

Electronic Supplementary Material (ESI) for Food & Function.

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1. Search strategies

All databases searched 11 December 2023.

MEDLINE

1. ('dietary fiber*' OR inulin OR gulcomannan OR 'galacto oligosaccharide' OR 'fructo oligosaccharide' OR fructan OR prebiotic OR psyllium OR konjac OR 'resistant starch' OR pectin OR oat OR 'whole grain' OR barley OR roughage) :ab,kw,ti AND [medline]/lim
2. (child* OR adolescen* OR young* OR youth* OR kids OR teen* OR schoolage OR student) :ab,kw,ti AND [medline]/lim
3. ('neurobehavioral outcomes' OR Cognition OR cognitive* OR intelligen* OR Intellectual OR learn* OR IQ OR I.Q. OR 'Cognitive function' OR memory OR Psychomotor OR 'Attention deficit hyperactivity disorder') AND [medline]/lim
4. (Mental* OR "psychiatric disorder" OR "mental disorder" OR "mental illness" OR "mental health" OR depression OR depressive OR depressed OR distress OR anxiety OR anxious OR mood OR "psychological well-being" OR "mental well-being" OR "subjective well-being" OR "psychological health" OR "psychological symptom") :ab,kw,ti AND [medline]/lim
5. 3 OR 4
6. 1 AND 2 AND 5
7. (animals/ not (animals/ and humans/)) AND [medline]/lim
8. 6 NOT 7
9. (mice or cats or rats or rodent* or animal* or guinea pig*) AND [medline]/lim
10. 8 NOT 9

EMBASE

1. ('dietary fiber*' OR inulin OR gulcomannan OR 'galacto oligosaccharide' OR 'fructo oligosaccharide' OR fructan OR prebiotic OR psyllium OR konjac OR 'resistant starch' OR pectin OR oat OR 'whole grain' OR barley OR roughage) :ab,kw,ti AND [embase]/lim
2. (child* OR adolescen* OR young* OR youth* OR kids OR teen* OR schoolage OR student) :ab,kw,ti AND [embase]/lim
3. ('neurobehavioral outcomes' OR Cognition OR cognitive* OR intelligen* OR Intellectual OR learn* OR IQ OR I.Q. OR 'Cognitive function' OR memory OR Psychomotor OR 'Attention deficit hyperactivity disorder') AND [embase]/lim
4. (Mental* OR "psychiatric disorder" OR "mental disorder" OR "mental illness" OR

"mental health" OR depression OR depressive OR depressed OR distress OR anxiety OR anxious OR mood OR "psychological well-being" OR "mental well-being" OR "subjective well-being" OR "psychological health" OR "psychological symptom") :ab,kw,ti AND [embase]/lim

5. 3 OR 4

6. 1 AND 2 AND 5

7. (animals/ not (animals/ and humans/)) AND [embase]/lim

8. 6 NOT 7

9. (mice or cats or rats or rodent* or animal* or guinea pig*) AND [embase]/lim

10. 8 NOT 9

SCOPUS

(((TITLE-ABS-KEY ("neurobehavioral outcomes" OR cognition OR cognitive* OR intelligen* OR intellectual OR learn* OR IQ OR I.Q. OR {cognitive function} OR memory OR Psychomotor OR {Attention deficit hyperactivity disorder})) OR (TITLE-ABS-KEY (mental OR {psychiatric disorder} OR {mental disorder} OR {mental illness} OR depression OR depressive OR depressed OR anxiety OR anxious OR mood OR {psychological well-being} OR {mental well-being} OR {subjective well-being} OR {emotional well-being} OR {psychological health} OR {psychological symptom}))) AND ((TITLE-ABS-KEY ("dietary fiber*" OR inulin OR gulcomannan OR galacto-oligosaccharide* OR fructo-oligosaccharide* OR fructan* OR prebiotic* OR psyllium OR konjac OR "resistant starch" OR pectin OR oat OR "whole grain" OR barley OR roughage*))) AND ((TITLE-ABS-KEY (child* OR adolescen* OR young* OR youth* OR kid* OR teen* OR schoolage OR student)))) AND NOT (TITLE-ABS-KEY (mice OR cats OR rats OR rodent* OR animal* OR "guinea pig*")))

2. Excluded articles with reasons

Ineligible intervention:

1. Acute Effects of Breakfast Compared With No Breakfast on Cognitive Function and Subjective State in 11-13 Year Old Children: A School-based, Randomised, Controlled, Parallel Groups Trial. *Journal*, 2019.
2. L. Su, S. Li and B. Sun, Curative Effect of Prebiotics/Probiotics-Assisted Ketogenic Diet on Children with Refractory Epilepsy, *Emerg Med Int*, 2022, 2022, 1076053.
3. S. P. Rovio, H. Salo, H. Niinikoski, H. Lagström, P. Salo, J. S. A. Viikari, T. Rönnemaa, A. Jula, O. T. Raitakari and K. Pahkala, Dietary Intervention in Infancy and Cognitive Function in Young Adulthood: the Special Turku Coronary Risk Factor Intervention Project, *Journal of pediatrics*, 2022, 246, 184 - 190.e181.
4. K. S. Lee, Y. J. Choi, Y. H. Lim, J. Y. Lee, M. K. Shin, B. N. Kim, C. H. Shin, Y. A. Lee, J. I. Kim and Y. C. Hong, Dietary patterns are associated with attention-deficit hyperactivity disorder (ADHD) symptoms among preschoolers in South Korea: a prospective cohort study, *Nutritional Neuroscience*, 2022, 25, 603-611.
5. Y. Mou, E. Blok, M. Barroso, P. W. Jansen, T. White and T. Voortman, Dietary patterns, brain morphology and cognitive performance in children: Results from a prospective population-based study, *European Journal of Epidemiology*, 2023, 38, 669-687.
6. E. Skott, L. L. Yang, M. Stiernborg, Å. Söderström, J. Rüegg, M. Schalling, Y. Forsell, M. Giacobini and C. Lavebratt, Effects of a synbiotic on symptoms, and daily functioning in attention deficit hyperactivity disorder—A double-blind randomized controlled trial, *Brain, Behavior, and Immunity*, 2020, 89, 9-19.
7. K. S. Yim, Effects of Skipping Breakfast on Nutrition Status, Fatigue Level, and Attention Level among Middle School Students in Gyunggi Province, Korea, *Journal of the Korean Society of Food Culture*, 2014, 29, 464-475.
8. Y. Takaoka and N. Kawakami, Fruit and vegetable consumption in adolescence and health in early adulthood: a longitudinal analysis of the statistics Canada's National Population Health Survey, *BMC Public Health*, 2013, 13, 1206.
9. N. Kopkin, M. L. Martin and D. Hollar, Improvements in standardised test scores from a multi-component nutrition and healthy living intervention in a US elementary-school setting, *Health Education Journal*, 2018, 77, 527-541.
10. K. D. Reynolds, F. A. Franklin, D. Binkley, J. M. Raczynski, K. F. Harrington, K. A. Kirk and S. Person, Increasing the fruit and vegetable consumption of fourth-graders: results from the high 5 project, *Prev Med*, 2000, 30, 309-319.
11. J. Bayes, J. Schloss and D. Sibbritt, Investigation into the diets and nutritional knowledge of young men with depression: The MENDDS survey, *Nutrition*, 2020, 78.
12. R. M. Taylor, M. L. Blumfield, L. M. Ashton, A. J. Hure, R. Smith, N. Buckley, K. Drysdale and C. E. Collins, Macronutrient Intake in Pregnancy and Child Cognitive

and Behavioural Outcomes, Children-Basel, 2021, 8.

13. B. J. Kaplan, The relevance of food for children's cognitive and behavioural health, *Canadian Journal of Behavioural Science / Revue canadienne des sciences du comportement*, 1988, 20, 359-373.
14. Synbiotic Treatment for Neuropsychiatric Symptom of Autism Spectrum Disorder: an Open-label Pilot Study. *Journal*, 2023.
15. The Utility of a Synbiotic With Adjunct Gut-directed Hypnotherapy on the Severity of Gastrointestinal Symptoms in Children With Autism. *Journal*, 2020.

Ineligible population:

1. M. Kavyani, S. Saleh-Ghadimi, P. Dehghan, M. Abbasalizad Farhangi and M. Khoshbaten, Co-supplementation of camelina oil and a prebiotic is more effective for in improving cardiometabolic risk factors and mental health in patients with NAFLD: A randomized clinical trial, *Food and Function*, 2021, 12, 8594-8604.
2. X. Mao, C. Chen, P. Xun, M. L. Daviglius, L. M. Steffen, D. R. Jacobs, L. Van Horn, S. Sidney, N. Zhu, B. Qin and K. He, Intake of Vegetables and Fruits Through Young Adulthood Is Associated with Better Cognitive Function in Midlife in the US General Population, *J Nutr*, 2019, 149, 1424-1433.
3. S. Fowlie, M. A. Eastwood and R. Prescott, Irritable bowel syndrome: Assessment of psychological disturbance and its influence on the response to fibre supplementation, *Journal of Psychosomatic Research*, 1992, 36, 175-180.
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5. A. L. Kleppang, M. V. Vettore, I. Hartz, S. H. Haugland and T. H. Stea, Patterns of unhealthy behaviours during adolescence and subsequent anxiety and depression in adulthood: a prospective register linkage study of the HUNT survey and health registries, *International Journal of Behavioral Nutrition and Physical Activity*, 2023, 20.

No original data:

1. L. S. Otten, D. De Kruijff, M. Mackus, J. Garssen and J. C. Verster, Attention deficit hyperactivity disorder (ADHD) and the dietary intake of fiber and fat, *European Neuropsychopharmacology*, 2016, 26, S726.
2. R. Baiao, L. Capitaio, H. Baek, N. Kappelmann, P. Montgomery and P. Burnet, The Effects of a Prebiotic Supplementation on Reading and Cognitive Performance in Elementary School Children: A Randomised Placebo-Controlled Study, *Biological Psychiatry*, 2019, 85, S316-S317.
3. G. A. O'Reilly, J. Huh, S. M. Schembre, E. B. Tate, M. A. Pentz and G. Dunton, Association of usual self-reported dietary intake with ecological momentary

measures of affective and physical feeling states in children, *Appetite*, 2015, 92, 314-321.

4. A. Abbaszadeh, M. Saharkhiz, Z. Khorasanchi, S. Karbasi, M. Askari, Z. S. Hoseini, M. Ayadilord, S. Mahmoudzadeh, H. Rezapour, H. Enayati, G. A. Ferns and A. Bahrami, Impact of a Nordic diet on psychological function in young students, *Nutr Health*, 2021, 27, 97-104.
5. L. Ugartemendia, R. Bravo, M. Y. Castano, J. Cubero, V. Zamoscik, P. Kirsch, A. B. Rodriguez and M. Reuter, "Influence of diet on mood and social cognition: a pilot study", *Food & Function*, 2020, 11, 8320-8330.
6. J. Y. Toh, S. Cai, S. X. Lim, W. W. Pang, K. M. Godfrey, L. P. Shek, K. H. Tan, F. Yap, Y. S. Lee, Y. S. Chong, J. G. Eriksson, B. F. P. Broekman, A. Rifkin-Graboi and M. F. F. Chong, Nutrient trajectories during infancy and their associations with childhood neurodevelopment, *Eur J Nutr*, 2023, 62, 2429-2439.
7. R. Grimaldi, G. R. Gibson, J. Vulevic, N. Giallourou, J. L. Castro-Mejia, L. H. Hansen, E. Leigh Gibson, D. S. Nielsen and A. Costabile, A prebiotic intervention study in children with autism spectrum disorders (ASDs), *Microbiome*, 2018, 6, 133.

Not outcome of interest:

1. K. Arasu, C. Y. Chang, S. Y. Wong, S. H. Ong, W. Y. Yang, M. H. Z. Chong, M. Mavinkurve, E. J. Khoo, K. Chinna, C. M. Weaver and W. S. S. Chee, Design and strategies used for recruitment and retention in a double blind randomized controlled trial investigating the effects of soluble corn fiber on bone indices in pre-adolescent children (PREBONE-Kids study) in Malaysia, *Contemporary Clinical Trials Communications*, 2021, 22.
2. R. B. Grigolon, K. L. Lenz Dunker, M. C. Almeida, D. C. Acha and A. M. Claudino, Dietary patterns as a red flag for higher risk of eating disorders among female teenagers with and without type I diabetes mellitus, *Eating and Weight Disorders-Studies on Anorexia Bulimia and Obesity*, 2019, 24, 151-161.
3. Y. Nakai, S. Akagawa, S. Fujishiro, Y. Akagawa, M. Yamagishi, S. Yamanouchi, T. Kimata, A. Ohashi, M. Hashiyada, A. Akane, S. Tsuji and K. Kaneko, Dysbiosis of the gut microbiota in children with severe motor and intellectual disabilities receiving enteral nutrition: A pilot study, *JPEN J Parenter Enteral Nutr*, 2023, 47, 67-76.
4. S. L. Nabb and D. Benton, The effect of the interaction between glucose tolerance and breakfasts varying in carbohydrate and fibre on mood and cognition, *Nutritional Neuroscience*, 2006, 9, 161-168.
5. , Effects of Wholegrains on Children's Health (KORN).Journal, 2020.
6. H. C. Koo, B. K. Poh and A. T. Ruzita, GReat-Child Trial™ based on social cognitive theory improved knowledge, attitudes and practices toward whole grains among Malaysian overweight and obese children, *Bmc Public Health*, 2019, 19.

7. T. L. Burgess-Champoux, H. W. Chan, R. Rosen, L. Marquart and M. Reicks, Healthy whole-grain choices for children and parents: a multi-component school-based pilot intervention, *Public Health Nutr*, 2008, 11, 849-859.
8. L. C. Hillman, N. H. Stace and E. W. Pomare, Irritable Bowel Patients and their Long - Term Response to a High Fiber Diet, *The American Journal of Gastroenterology*, 1984, 79, 1-7.
9. H. Jafari-Vayghan, S. Mirmajidi, Z. Mollarasouli, F. Vahid, S. Saleh-Ghadimi and P. Dehghan, Mental health is associated with nutrient patterns and Index of Nutritional Quality (INQ) in adolescent girls - an analytical study, *Human Nutrition and Metabolism*, 2023, 31.
10. A. L. Kleppang, K. de Ridder, S. H. Haugland and T. H. Stea, Physical activity, sugar-sweetened beverages, whole grain bread and insomnia among adolescents and psychological distress in adulthood: prospective data from the population-based HUNT study, *International Journal of Behavioral Nutrition and Physical Activity*, 2021, 18.
11. L. Walnik, M. Kück, U. Tegtbur, V. Fischer and A. Kerling, Physical Fitness, Nutrition and Quality of Life in German Medical Students, *Nutrients*, 2022, 14.
12. R. J. Shulman, E. B. Hollister, K. Cain, D. I. Czyzewski, M. M. Self, E. M. Weidler, S. Devaraj, R. A. Luna, J. Versalovic and M. Heitkemper, Psyllium Fiber Reduces Abdominal Pain in Children With Irritable Bowel Syndrome in a Randomized, Double-Blind Trial, *Clin Gastroenterol Hepatol*, 2017, 15, 712-719 e714.
13. R. J. Shulman, E. B. Hollister, K. Cain, D. I. Czyzewski, M. Self, E. M. Weidler, S. Devaraj, J. Versalovic and M. Heitkemper, Randomized, double blind trial of psyllium fiber in children with irritable bowel syndrome (IBS), *Gastroenterology*, 2015, 148, S120.
14. M. Miyamoto, Y. Hanatani and K. Shibuya, Relationship among nutritional intake, anxiety, and menstrual irregularity in elite rowers, *Nutrients*, 2021, 13.
15. P. A. Humphreys and R. N. Gevirtz, Treatment of recurrent abdominal pain: Components analysis of four treatment protocols, *Journal of Pediatric Gastroenterology and Nutrition*, 2000, 31, 47-51.

Review articles:

1. S. Fatahi, S. S. Matin, M. H. Sohoul, M. A. Găman, P. Rae, B. Olang, V. Kathirgamathamby, H. O. Santos, N. S. Guimarães and F. Shidfar, Association of dietary fiber and depression symptom: A systematic review and meta-analysis of observational studies, *Complementary Therapies in Medicine*, 2021, 56.
2. F. Saghafian, M. Hajishafiee, P. Rouhani and P. Saneei, Dietary fiber intake, depression, and anxiety: a systematic review and meta-analysis of epidemiologic studies, *Nutr Neurosci*, 2023, 26, 108-126.

3. A. N. Reynolds, H. T. Diep Pham, J. Montez and J. Mann, Dietary fibre intake in childhood or adolescence and subsequent health outcomes: A systematic review of prospective observational studies, *Diabetes Obes Metab*, 2020, 22, 2460-2467.
4. J. F. W. Cohen, M. T. Gorski, S. A. Gruber, L. B. F. Kurdziel and E. B. Rimm, The effect of healthy dietary consumption on executive cognitive functioning in children and adolescents: A systematic review, *British Journal of Nutrition*, 2016, 116, 989-1000.

Reports not retrieved:

1. At Home Placebo-controlled 8-week GOS Intervention on Emotion Behaviour and Cognition in Children (Age 6-14 Years).*Journal*, 2024.
2. A. I. Khavkin, T. A. Kovtun, D. V. Makarkin, O. B. Fedotova and O. N. Komarova, Cereals and children's health, *Rossiyskiy Vestnik Perinatologii i Pediatrii*, 2020, 65, 162-169.
3. The management of constipation, *MeReC Bulletin*, 1999, 10, 33-36.
4. Randomised, Blinded, Parallel, Placebo-controlled Study to Evaluate Whether Supplementation of the Dietary Fiber Psyllium Can Reduce Abdominal Pain and Improve Quality of Life and Anxiety in Children With Abdominal Pain.*Journal*, 2020.

Supplement Table 1. Characteristics of the included intervention studies

Study	Country	Study design	Age	Sample size	Duration	Intervention	Outcomes included in the analysis	Outcome definition	Method of outcome measurement
Nicola Johnstone 2021	UK	RCT	18-25	64 (48)	28 days	GOS: 7.5g/d	indices of state and trait anxiety social anxiety mood depression emotion regulation emotional behavior		STAI SAS-A SMFQ BDI-II ERQ-CA TCAQ attentional dot-probe task
Liliana P Capitão 2020	UK	RCT	7-9(8.84±0.95)	35	12 weeks	B-GOS	Reading and working memory broader cognition symptom of anxiety mood		British Ability Scales CogTrackTMSsystem STAI for children SMFQ
Christine Hughes 2011	USA	RCT	19-20	427	8 weeks	GOS: 0, 2.5 or 5.0 g/d	daily stress level	0 = no stress, 10 = extremely stressed	Online study questionnaires
Kristin Schmidt 2015	UK	RCT	Placebo:23.27±3.86 FOS:24.53±3.87 B-GOS:23.27±3.95	45	3 weeks	FOS, B-GOS: 5.5 g/d	verbal IQ personality stress responsivity depression anxiety mood verbal working memory Attention		NART EPQ PRSR BDI STAI VAS PANAS dspace Attentional dot-probe task Simple Reaction Time Tasks Focused Attention Task Categoric Search Task Repeated-Digits Vigilance Task 18 bi-polar visual analogue scales
Andrew P. Smith 2015	UK	cross-over	23	47	2 days	Inulin:5g	Memory Psychomotor Selective Attention Sustained Attention mood		Attentional dot-probe task Simple Reaction Time Tasks Focused Attention Task Categoric Search Task Repeated-Digits Vigilance Task 18 bi-polar visual analogue scales
Jolice P. van den Berg 2016	Netherlands	RCT	0-2	77	28 days	mixed prebiotic (scGOS/lcFOS/pAOS)	cognitive development motor development		MDI BSID
Mary Brauchla 2014	USA	RCT	7-11	81(66)	8 weeks	two high fiber snacks per day	HRQOL		PedsQL™ Pediatric Quality of Life Inventory.
Young-Chul Chung M.D. 2012	Korea	RCT	15-17	28	9 weeks	mixed-grain product: 120g	concentration, comprehension, executive function, memory, persistence, task-processing speed, and verbal expression		CNT Self-rating scales: seven-point (1-7) Likert scales
Lucsane Gruneck 2022	Thailand	Non-Randomized Trial	6-12	127(85)	15 weeks	Sinlek rice (brown rice)	Short-Term Working Memory Attention		CBT PVT

Abbreviations: GOS: galacto-oligosaccharides; B-GOS: Bimuno®-galactooligosaccharides; FOS: Fructooligosaccharides; scGOS: Short chain galacto-oligosaccharides; lcFOS: long chain fructo-oligosaccharides; pAOS: pectin derived acidic oligosaccharides; STAI: State-Trait Anxiety Inventory; SAS-A: Social Anxiety Scale for Adolescents and Young People; SMFQ: Mood and Feelings Questionnaire (Short Version); BDI-II: Beck Depression Inventory-II; ERQ-CA: Emotion Regulation Questionnaire for Children and Adolescents; TCAQ: Thought Control Ability Questionnaire; NART: National Adult Reading Test; EPQ: Eysenck Personality

Questionnaire; PRSR: Perceived Stress Reactivity Scale; BDI: Beck Depression Inventory; VAS: Visual Analogue Scales; PANAS: Positive and Negative Affect Schedules; dspan: digit span task; MDI: Mental Development Index; BSID: Psychomotor Development Index of the Bayley Scales of Infant and Toddler Development; HRQOL: health-related quality of life scores; CNT: The Computerized Neuropsychological Test; CBT: Corsi block-tapping test; the PVT: psychomotor vigilance test.

Supplement Table 2. Characteristics of the included observational studies

Study	Country	Study design	Age	Sample size	Food consumption measured	Exposure	Outcomes included in the analysis	Outcome definition	Method of outcome measurement
Michał Seweryn Karbownik 2022	Poland	prospective cohort study	22.7±1.1	372	7 days selective dietary record	inulin and FOS	cognitive performance under stress Depressive symptoms Anxiety symptoms		the final exam score in pharmacology PHQ-9 GAD-7
Anett Nyaradi 2013	Australia	prospective cohort study	10	2868	24-h dietary recall	whole grain	Verbal ability Nonverbal ability		PPVT-III RCPM
Olivia G. Swann 2021	Australia	prospective cohort study	14,17	1260 (age=14) 653 (age=17)	FFQ	overall fiber, cereal fiber, fruit and vegetable fiber intake	depression	average or mildly elevated depressive symptoms (<60) moderately elevated or extremely elevated depressive symptoms (≥60), labelled as none/mild (0) and moderate/extreme (1)	BDI-Y
Tae-Hee Kim MD, PhD 2015	Korea	case control study	12-18	849	FFQ	dietary fiber	depression	cutoff: 16	K-BDI
Sayyed Saeid Khayyatzadeh 2020	Iran	cross sectional study	12-18	988	FFQ	soluble dietary fiber and insoluble dietary fiber	depression	0–13 minimal or no depression, 14–19 mild depression, 20–28 moderate depression and 29–63 severe depression	BDI
Max J. L. 2021	USA	cross sectional study	20.94±6.36 22.43±8.08	134	FFQ	total fiber, soluble fiber, insoluble fiber dietary fiber intake	depression anxiety	Seven questions for each disorder 0-7: non cases of anxiety or depression; 8-10: mild cases; 11-14: moderate cases; 15-21: severe cases.	HADS “Short-Form 36” self-survey
Atiah M. Meli 2023	Malaysia	cross sectional study	7-11	94	24-h dietary recall on 2 days	dietary fiber intake	cognitive performance		RCPM
Kelsey M. Hassevoort 2020	USA	cross sectional study	8-12	57	3-day food record	total dietary fiber	creativity		TTCT

Supplement Table 2 (Contd.)

Study	Country	Study design	Age	Sample size	Food consumption measured	Exposure	Outcomes included in the analysis	Outcome definition	Method of outcome measurement
Sehrish Naveed 2020	Finland	cross sectional study	6-8	487	4-day food record	total fiber soluble fiber insoluble fiber	nonverbal reasoning		RCPM
Naiman A Khan 2014	USA	cross sectional study	7-9	65	3-day food record	total dietary fiber insoluble fiber soluble fiber pectins	attentional inhibition		Flanker task

Abbreviations: FOS: Fructooligosaccharides; FFQ: Food Frequency Questionnaire; BDI: Beck Depression Inventory; PHQ-9: Patient Health Questionnaire-9 scale; GAD-7: Generalized Anxiety Disorder-7 scale; PPVT-III: Peabody Picture Vocabulary Test-III; RCPM: Raven’s colored progressive matrices; BDI-Y: the Beck Depression Inventory for Youth; K-BDI: Korean version of the Beck Depression Inventory; HADS: Hospital Anxiety and Depression Scale; TTCT: The verbal form of the Torrance Test of Creative Thinking.

Supplement Table 3. Assessment methods for mental and cognitive outcome in included studies.

Outcome	Assessment methods	Description and scoring criteria
Depression	PHQ-9 ¹	A 9-item self-administered scale, scored from 0 (not at all) to 3 (nearly every day) per symptom. 0-4: no; 5-9: mild; 10-14: moderate; 15-19: moderately severe; 20-27: severe
	BDI ²⁻⁴	A 21-item inventory assessing depression symptoms such as guilt, hopelessness, and sleep disturbance 0-13: minimal; 14-19: mild; 20-28: moderate; 29-63: severe
	HADS ⁵	Seven questions for depression: 0-7: no; 8-10: mild; 11-14: moderate; 15-21: severe
Anxiety	STAI ^{6, 7}	40 items divided into 20 for state anxiety and 20 for trait anxiety. score >40: clinical anxiety
	GAD ¹	A 7-item questionnaire scored on a 0-3 Likert scale. 0-4: Minimal anxiety 5-9: Mild anxiety 10-14: Moderate anxiety 15-21: Severe anxiety
	HADS ⁵	Seven questions for anxiety: 0-7: no; 8-10: mild; 11-14: moderate; 15-21: severe
Stress	PRSR ⁷	23-item questionnaire, 5 subscales; rated 1 (not at all) to 5 (extremely characteristic); higher total scores indicate greater stress reactivity.
	SACL ⁸	Consists of 16 items to assess self-reported stress, where higher scores indicate greater stress levels.
	Online questionnaires ⁹	0 = no stress, 10 = extreme stress
Memory	BAS ¹⁰	Scores are normalized based on age to assess children's verbal reasoning, non-verbal reasoning, and spatial abilities.
	Digit span ^{7, 8}	Participants recall sequences of numbers in forward or backward order to assess working memory and attention; scored by the longest sequence correctly remembered.
	Corsi task ¹¹	Measures visuo-spatial working memory by requiring participants to replicate sequences of block taps, scoring based on the longest sequence correctly recalled.
	Free Recall Task ¹²	Participants viewed 20 words on a screen and later recalled them immediately and again after 40 minutes.
Attention	Audio-CPT ⁸	Participants responded to sequences of letters displayed on a computer screen, pressing the right button for 'AX' sequences and the left for others, with distractors and a high frequency of target trials to increase difficulty.

	Attentional dot-probe task ⁷	Respond to star probes after viewing emotional/neutral word pairs; 180 trials measuring reaction times and accuracy for attentional vigilance assessment.
	PVT ¹¹	A brief 3-minute version used to measure reaction time, errors of commission (false starts), and errors of omission (lapses)
	Focused Attention Task ¹²	Participants quickly pressed specific keys in response to central 'A' or 'B' letters while ignoring peripheral distracters.
	Repeated-Digits Vigilance Task ¹²	Identified and responded to repeated three-digit numbers shown at a high frequency, measuring their reaction times and accuracy over three minutes.
Intelligence	MDI ¹³	Evaluates infant cognition including sensory-perception, knowledge, memory, problem-solving, and early language skills.
	Self-rating scales ⁸	1-3: below usual status; 4: usual status; 5-7: indicated above usual status.
	Final exam score ¹	Final exam of assessing participants' subject knowledge
	RCPM ¹⁴	Non-verbal test with 36 picture-based questions across three difficulty levels (A, AB, B), assessing cognitive performance; scores categorized from "extremely low" to "very superior".

Abbreviations: PHQ-9: Patient Health Questionnaire-9 scale; BDI: Beck Depression Inventory; HADS: Hospital Anxiety and Depression Scale; STAI: State-Trait Anxiety Inventory; GAD: Generalized Anxiety Disorder scale; PRSR: Perceived Stress Reactivity Scale; SACL: Stress-arousal checklist; BAS: British Abilities Scales; Audio-CPT: Auditory continuous-performance test; PVT: Psychomotor vigilance test; MDI: Mental Development Index; RCPM: Raven's colored progressive matrices.

1. M. S. Karbownik, Ł. Mokros, M. Dobielska, M. Kowalczyk and E. Kowalczyk, Association Between Consumption of Fermented Food and Food-Derived Prebiotics With Cognitive Performance, Depressive, and Anxiety Symptoms in Psychiatrically Healthy Medical Students Under Psychological Stress: A Prospective Cohort Study, *Front Nutr*, 2022, 9, 850249.
2. S. S. Khayyatzadeh, A. Omranzadeh, M. M. Miri-Moghaddam, S. Arekhi, A. Naseri, A. Ziaee, L. Khajavi, F. Nejati Salehkhani, G. A. Ferns and M. Ghayour-Mobarhan, Dietary antioxidants and fibre intake and depressive symptoms in Iranian adolescent girls, *Public Health Nutr*, 2021, 24, 5650-5656.
3. O. G. Swann, M. Breslin, M. Kilpatrick, T. A. O'Sullivan, T. A. Mori, L. J. Beilin, A. Lin and W. H. Oddy, Dietary fibre intake and its associations with depressive symptoms in a prospective adolescent cohort, *Br J Nutr*, 2021, 125, 1166-1176.
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Supplement Fig. 1 Results of quality assessment of the includes intervention studies.

Young-Chul Chung M.D., 2012	Smith AP, 2015	Schmidt K 2015	Nabb SL, 2006	Jolice P. van den Berg, 2016	Johnstone N, 2021	Gruneck L 2022	Christine Hughes, 2011	Capitão LP, 2020	Brauchia M, 2014	
●	●	●	●	●	●	●	●	●	●	Random sequence generation (selection bias)
●	+	+	●	●	●	●	●	+	●	Allocation concealment (selection bias)
●	●	+	●	+	+	+	+	+	●	Blinding of participants and personnel (performance bias)
+	?	+	?	+	+	+	+	+	?	Blinding of outcome assessment (detection bias)
+	+	+	+	+	+	+	+	+	+	Incomplete outcome data (attrition bias)
+	+	+	+	+	●	+	+	+	+	Selective reporting (reporting bias)
+	+	+	+	+	+	+	+	+	+	Other bias

Supplement Table 4. Results of quality assessment of the includes observational studies.

References	1	2	3	4	5	6	7	8	9	10	11
Cross-sectional studies											
Kelsey M. Hassevoort 2020	yes	yes	yes	yes	yes	yes	yes	yes	\	\	\
Sayyed Saeid Khayyatzadeh 2020	yes	yes	unsure	yes	yes	yes	yes	yes	\	\	\
Sehrish Naveed 2020	yes	yes	yes	yes	yes	yes	yes	yes	\	\	\
Naiman A Khan 2014	unsure	unsure	yes	yes	yes	yes	yes	yes	\	\	\
Atiah M. Meli 2023	yes	yes	yes	yes	yes	yes	yes	yes	\	\	\
Max J. L. 2021	yes	yes	yes	unsure	yes	yes	no	yes	\	\	\
Case-control study											
Tae-Hee Kim MD 2015	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	\
Cohort studies											
Anett Nyaradi 2013	no	yes	no	yes	yes	no	yes	yes	no	no	yes
Olivia G. Swann 2021	unsure	yes	yes	yes	yes	no	yes	yes	no	no	yes
Michał Seweryn Karbownik 2022	unsure	yes	yes	yes	yes	no	yes	no	yes	yes	yes

Cross-sectional studies:

1. Were the criteria for inclusion in the sample clearly defined? 2. Were the study subjects and the setting described in detail? 3. Was the exposure measured in a valid and reliable way? 4. Were objective, standard criteria used for measurement of the condition? 5. Were confounding factors identified? 6. Were strategies to deal with confounding factors stated? 7. Were the outcomes measured in a valid and reliable way? 8. Was appropriate statistical analysis used?

Case-control study:

1. Were the groups comparable other than the presence of disease in cases or the absence of disease in controls?
2. Were cases and controls matched appropriately?
3. Were the same criteria used for identification of cases and controls?
4. Was exposure measured in a standard, valid and reliable way?
5. Was exposure measured in the same way for cases and controls?
6. Were confounding factors identified?
7. Were strategies to deal with confounding factors stated?
8. Were outcomes assessed in a standard, valid and reliable way for cases and controls?
9. Was the exposure period of interest long enough to be meaningful?
10. Was appropriate statistical analysis used?

Cohort studies:

1. Were the two groups similar and recruited from the same population?
2. Were the exposures measured similarly to assign people to both exposed and unexposed groups?
3. Was the exposure measured in a valid and reliable way?
4. Were confounding factors identified?
5. Were strategies to deal with confounding factors stated?
6. Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure)?
7. Were the outcomes measured in a valid and reliable way?
8. Was the follow up time reported and sufficient to be long enough for outcomes to occur?
9. Was follow up complete, and if not, were the reasons for loss to follow up described and explored?
10. Were strategies to address incomplete follow up utilized?
11. Was appropriate statistical analysis used?

Supplement Table 5. The association between dietary fibre consumption and mental and cognitive outcomes.

Certainty assessment							Effect	Certainty	Importance
No of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Relative (95% CI)		

Association between dietary fiber consumption and depression

5	observational studies	not serious	not serious	not serious	not serious	none	OR 0.51(0.38 to 0.69)	⊕⊕○○ LOW	CRITICAL
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Association between dietary fiber consumption and anxiety

2	observational studies	not serious	not serious	not serious	serious	none	OR 0.80(0.50 to 1.29)	⊕○○○ VERY LOW	CRITICAL
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Association between dietary fiber consumption and intelligence

2	observational studies	not serious	not serious	not serious	serious	none	OR 0.81(0.48 to 1.37)	⊕○○○ VERY LOW	CRITICAL
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Association between dietary fiber consumption and stress

3	randomized controlled trial	serious	not serious	not serious	serious	none	SMD 0.03 (-0.21 to 0.28)	⊕○○○ Very Low	CRITICAL
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Association between dietary fiber consumption and anxiety

2	randomized controlled trial	not serious	not serious	not serious	serious	none	SMD -0.23 (-0.72 to 0.27)	⊕⊕○○ Low	CRITICAL
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Association between dietary fiber consumption and memory

5	randomized controlled trial	not serious	serious	not serious	serious	none	SMD -0.35 (-1.08 to 0.38)	⊕○○○ Very Low	CRITICAL
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Association between dietary fiber consumption and intelligence

2	randomized controlled trial	serious	not serious	not serious	serious	none	SMD -0.31 (-0.69 to 0.08)	⊕○○○ Very Low	CRITICAL
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Association between dietary fiber consumption and attention

3	randomized controlled trial	not serious	serious	not serious	serious	none	SMD -2.72 (-6.30 to 0.86)	⊕○○○ Very Low	CRITICAL
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Abbreviations: CI: Confidence interval; OR: Odds ratio

Supplement Table 6. Prisma 2020 checklist.

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Page 1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Page 1
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Page 1
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Page 2
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Page 2
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Page 2
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Page 2
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Page 2
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Page 2
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Page 2
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Page 2
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Page 2-3
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Page 3
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Page 3
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Page 3

Section and Topic	Item #	Checklist item	Location where item is reported
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Page 3
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Page 3
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	Page 3
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	Page 3
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Page 3
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Page 3
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Page 3-4
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Page 3
Study characteristics	17	Cite each included study and present its characteristics.	Page 4
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Page 4
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Page 4-7
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Page 4-6
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Page 4-7
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Page 5
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	Page 6
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Page 6
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Page 4-6
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Page 6-7

Section and Topic	Item #	Checklist item	Location where item is reported
	23b	Discuss any limitations of the evidence included in the review.	Page 7-8
	23c	Discuss any limitations of the review processes used.	Page 7-8
	23d	Discuss implications of the results for practice, policy, and future research.	Page 8
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Page 2
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	NA
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	NA
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Page 8
Competing interests	26	Declare any competing interests of review authors.	Page 8
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	ESI

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. doi: 10.1136/bmj.n71