112
Model 2 ^c	0.17 (-0.14, 0.48)	0.276	-15.0	0 (ref)	0.61 (-0.20, 1.42)	0.141	0.82 (-0.05,1.70)	0.064	0.59 (-0.19,1.37)	0.140

Notes. Base model covariates: maternal age, ethnicity, education, parity, total energy intake, hospital recruitment site, and COVID-19 pandemic lockdown. *P*-values < 0.05 are presented in **bold**. Abbreviations: CI, confidence interval; UPF, ultra-processed food; EPDS, Edinburgh Postnatal Depression Scale; BMI, body mass index; PSQI, Pittsburgh Sleep Quality Index; rMED, relative Mediterranean diet score.

a. Adjusted for maternal age and recruitment hospital

b. Adjusted for maternal age, ethnicity, educational level, parity, family and personal history of mental health problems, total energy intake, hospital recruitment site, and COVID-19 pandemic lockdown (main model)

c. Adjusted for all variables in model 1 + BMI at 12 weeks gestation

Outcome: EPDS total score at 2 months postpartum. Models fitted using multiple imputation (*m* = 5) with pooled estimates per Rubin's Rules. β coefficients represent absolute change in EPDS score on the response scale (Gaussian GLM).

Table S9. Association between ultra-processed food intake and EPDS score at 2 months postpartum across adjusted models excluding participants with high depressive symptoms at 20 weeks gestation (n = 673)

Model	10% Increase in UPF			UPF Quartile (min-max values %g/day)						
				Q1 (1.0 – 11.5)	Q2 (11.5 – 17.9)		Q3 (17.9 – 25.3)		Q4 (25.3 – 59.5)	
n				171	170		175		157	
	β (95% CI)	<i>p</i>	Variation in β (%)	β (95% CI)	β (95% CI)	<i>p</i>	β (95% CI)	<i>p</i>	β (95% CI)	<i>p</i>
Model 0^a	0.23 (-0.07, 0.52)	0.128	15	0 (ref)	0.42 (-0.29, 1.13)	0.265	0.70 (-0.02, 1.43)	0.058	0.70 (-0.05, 1.44)	0.066
Model 1^b	0.24 (-0.05, 0.53)	0.101	14.3	0 (ref)	0.49 (-0.22, 1.20)	0.178	0.74 (0.01, 1.47)	0.046	0.75 (0.01, 1.50)	0.048
Model 2^c	0.23 (-0.06, 0.53)	0.117	9.5	0 (ref)	0.46 (-0.25, 1.17)	0.206	0.71 (-0.03, 1.44)	0.059	0.71 (-0.04, 1.46)	0.065

Notes. Base model covariates: maternal age, ethnicity, education, parity, family and personal history of mental health problems, total energy intake, hospital recruitment site, and COVID-19 pandemic lockdown. *P*-values < 0.05 are presented in **bold**. Abbreviations: CI, confidence interval; UPF, ultra-processed food; EPDS, Edinburgh Postnatal Depression Scale; BMI, body mass index; PSQI, Pittsburgh Sleep Quality Index; rMED, relative Mediterranean diet score.

a. Adjusted for maternal age and recruitment hospital

b. Adjusted for maternal age, ethnicity, educational level, parity, family and personal history of mental health problems, total energy intake, hospital recruitment site, and COVID-19 pandemic lockdown (main model)

c. Adjusted for all variables in model 1 + BMI at 12 weeks gestation

Outcome: EPDS total score at 2 months postpartum. Models fitted using multiple imputation (*m* = 5) with pooled estimates per Rubin's Rules. β coefficients represent absolute change in EPDS score on the response scale (Gaussian GLM).

Table S10: Association between ultra-processed food intake and EPDS score at 2 months postpartum across adjusted models excluding antidepressant use (n = 711)

Model	10% Increase in UPF			UPF Quartile (min-max values %g/day)						
				Q1 (1.0 – 11.5)	Q2 (11.5 – 17.9)		Q3 (17.9 – 25.3)		Q4 (25.3 – 59.5)	
n				178	179		180		174	
	β (95% CI)	<i>p</i>	Variation in β (%)	β (95% CI)	β (95% CI)	<i>p</i>	β (95% CI)	<i>p</i>	β (95% CI)	<i>p</i>
Model 0 ^a	0.19 (-0.10, 0.48)	0.202	-5.0	0 (ref)	0.56 (-0.17, 1.30)	0.132	0.80 (0.05, 1.54)	0.037	0.73 (-0.02, 1.47)	0.056
Model 1 ^b	0.20 (-0.08, 0.49)	0.165	-4.8	0 (ref)	0.59 (-0.13, 1.32)	0.109	0.81 (0.06, 1.55)	0.035	0.75 (0.01, 1.50)	0.049
Model 2 ^c	0.18 (-0.11, 0.47)	0.225	-14.3	0 (ref)	0.54 (-0.19, 1.27)	0.145	0.74 (-0.01,1.49)	0.053	0.67 (-0.07,1.41)	0.077

Notes. Base model covariates: maternal age, ethnicity, education, parity, family and personal history of mental health problems, total energy intake, hospital recruitment site, and COVID-19 pandemic lockdown. *P*-values < 0.05 are presented in **bold**. Abbreviations: CI, confidence interval; UPF, ultra-processed food; EPDS, Edinburgh Postnatal Depression Scale; BMI, body mass index; PSQI, Pittsburgh Sleep Quality Index; rMED, relative Mediterranean diet score.

a. Adjusted for maternal age and recruitment hospital

b. Adjusted for maternal age, ethnicity, educational level, parity, family and personal history of mental health problems, total energy intake, hospital recruitment site, COVID-19 pandemic lockdown (main model)

c. Adjusted for all variables in model 1 + BMI at 12 weeks gestation

Outcome: EPDS total score at 2 months postpartum. Models fitted using multiple imputation (*m* = 5) with pooled estimates per Rubin's Rules. β coefficients represent absolute change in EPDS score on the response scale (Gaussian GLM).

Table S11. Association between ultra-processed food intake and EPDS score at 2 months postpartum across adjusted models using inverse probability weighting (N = 726)

Model	10% Increase in UPF			UPF Quartile (min-max values %g/day)						
				Q1 (1.0 - 11.5)		Q2 (11.5 - 17.9)		Q3 (17.9 - 25.3)		Q4 (25.3 - 59.5)
n				182	181		181		182	
	β (95% CI)	<i>p</i>	Variation in β (%)	β (95% CI)	β (95% CI)	<i>p</i>	β (95% CI)	<i>p</i>	β (95% CI)	<i>p</i>
Model 0 ^a	0.20 (-0.12, 0.52)	0.217	0	0 (ref)	0.68 (-0.14, 1.51)	0.106	1.01 (0.14, 1.87)	0.023	0.93 (0.08, 1.78)	0.032
Model 1 ^b	0.20 (-0.11, 0.50)	0.206	-5.0	0 (ref)	0.61 (-0.20, 1.43)	0.140	0.88 (0.04, 1.73)	0.041	0.89 (0.06, 1.72)	0.036
Model 2 ^c	0.18 (-0.13, 0.49)	0.249	-14.3	0 (ref)	0.56 (-0.26, 1.37)	0.181	0.81 (-0.05, 1.66)	0.064	0.83 (0.00, 1.66)	0.049

Notes. Abbreviations: CI, confidence interval; UPF, ultra-processed food; EPDS, Edinburgh Postnatal Depression Scale; BMI, body mass index; PSQI, Pittsburgh Sleep Quality Index; rMED, relative Mediterranean diet score. *P*-values < 0.05 are presented in **bold**.

a. Adjusted for maternal age and recruitment hospital

b. Adjusted for maternal age, ethnicity, educational level, parity, family and personal history of mental health problems, total energy intake, hospital recruitment site, and COVID-19 pandemic lockdown (main model)

c. Adjusted for all variables in model 1 + BMI at 12 weeks gestation

Table S12. Association between ultra-processed food intake and EPDS score at 32 weeks gestation adjusted for additional variables (N = 495)

Model	10% Increase in UPF		UPF Quartile (min-max values %g/day)						
			Q1 (1.0 – 11.4)	Q2 (11.4 – 17.4)	Q3 (17.4 – 24.7)	Q4 (24.7 – 59.5)			
n			124	124	124	123			
	OR (95% CI)	p	β (95% CI)	β (95% CI)	p	β (95% CI)	p	β (95% CI)	p
Model 2	0.40 (0.02, 0.79)	0.040	1 (ref)	0.54 (-0.34, 1.42)	0.232	0.20 (-0.70, 1.10)	0.660	1.09 (0.08, 2.10)	0.034
Model a	0.41 (0.02, 0.79)	0.040	1 (ref)	0.53 (-0.35, 1.42)	0.236	0.20 (-0.70, 1.10)	0.663	1.09 (0.08, 2.10)	0.035
Model b	0.37 (-0.03, 0.77)	0.067	1 (ref)	0.37 (-0.52, 1.25)	0.414	-0.06 (-0.98, 0.86)	0.903	0.93 (-0.10, 1.96)	0.077
Model c	0.40 (0.02, 0.77)	0.038	1 (ref)	0.44 (-0.42, 1.30)	0.317	0.34 (-0.55, 1.24)	0.452	1.13 (0.13, 2.14)	0.027
Model d	0.34 (-0.09, 0.76)	0.121	1 (ref)	0.44 (-0.46, 1.34)	0.334	0.05 (-0.87, 0.98)	0.909	0.87 (-0.21, 1.94)	0.113
Model e	0.41 (0.01, 0.81)	0.042	1 (ref)	0.53 (-0.36, 1.42)	0.240	0.20 (-0.72, 1.11)	0.673	1.08 (0.04, 2.13)	0.043
Model f	0.40 (0.02, 0.79)	0.040	1 (ref)	0.54 (-0.34, 1.42)	0.230	0.24 (-0.66, 1.14)	0.604	1.09 (0.08, 2.10)	0.034
Model g	0.40 (0.02, 0.79)	0.041	1 (ref)	0.54 (-0.34, 1.43)	0.229	0.21 (-0.69, 1.11)	0.651	1.09 (0.08, 2.09)	0.034
Model h	0.40 (0.02, 0.79)	0.042	1 (ref)	0.54 (-0.34, 1.42)	0.229	0.19 (-0.71, 1.09)	0.679	1.09 (0.08, 2.09)	0.035
Model i	0.40 (0.01, 0.79)	0.044	1 (ref)	0.49 (-0.39, 1.37)	0.273	0.22 (-0.68, 1.13)	0.490	1.06 (0.05, 2.07)	0.041
Model j	0.37 (-0.02, 0.76)	0.061	1 (ref)	0.43 (-0.46, 1.33)	0.344	0.09 (-0.81, 0.99)	0.845	0.99 (-0.02, 2.00)	0.055
Model k	0.44 (0.05, 0.83)	0.026	1 (ref)	0.57 (-0.32, 1.47)	0.209	0.18 (-0.73, 1.10)	0.692	1.19 (0.16, 2.21)	0.023

Notes. Outcome: EPDS total score at 32 weeks gestation. Abbreviations: CI, confidence interval; UPF, ultra-processed food; EPDS, Edinburgh Postnatal Depression Scale; BMI, body mass index. Models fitted using multiple imputation ($m = 5$) with pooled estimates per Rubin's Rules. β coefficients represent absolute change in EPDS score on the response scale (Gaussian GLM). P-values < 0.05 are presented in **bold**. Model 2 (for reference); adjusted for maternal age, ethnicity, educational level, parity, family and personal history of mental health problems, total energy intake, BMI, hospital recruitment site, and COVID-19 pandemic lockdown.

- a. Adjusted for model 2 + gestational weight gain
- b. Adjusted for model 2 + Pittsburgh Sleep Quality Index
- c. Adjusted for model 2 + depressive symptoms at 20 weeks (SCL-90-R)
- d. Adjusted for model 2 + healthful plant-based diet index
- e. Adjusted for model 2 + relative Mediterranean diet score
- f. Adjusted for model 2 + vitamin or mineral supplementation
- g. Adjusted for model 2 + Gini index
- h. Adjusted for model 2 + median income at the census tract level
- i. Adjusted for model 2 + pregnancy and birth complications
- j. Adjusted for model 2 + smoking status
- k. Adjusted for model 2 + physical activity

Table S13. Logistic regression models examining the association between ultra-processed food intake and EPDS score (≥ 11 and ≥ 13) at 32 weeks gestation (n = 495)

	Model	10% Increase in UPF				UPF Quartile (min-max values %g/day)					
				Q1 (1.0 – 11.4)	Q2 (11.4 – 17.4)			Q3 (17.4 – 24.7)	Q4 (24.7 – 59.5)		
n				124	124			124			123
		OR (95% CI)	p			OR (95% CI)	p			OR (95% CI)	p
EPDS ≥11	Model 0 ^a	1.42 (1.06, 1.91)	0.018	1 (ref)	1.09 (0.35, 3.36)	0.890	1.42 (0.49, 4.17)	0.520	2.60 (0.97, 6.97)	0.057	
	Model 1 ^b	1.49 (1.10, 2.03)	0.011	1 (ref)	0.97 (0.30, 3.10)	0.960	1.36 (0.45, 4.11)	0.590	2.75 (0.98, 7.74)	0.055	
	Model 2 ^c	1.46 (1.07, 1.99)	0.018	1 (ref)	0.94 (0.29, 3.00)	0.913	1.24 (0.41, 3.77)	0.707	2.58 (0.91, 7.30)	0.072	
EPDS ≥13	Model 0 ^a	1.72 (1.21, 2.45)	0.003	1 (ref)	1.40 (0.23, 8.63)	0.713	2.37 (0.45, 12.59)	0.309	5.92 (1.28, 27.27)	0.023	
	Model 1 ^b	2.03 (1.36, 3.02)	0.001	1 (ref)	1.49 (0.23, 9.72)	0.676	2.79 (0.49, 12.95)	0.249	9.27 (1.78, 48.22)	0.008	
	Model 2 ^c	2.00 (1.34, 2.98)	0.001	1 (ref)	1.45 (0.22, 9.44)	0.698	2.59 (0.44, 15.04)	0.290	8.86 (1.69, 46. 52)	0.010	

Notes. Outcomes: EPDS total score ≥ 11 and ≥ 13 at 32 weeks gestation. Abbreviations: CI, confidence interval; OR, odds ratio; UPF, ultra-processed food; EPDS, Edinburgh Postnatal Depression Scale; BMI, body mass index. Models fitted using multiple imputation (m = 5) with pooled estimates per Rubin's Rules. Odds ratios represent odds of an EPDS score ≥ 11 , for a 10% increase in UPF consumption and in each UPF quartile relative to Quartile 1. P-values < 0.05 are presented in **bold**.

a. Adjusted for maternal age and recruitment hospital

b. Adjusted for maternal age, ethnicity, educational level, parity, family and personal history of mental health problems, total energy intake, hospital recruitment site, and COVID-19 pandemic lockdown

c. Adjusted for model 1 + BMI at 12 weeks gestation

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