

A cross-sectional study: relationship between diet and mental health in the Korea National Health and Nutrition Examination Survey 2022

HoChan Cheon

Walter and Eliza Hall Institute of Medical Research

Deborah Ashtree

Food & Mood Centre, IMPACT, Deakin University

Emma Todd

Food & Mood Centre, IMPACT, Deakin University

Rebecca Orr

Food & Mood Centre, IMPACT, Deakin University

Jee Hyun Kim

IMPACT, Deakin University

Johnny (Chun Hui) Park

`johnny.park@deakin.edu.au`

IMPACT, Deakin University

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Abstract

Introduction

Anxiety and depressive disorders pose a major public health challenge in South Korea. Diet may be a key factor associated with mental health, particularly anxiety and depression. This study investigates associations between Global Burden of Disease-defined food groups and nutrients association with anxiety and depression using the Korea National Health and Nutrition Examination Survey (KNHANES), aligning with the Global burden of disease Lifestyle And mental Disorders (GLAD) project to inform global evidence on nutritional determinants of mental health.

Methods

4550 individuals (56.7% females) from the 2022 KNHANES dataset met inclusion criteria for the study sample. Dietary exposures were derived from 24-hour recalls. Probable depressive and anxiety disorders were defined by total score ≥ 10 on Patient Health Questionnaire-9 and General Anxiety Disorder-7, respectively. Following assumption validation, logistic regression estimated odds ratios between dietary exposures and probable anxiety or depression across four models: 1) unadjusted, 2) minimally adjusted with age, sex and education, 3) energy-adjusted using Willet's method and 4) fully adjusted.

Results

Higher intake of fatty acids was generally associated with lower odds of probable depression and anxiety disorder across models. Monounsaturated (MUFA) and polyunsaturated (PUFA) fatty acids were associated with lower probable depression and n-3, saturated fatty acid and MUFA significantly associated with lower probable anxiety disorder across all models. Increased vegetables and sugar-sweetened beverage intake was associated with increased odds of probable depression, while fruit intake was associated with increased odds of probable anxiety disorder.

INTRODUCTION

Anxiety and depressive disorders are a major global public health challenge. In South Korea, the 12-month prevalence rates for these disorders were reported at 3.1% and 1.7% in 2021, respectively (1). Considering the high correlation between anxiety and depressive disorders with suicidal risk (2–4), and South Korea's status as having the highest suicide rate among the Organisation for Economic Co-operation and Development countries (5), understanding the underlying risk factors of mental health is particularly relevant for South Korea.

Diet plays a critical role in modulating mental health (6, 7). Studies over the past fifteen years using data from the nationally representative Korea National Health and Nutrition Examination Survey (KNHANES) have advanced understanding of nutritional influences on mental health in the Korean population. For example, adherence to Mediterranean-style dietary patterns adapted to Korean food culture (8) demonstrated a protective effect against depressive symptoms (9). Further, Kim et al. (2023) found that

higher overall diet quality assessed using the Korean Healthy Eating Index (KHEI) was associated with lower odds of perceived stress and depressive symptoms, as well as better health-related quality of life, particularly among women in the 2016 to 2018 KNHANES dataset (10). The KHEI integrates diverse dietary components reflective of the Korean diet and broadly categorises them into three aspects: 1) adequate intake of fruit, dairy, mixed grain, vegetables, protein sources and legumes 2) moderation of sodium, saturated fat and sugar, and 3) balanced energy intake from carbohydrates, proteins and fats. Although evidence supports a relationship between the KHEI and lower odds of depression, less is known about the specific dietary components driving these associations.

Building on this foundation, the present study aims to comprehensively examine the roles of food groups, including fruits, vegetables, legumes, wholegrains, nuts and seeds, milk, red meat, processed meat, and sugar-sweetened beverages, and nutrients, including fibre, calcium, sodium, and omega-3 (n-3), monounsaturated, polyunsaturated and saturated fatty acids, in relation to anxiety and depression symptomatology in the KNHANES dataset. These dietary components largely align with components of the Korean national nutritional recommendations (11).

The methods used in this manuscript align with the Global burden of disease Lifestyle And mental Disorders (GLAD) project, a large-scale initiative aiming to strengthen global evidence of lifestyle factors for mental health disorders, and inform their inclusion in the Global Burden of Disease study (GBD) (12). The present manuscript will contribute to elucidating the nutritional determinants of mental health in the Korean and global populations.

METHODS

Data source and study population

Participants from the nationally representative KNHANES were sampled using a rolling sampling survey method. Of these participants, 4550 individuals (1971 males, 2579 females) from the 2022 KNHANES dataset were included in the study sample. Data from 2022 were included for analysis as it was the only year in which both anxiety and depression symptom questionnaires were administered. Participants were eligible if they were aged 19 years or older (as the General Anxiety Disorder-7 (GAD-7) and Patient Health Questionnaire-9 (PHQ-9) questionnaires were not administered to those aged < 19 years), completed all three surveys, including the health examination, health interview and 24-hour recall nutrition survey, and had complete data. In total, 1715 individuals were excluded due to being younger than 19 years of age (n = 943), missing data in education, GAD-7 or PHQ-9 among those aged > 19 years (n = 495) and incomplete nutritional data (n = 277).

Nutrition and Dietary Exposures measures

The 24-hour dietary recall is an interviewer-administered, open-ended assessment of all foods and beverages consumed in a single day, used to estimate food, nutrient, and energy intake. These intakes

were then grouped into dietary exposures as defined by the GBD study (13), and expressed as grams per day for fruit, vegetables, wholegrains, legumes, nuts and seeds, red meat, milk, processed meat, sugar-sweetened beverages, dietary fibre, calcium, and sodium; milligrams per day for n-3; and percentage of total energy intake in kilocalories for polyunsaturated fatty acids (PUFA). In addition to GBD dietary exposures, total energy intake in kilocalories and monounsaturated fatty acids (MUFA) in grams per day were also included. Not all participants consumed all measured food items.

Mental health outcome measures

In the KNHANES dataset, the PHQ-9, a 9-item questionnaire, was used to assess depressive symptoms. Each of the 9 items is scored from 0 ("not at all") to 3 ("nearly every day"), yielding a total score of 0 to 27. Participants with PHQ-9 scores ≥ 10 were classified as having probable major depressive disorder (sensitivity 88%, specificity 88%) (14). The GAD-7 is a 7-item clinical scale used to assess anxiety symptoms, with each item scored from 0 ("not at all") to 3 ("nearly every day"), for a total score ranging from 0 to 21. The cutoff score of ≥ 10 was used to indicate probable generalized anxiety disorder (sensitivity 89%, specificity 82%)(15). The scores from both instruments were dichotomized with 1 (indicating probable disorder) or 0 (indicating subclinical symptoms or no probable disorder) for subsequent logistic regression analysis.

Covariates

Sociodemographic variables, including age, sex and education, were selected as covariates to isolate the relationship between depression and diet, as per the GLAD protocol design (report identifier: DERR2-10.2196/65576)(12). Education was categorized into 1) primary school graduation or less, 2) graduated middle school, 3) graduated high school, or 4) graduated university or above. Participants with missing values for the education variable were excluded from the analysis.

Statistical analysis

Descriptive statistics were calculated for the sociodemographic variables using mean $\pm$ standard deviation. To assess the association between each dietary variable and probable depression and anxiety (separately), we fitted logistic regression to estimate odds ratios (ORs) and accompanying 95% confidence intervals (CIs). Four models were included: 1) unadjusted; 2) minimally adjusted with age in years, sex and education as covariates; 3) adjusted only for total energy intake using Willett's method without the covariates (16); 4) fully adjusted, adjusted relative to total energy intake using Willett's method and the sociodemographic covariates (16). Statistical significance was assessed using two-tailed tests with $\alpha = 0.05$. All data processing and analyses were conducted using Python (version 3.13.8), and all assumptions (i.e. multicollinearity, outliers) were assessed prior to model fit using R (version number 4.6.0). Benjamini-Hochberg p-value correction is used for multiple hypothesis testing on each model. Results were interpreted based on ORs and 95% CIs.

RESULTS

A total of 4550 cases were included in the analysis. Table 1 describes demographic characteristics and dietary exposure of the study sample.

Table 1
Demographic characteristics and dietary variables

Variable		Total (n = 4550)	Male (n = 1971)	Female (n = 2579)
Age (years)		52.97 ± 17.02	53.06 ± 17.30	52.90 ± 16.80
Education (%)	< High School	26.62	21.87	30.24
	= High School	32.95	34.30	31.91
	> High School	40.44	43.84	37.84
% PHQ-9 ≥ 10		4.53	3.40	5.39
% GAD-7 ≥ 10		4.81	3.15	6.09
Total Energy Intake (n = 4550)		1401.56 ± 670.37	1579.56 ± 725.43	1265.53 ± 590.01
Fiber (n = 4550)		25.05 ± 13.49	27.98 ± 14.12	22.81 ± 12.54
Calcium (n = 4550)		0.49 ± 0.29	0.54 ± 0.32	0.46 ± 0.27
Sodium (n = 4550)		3.12 ± 1.79	3.75 ± 1.93	2.64 ± 1.49
N-3 (n = 4550)		1865.01 ± 1771.53	2094.14 ± 1824.06	1689.89 ± 1710.07
SFA (n = 4550)		14.31 ± 11.15	16.38 ± 12.34	12.72 ± 9.85
MUFA (n = 4550)		14.87 ± 11.47	17.30 ± 12.87	13.02 ± 9.88
PUFA (n = 4550)		5.94 ± 3.04	5.81 ± 2.83	6.04 ± 3.19
Wholegrains (n = 4533)		50.01 ± 39.07	57.71 ± 44.37	44.11 ± 33.28
Legumes (n = 3083)		33.32 ± 54.80	33.57 ± 57.36	33.11 ± 52.62
Nuts & Seeds (n = 3612)		2.35 ± 8.30	2.06 ± 6.32	2.57 ± 9.54
Vegetables (n = 4510)		17.41 ± 18.10	17.40 ± 16.78	17.43 ± 19.05
Fruits (n = 2920)		120.68 ± 123.86	124.15 ± 132.94	118.47 ± 117.69
Red Meat (n = 3523)		48.06 ± 65.45	52.62 ± 71.81	4.25 ± 59.37
Note: Mean ± Standard Deviation. Total energy intake is kilocalories/day. All dietary exposures are in grams per day, except omega(N)-3 (mg/day) and polyunsaturated fats (PUFA; % of total Energy Intake). SFA = saturated fatty acids. MUFA = monounsaturated fatty acids. SSB = sugar sweetened beverages.				

Variable	Total (n = 4550)	Male (n = 1971)	Female (n = 2579)
Milk (n = 1968)	135.19 ± 104.80	142.46 ± 121.08	130.66 ± 92.99
Processed Meat (n = 169)	21.61 ± 17.60	23.49 ± 18.25	20.46 ± 17.18
SSB (n = 3537)	146.47 ± 161.50	150.52 ± 164.69	143.33 ± 158.96
Note: Mean ± Standard Deviation. Total energy intake is kilocalories/day. All dietary exposures are in grams per day, except omega(N)-3 (mg/day) and polyunsaturated fats (PUFA; % of total Energy Intake). SFA = saturated fatty acids. MUFA = monounsaturated fatty acids. SSB = sugar sweetened beverages.			

Assumption validation

Log-linearity between all dietary exposure variables and both outcome measures was observed. No overly influential observations (based on Cook's distance) were identified (Appendix 1, 2).

Multicollinearity analysis revealed that all dietary exposure variables had lower than 10 variance inflation factor (VIF) (Appendix 3).

Probable depression (PHQ-9) and dietary exposure

In the unadjusted logistic regression model (Model 1), higher consumption of N-3, saturated, monounsaturated and polyunsaturated fatty acids was associated with significantly lower odds of probable depression, while higher consumption of vegetables was associated with higher odds of probable depression (Table 2). These associations were consistent even after adjusting for the covariates (i.e. age, sex and education), except for the positive association between sugar-sweetened drinks and odds of probable depression (Model 2; Table 3). When the dietary exposures were adjusted for total energy intake using Willett's method and not the covariates (Model 3), increased consumption of N-3, monounsaturated and polyunsaturated fatty acids was associated with lower odds of probable depression, while wholegrains, vegetables and sugar-sweetened beverages were associated with higher odds of probable depression (Table 4). When the exposure variables were fully adjusted for total energy intake and the covariates (Model 4), the associations for monounsaturated and polyunsaturated fatty acids, vegetables and sugar-sweetened beverages remained consistent with the outcomes from Model 3 (Table 5). There were no other significant associations between dietary exposure variables and probable depression.

Table 2
Model 1: Unadjusted associations between probable depression (total PHQ-9 score $\geq$ 10) and dietary exposures.

Dietary factors	OR (95% CI)	p-value	p-value (BH adjusted)
Total Intake	0.99988 (0.99965–1.00011)	0.31147	0.39116
Fiber	0.99016 (0.97807–1.00240)	0.11466	0.20424
Calcium	0.62383 (0.36124–1.07732)	0.09050	0.20424
Sodium	0.95580 (0.87398–1.04528)	0.32213	0.39116
N-3	0.99983 (0.99972–0.99995)	0.00449	0.02208
SFA	0.97716 (0.96146–0.99312)	0.00520	0.02208
MUFA	0.97050 (0.95431–0.98697)	0.00049	0.00828
PUFA	0.91556 (0.86769–0.96608)	0.00129	0.01093
Wholegrains	1.00271 (0.99962–1.00581)	0.08591	0.20424
Legumes	1.00055 (0.99765–1.00345)	0.71163	0.71163
Nuts & Seeds	0.98416 (0.95599–1.01315)	0.28110	0.39116
Vegetables	1.00705 (1.00110–1.01304)	0.02022	0.06876
Fruits	1.00078 (0.99955–1.00201)	0.21290	0.32903
Red Meat	1.00090 (0.99871–1.00309)	0.42079	0.47689
Milk	1.00148 (0.99961–1.00334)	0.12014	0.20424
Processed Meat	1.01231 (0.97739–1.04847)	0.49456	0.52547
Sugar-sweetened Drinks	1.00075 (0.99983–1.00168)	0.11154	0.20424

BH: Benjamini-Hochberg, N-3: Omega-3 fatty acids, MUFA: Monounsaturated fatty acid, PUFA: Polyunsaturated fatty acids, SFA: Saturated fatty acids.

Table 3
Model 2: Associations between probable depression (total PHQ-9 score ≥ 10) and dietary exposures, adjusted for age, sex and education.

Dietary factors	OR (95% CI)	p-value	p-value (BH adjusted)
Total Intake	0.99999 (0.99977–1.00022)	0.95604	0.95604
Fiber	0.99348 (0.98152–1.00560)	0.29036	0.46685
Calcium	0.76265 (0.44357–1.31125)	0.32711	0.46685
Sodium	0.97296 (0.89101–1.06244)	0.54139	0.58860
N-3	0.99986 (0.99975–0.99997)	0.01514	0.07026
SFA	0.98134 (0.96581–0.99712)	0.02066	0.07026
MUFA	0.97539 (0.95940–0.99165)	0.00313	0.05327
PUFA	0.92973 (0.88121–0.98091)	0.00770	0.06548
Wholegrains	1.00239 (0.99927–1.00553)	0.13317	0.28299
Legumes	1.00086 (0.99801–1.00372)	0.55398	0.58860
Nuts & Seeds	0.98655 (0.96005–1.01377)	0.32954	0.46685
Vegetables	1.00716 (1.00116–1.01318)	0.01920	0.07026
Fruits	1.00084 (0.99960–1.00207)	0.18361	0.34681
Red Meat	1.00095 (0.99875–1.00315)	0.39914	0.52196
Milk	1.00148 (0.99960–1.00337)	0.12286	0.28299
Processed Meat	1.01182 (0.97651–1.04839)	0.51677	0.58860
Sugar-sweetened Drinks	1.00095 (1.00002–1.00188)	0.04487	0.12713

BH: Benjamini-Hochberg, N-3: Omega-3 fatty acids, MUFA: Monounsaturated fatty acid, PUFA: Polyunsaturated fatty acids, SFA: Saturated fatty acids.

Table 4

Model 3: Associations between probable depression (total PHQ-9 score ≥ 10) and dietary exposures, adjusted only for energy residuals according to Willett's method.

Dietary factors	OR (95% CI)	p-value	p-value (BH adjusted)
Total Intake	1.00013 (0.99982–1.00045)	0.40644	0.52693
Fiber	0.99663 (0.98235–1.01112)	0.64675	0.67562
Calcium	0.78908 (0.43594–1.4283)	0.43394	0.52693
Sodium	1.0256 (0.92325–1.1393)	0.63748	0.67562
N-3	0.99987 (0.99975–0.99999)	0.02743	0.09326
SFA	0.98171 (0.96311–1.00067)	0.05856	0.16592
MUFA	0.97225 (0.95346–0.99141)	0.0047	0.03994
PUFA	0.91985 (0.87198–0.97036)	0.00219	0.03720
Wholegrains	1.0035 (1.00045–1.00655)	0.02426	0.09326
Legumes	1.00061 (0.99774–1.0035)	0.67562	0.67562
Nuts & Seeds	0.98466 (0.95678–1.01336)	0.29157	0.45061
Vegetables	1.00727 (1.00136–1.01322)	0.01589	0.09005
Fruits	1.00082 (0.99959–1.00205)	0.19333	0.36517
Red Meat	1.00118 (0.99901–1.00336)	0.28615	0.45061
Milk	1.00155 (0.99969–1.00341)	0.10215	0.22557
Processed Meat	1.01392 (0.97922–1.04911)	0.42694	0.52693
Sugar-sweetened Drinks	1.00076 (1.00003–1.00169)	0.10615	0.22557

BH: Benjamini-Hochberg, N-3: Omega-3 fatty acids, MUFA: Monounsaturated fatty acid, PUFA: Polyunsaturated fatty acids, SFA: Saturated fatty acids.

Table 5

Model 4: Associations between probable depression (total PHQ-9 score ≥ 10) and dietary exposures, adjusted for energy residuals according to Willett's method, age, sex and education.

Dietary factors	OR (95% CI)	p-value	p-value (BH adjusted)
Total Intake	1.00031 (0.99999–1.00062)	0.05616	0.13639
Fiber	0.99943 (0.98516–1.01390)	0.93799	0.93799
Calcium	0.95575 (0.52942–1.72539)	0.88062	0.93566
Sodium	1.03398 (0.93120–1.14811)	0.53163	0.60251
N-3	0.99989 (0.99977–1.00000)	0.05593	0.13639
SFA	0.98493 (0.96633–1.00389)	0.11848	0.22380
MUFA	0.97615 (0.95727–0.99541)	0.01546	0.08912
PUFA	0.93332 (0.88481–0.98450)	0.01129	0.08912
Wholegrains	1.00305 (0.99995–1.00616)	0.05358	0.13639
Legumes	1.00091 (0.99807–1.00375)	0.52956	0.60251
Nuts & Seeds	0.98677 (0.96039–1.01388)	0.33553	0.47534
Vegetables	1.00734 (1.00138–1.01334)	0.01573	0.08912
Fruits	1.00085 (0.99962–1.00209)	0.17438	0.29644
Red Meat	1.00119 (0.99900–1.00339)	0.28756	0.44441
Milk	1.00155 (0.99968–1.00343)	0.10441	0.22188
Processed Meat	1.01364 (0.97922–1.04926)	0.44213	0.57817
Sugar-sweetened Drinks	1.00095 (1.00003–1.00188)	0.04368	0.13639

BH: Benjamini-Hochberg, N-3: Omega-3 fatty acids, MUFA: Monounsaturated fatty acid, PUFA: Polyunsaturated fatty acids, SFA: Saturated fatty acids.

Probable anxiety disorder (GAD-7) and dietary exposure

The unadjusted logistic regression model (Model 1) reported higher consumption of fibre, calcium, N-3, saturated, monounsaturated and polyunsaturated fatty acids was associated with lower odds for probable anxiety disorder, while increased consumption of fruits was associated with higher odds for probable anxiety disorder (Table 6). Only the associations for N-3, monounsaturated and polyunsaturated fatty acids, and fruits remained significant after adjusting the dataset to the covariates

(Model 2; Table 7). Adjustment to total energy intake using Willett’s method revealed higher consumption of N-3, monounsaturated and saturated fatty acids was associated with lower odds of probable anxiety disorder, and higher consumption of fruit was associated with higher odds of probable anxiety disorder (Model 3; Table 8). When the dataset was adjusted for total energy and other covariates (Model 4), all associations remained significant (Table 9). There were no other significant associations between dietary exposure variables and anxiety disorder symptom scores.

Table 6
Model 1: Unadjusted associations between probable anxiety disorder (total GAD-7 score ≥ 10) and dietary exposures.

Dietary factors	OR (95% CI)	p-value	p-value (BH adjusted)
Total Intake	0.99983 (0.99960–1.00006)	0.13766	0.26067
Fiber	0.98743 (0.97528–0.99974)	0.04541	0.11029
Calcium	0.53787 (0.31009–0.93297)	0.02732	0.09236
Sodium	0.93889 (0.85826–1.02709)	0.16867	0.26067
N-3	0.99981 (0.99970–0.99993)	0.00183	0.01034
SFA	0.96940 (0.95345–0.98562)	0.00024	0.00411
MUFA	0.97194 (0.95636–0.98778)	0.00056	0.00476
PUFA	0.94792 (0.90280–0.99528)	0.03156	0.09236
Wholegrains	1.00090 (0.99746–1.00435)	0.60757	0.72223
Legumes	1.00059 (0.99778–1.00342)	0.67974	0.72223
Nuts & Seeds	0.97500 (0.94195–1.00921)	0.15018	0.26067
Vegetables	1.00447 (0.99816–1.01083)	0.16511	0.26067
Fruits	1.00121 (1.00010–1.00233)	0.03260	0.09236
Red Meat	0.99910 (0.99649–1.00172)	0.50024	0.70867
Milk	1.00026 (0.99831–1.00221)	0.79377	0.79377
Processed Meat	1.00818 (0.97236–1.04531)	0.65906	0.72223
Sugar-sweetened Drinks	1.00028 (0.99933–1.00123)	0.56186	0.72223

BH: Benjamini-Hochberg, N-3: Omega-3 fatty acids, MUFA: Monounsaturated fatty acid, PUFA: Polyunsaturated fatty acids, SFA: Saturated fatty acids.

Table 7

Model 2: Associations between probable anxiety disorder (total GAD-7 score ≥ 10) and dietary exposures, adjusted for age, sex and education.

Dietary factors	OR (95% CI)	p-value	p-value (BH adjusted)
Total Intake	0.99987 (0.99963–1.00010)	0.25372	0.39211
Fiber	0.98863 (0.97647–1.00095)	0.07031	0.17075
Calcium	0.57526 (0.33061–1.00094)	0.05039	0.14815
Sodium	0.94514 (0.86430–1.03355)	0.21620	0.36755
N-3	0.99982 (0.99971–0.99994)	0.00300	0.01702
SFA	0.97073 (0.95476–0.98698)	0.00045	0.00766
MUFA	0.97342 (0.95781–0.98930)	0.00110	0.00934
PUFA	0.95267 (0.90715–1.00048)	0.05229	0.14815
Wholegrains	1.00077 (0.99732–1.00423)	0.66289	0.70858
Legumes	1.00072 (0.99792–1.00353)	0.61486	0.70858
Nuts & Seeds	0.97637 (0.94412–1.00972)	0.16291	0.30771
Vegetables	1.00451 (0.99819–1.01087)	0.16219	0.30771
Fruits	1.00123 (1.00012–1.00235)	0.03012	0.12800
Red Meat	0.99911 (0.99650–1.00173)	0.50667	0.66257
Milk	1.00025 (0.99829–1.00220)	0.80471	0.80471
Processed Meat	1.00800 (0.97207–1.04526)	0.66690	0.70858
Sugar-sweetened Drinks	1.00035 (0.99940–1.00130)	0.46846	0.66257

BH: Benjamini-Hochberg, N-3: Omega-3 fatty acids, MUFA: Monounsaturated fatty acid, PUFA: Polyunsaturated fatty acids, SFA: Saturated fatty acids.

Table 8

Model 3: Associations between probable anxiety disorder (total GAD-7 score ≥ 10) and dietary exposures, adjusted for energy residuals according to Willett's method.

Dietary factors	OR (95% CI)	p-value	p-value (BH adjusted)
Total Intake	1.0001 (0.9998–1.00041)	0.50915	0.71603
Fiber	0.9955 (0.98133–1.00986)	0.53687	0.71603
Calcium	0.71782 (0.39687–1.2983)	0.27284	0.51536
Sodium	1.02149 (0.92021–1.13393)	0.68975	0.71603
N-3	0.99986 (0.99975–0.99998)	0.02194	0.11493
SFA	0.97433 (0.95601–0.99299)	0.00722	0.11493
MUFA	0.97779 (0.95947–0.99646)	0.01995	0.11493
PUFA	0.95277 (0.90768–1.0001)	0.05046	0.17157
Wholegrains	1.00198 (0.9987–1.00527)	0.23689	0.5034
Legumes	1.00067 (0.99787–1.00347)	0.64161	0.71603
Nuts & Seeds	0.97627 (0.94398–1.00967)	0.16171	0.39272
Vegetables	1.00477 (0.99852–1.01107)	0.13484	0.38205
Fruits	1.00125 (1.00014–1.00237)	0.02704	0.11493
Red Meat	0.99951 (0.99697–1.00207)	0.70891	0.71603
Milk	1.00036 (0.99842–1.0023)	0.71603	0.71603
Processed Meat	1.00794 (0.97231–1.04488)	0.66673	0.71603
Sugar-sweetened Drinks	1.00038 (0.99945–1.00132)	0.4197	0.71348

BH: Benjamini-Hochberg, N-3: Omega-3 fatty acids, MUFA: Monounsaturated fatty acid, PUFA: Polyunsaturated fatty acids, SFA: Saturated fatty acids.

Table 9

Model 4: Associations between probable anxiety disorder (total GAD-7 score ≥ 10) and dietary exposures, adjusted for energy residuals according to Willett's method, age, sex, and education.

Dietary factors	OR (95% CI)	p-value	p-value (BH adjusted)
Total Intake	1.00017 (0.99986–1.00048)	0.28464	0.54398
Fiber	0.99653 (0.98236–1.01090)	0.63401	0.72609
Calcium	0.76915 (0.42430–1.39428)	0.38714	0.59831
Sodium	1.02435 (0.92296–1.13688)	0.65102	0.72609
N-3	0.99987 (0.99975–0.99999)	0.02932	0.12460
SFA	0.97542 (0.95707–0.99412)	0.01022	0.12460
MUFA	0.97914 (0.96077–0.99787)	0.02922	0.12460
PUFA	0.95739 (0.91191–1.00513)	0.07944	0.27010
Wholegrains	1.00180 (0.99849–1.00512)	0.28799	0.54398
Legumes	1.00078 (0.99800–1.00358)	0.58134	0.72609
Nuts & Seeds	0.97746 (0.94587–1.01010)	0.17376	0.42198
Vegetables	1.00479 (0.99853–1.01110)	0.13393	0.37946
Fruits	1.00127 (1.00015–1.00238)	0.02556	0.12460
Red Meat	0.99951 (0.99695–1.00207)	0.70587	0.72609
Milk	1.00035 (0.99840–1.00230)	0.72609	0.72609
Processed Meat	1.00782 (0.97206–1.04490)	0.67240	0.72609
Sugar-sweetened Drinks	1.00045 (0.99952–1.00139)	0.34269	0.58257

BH: Benjamini-Hochberg, N-3: Omega-3 fatty acids, MUFA: Monounsaturated fatty acid, PUFA: Polyunsaturated fatty acids, SFA: Saturated fatty acids.

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