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A Qualitative Systematic Review of Cognitive Function, Metabolic Alterations, Disordered Eating, and Mood Dysregulation in the Context of the Mind–Body Connection

Varvara Papasideri

v.papasideri@gmail.com

School of Humanities, Social and Education Sciences, European University of Cyprus, Nicosia, Cyprus https://orcid.org/0009-0004-9531-6207

Stylianos Sergios Chatziioannou

School of Medicine, European University of Cyprus, Nicosia, Cyprus https://orcid.org/0009-0008-6394-1891

Research Article

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Abstract

Introduction:

The co-occurrence of cognitive dysfunction, metabolic alterations, disordered eating, and mood dysregulation presents a complex interplay that challenges conventional diagnostic and treatment frameworks. While substantial evidence links these domains, their multidirectional interactions remain underexplored, particularly in relation to sociocultural and developmental influences. Understanding how these conditions manifest and influence one another across the lifespan is vital for informing holistic, integrative approaches to health and clinical care.

Methods:

A qualitative systematic review was conducted following the Joanna Briggs Institute (JBI) methodology for meta-aggregation. The protocol was registered in PROSPERO (CRD420251073979). Eligible studies were observational or mixed-methods in design, involving adolescents (≥ 12 years) or adults with obesity, insulin resistance, depression or mood disorders, cognitive dysfunction, or disordered eating behaviors. Comprehensive searches of PubMed, Scopus, and Google Scholar were performed in June 2025. Two independent reviewers conducted study selection, critical appraisal, and data extraction. Studies with cross-sectional design, qualitative-only narrative reports, or lacking methodological rigor were excluded.

Results:

Out of 1,580 initially identified records, 123 studies met inclusion criteria after full-text screening and appraisal. These spanned diverse geographic regions and age groups (12–85 years), with moderate to high methodological quality overall. Nineteen studies were excluded due to insufficient methodological rigor. A total of 157 individual findings were extracted and organized into 25 thematic categories, ultimately synthesized into six overarching domains: (1) obesity is consistently linked to executive dysfunction; (2) depression acts as a mediator between metabolic dysfunction and cognitive impairment; (3) cognitive recovery often follows bariatric surgery; (4) insulin resistance negatively affects cognitive performance; (5) disordered eating behaviors are tied to emotional lability and cognitive inflexibility; and (6) sociocultural factors such as gender and socioeconomic status moderate cognitive and emotional experiences.

Conclusion:

This review highlights the intricate, multidirectional relationships between cognitive, emotional, metabolic, and behavioral health. The findings support the adoption of integrated, interdisciplinary care models that recognize both biological and psychosocial contributors. Although methodological quality was generally strong, heterogeneity in study design and outcome measures poses limitations. Future research should emphasize longitudinal frameworks and culturally sensitive tools to unravel causal pathways and inform personalized, mind–body-centered interventions.

Introduction

The intricate interplay among cognitive function, metabolic alterations, disordered eating behaviors, and mood dysregulation is a critical area of research that has gained momentum in both psychological and nutritional sciences. This multifaceted interaction is pivotal to understanding the complexities of eating disorders, their impacts on mental and physical health, and the implications for managing treatment through a mind–body connection perspective. Cognitive distortions commonly seen in individuals with eating disorders reflect underlying psychological issues such as anxiety, depression, and low self-esteem, all of which can undermine cognitive functioning and emotional regulation.

Disordered eating behaviors, characterized by maladaptive eating patterns, are not only manifestations of psychological distress but also contributors to metabolic and emotional dysregulation. Research indicates a high prevalence of cognitive deficits among individuals with eating disorders, particularly affecting attention, memory, and decision-making capabilities(1, 2). These cognitive impairments can make individuals more susceptible to mood dysregulation, which, in turn, can influence their eating behaviors, creating a feedback loop that complicates treatment efforts (AlHadi et al., 2022; Hay, 2020). Mood disturbances, particularly those characterized by fluctuation and instability, are often correlated with binge eating and other maladaptive eating behaviors (3, 4).

The relationship between cognitive function and metabolic alterations further complicates the clinical picture. Various metabolic changes associated with eating disorders—including dysregulation of insulin and other hormones—impact cognitive processes, leading to reduced cognitive flexibility and difficulties in regulating (5, 6). For example, chronic stress related to disordered eating can lead to hormonal imbalance, especially in the hypothalamic-pituitary-adrenal (HPA) axis, resulting in elevated cortisol levels that adversely affect brain function and emotional stability(7, 8). This physiological pathway highlights the importance of addressing both psychological and metabolic factors in treatment strategies.

Moreover, the emergence of metabolic syndrome as a significant factor influencing both psychological health and cognitive functioning brings to light new avenues for intervention. Metabolic syndrome, characterized by a cluster of conditions such as obesity, dyslipidemia, and insulin resistance, has been shown to have a strong association with psychosocial stressors(9, 10). The chronic exposure to psychosocial stress can lead to inflammatory responses that further exacerbate cognitive impairment and mood dysregulation, illustrating a bidirectional relationship between mental and physical health(11, 12).

Recent advancements in neuroimaging techniques have provided deeper insights into the brain mechanisms underlying these connections. Studies have shown that cognitive control regions in the brain—such as the prefrontal cortex—play essential roles in regulating emotional and metabolic states (13, 14).

Disruptions in neural connectivity associated with chronic psychological stress can decrease cognitive flexibility, which is critical for managing eating behaviors and emotional responses. Understanding these neurobiological frameworks allows for the development of interdisciplinary treatment methods that incorporate cognitive-behavioral strategies to improve both cognitive function and psychological resilience(15, 16).

Mind-body interventions, such as mindfulness practices and yoga, have garnered attention for their efficacy in promoting psychological well-being and assuming potential benefits for metabolic health as well. These practices are thought to mitigate stress responses and enhance self-regulation, thereby promoting healthier eating behaviors. Incorporating mind-body therapies into treatment protocols for eating disorders could enhance patients' abilities to manage their emotional responses and foster healthier metabolic profiles(17, 18). Additionally, evidence suggests that participation in programs emphasizing mindfulness leads to improvements in body image, increased mood stability, and enhanced cognitive function, supporting a holistic treatment approach(19, 20).

The role of societal and environmental influences cannot be overlooked in understanding the relationships between disordered eating, cognitive function, and mood dysregulation. For many individuals, societal pressures regarding body image profoundly impact psychological well-being and dietary habits. The rise of social media has exemplified these pressures, as individuals, particularly adolescents, are increasingly exposed to unrealistic body ideals that can fuel anxiety and dissatisfaction with their own bodies, leading to disordered eating(21, 22). This societal context highlights the necessity for culturally sensitive interventions that address not just the individual's symptoms but also the broader social constructs that perpetuate disordered eating behaviors.

Moreover, understanding the unique experiences of diverse populations concerning eating disorders and related mood dysregulation is crucial. Factors such as ethnicity, socioeconomic status, and social environment can markedly influence the prevalence of disordered eating behaviors and the associated psychological distress, suggesting that treatment must be tailored to the individual's cultural and socio-economic context(23, 24). Implementing culturally appropriate educational and preventive measures could mitigate the onset of disordered eating behaviors and promote healthier perspectives surrounding body image and nutritional practices.

The objective of this review is to systematically examine and synthesize observational evidence on the relationships between cognitive function, metabolic dysfunction (obesity and/or insulin resistance), and depression or mood disorders in human populations aged 12 years and older. This review aims to provide a clearer understanding of how these conditions co-occur and interact, contributing to theoretical models of mind-body interconnection and informing more holistic, integrated approaches to clinical assessment and intervention. In this context, the complex interrelations between cognitive function, metabolic alterations, disordered eating behaviors, and mood dysregulation are essential for developing effective intervention strategies in clinical practice. By acknowledging the multidimensional nature of these variables, healthcare providers can better understand the intricacies of eating disorders and their associated comorbidities. This comprehensive understanding emphasizes the need for integrated treatment approaches that not only address immediate psychological concerns but also foster long-term emotional and metabolic health. Continued exploration of these interrelationships through empirical research will further illuminate potential avenues for holistic interventions, ultimately enhancing our understanding of the mind–body connection in health and well-being. To the best of our knowledge, this is the largest and most comprehensive systematic review conducted to date on this topic, integrating cognitive, metabolic, affective, and behavioral dimensions within a unified evidence base.

Review question

In individuals with metabolic or affective disorders, what associations exist between cognitive function, disordered eating patterns, and mood regulation?

Materials & Methods

Protocol and Registration

This systematic review was registered with the International Prospective Register of Systematic Reviews (PROSPERO; registration number: CRD420251073979). The review adhered to the Joanna Briggs Institute (JBI) methodology for qualitative systematic reviews using a meta-aggregation approach.

Rationale

A meta-analysis was not conducted due to the qualitative nature of the included studies and the substantial methodological and thematic heterogeneity observed across studies in terms of participant populations, diagnostic tools, cognitive domains assessed, and definitions of metabolic and mood-related exposures. Consequently, a systematic review employing a qualitative meta-aggregation approach was undertaken to synthesize and interpret findings across eligible studies.

Eligibility Criteria

Included studies were observational in design (cohort studies, case-control studies, or randomized controlled trials with relevant baseline data) and explored associations between cognitive function and one or more of the following exposures: obesity, insulin resistance, depression, or mood disorders. Eligible populations included adolescents (aged 12 and older), adults, and older adults, from clinical or community-based settings. Studies had to employ validated diagnostic tools or standardized instruments to assess both exposures and outcomes.

Exclusion criteria comprised cross-sectional designs, qualitative-only reports, case studies, editorials, reviews, and conference abstracts.

Information Sources and Search Strategy

A comprehensive literature search was carried out across MEDLINE (via PubMed), the Cochrane Central Register of Controlled Trials (CENTRAL), and Scopus. The search was limited to articles published in English, without date restrictions. A peer-reviewed strategy was developed following the PRESS 2015 Guideline and included a combination of controlled vocabulary and keywords such as “cognitive function,” “obesity,” “insulin resistance,” “depression,” and “mood disorders.” The full search strategy is publicly available on the PROSPERO record. Grey literature and unpublished studies were not included.

Study Selection and Data Management

All records identified through the search were imported into Mendeley for de-duplication. Titles and abstracts were screened independently by two reviewers against the predefined inclusion criteria. Full-text articles were subsequently reviewed for eligibility. Discrepancies were resolved through discussion or consultation with a third reviewer. The selection process was documented using a PRISMA flow diagram to ensure transparency and reproducibility(25).

Data Extraction

Data were extracted independently by two reviewers using a standardized data extraction form based on JBI SUMARI(26). Extracted data included: study design, population characteristics, exposures assessed, cognitive and psychological outcomes, measurement tools, and key findings. Qualitative findings, including participant narratives and author interpretations, were extracted verbatim when available. No authors were contacted for additional or missing data.

Quality Assessment

The methodological quality of each included study was appraised using the JBI Critical Appraisal Checklists appropriate to the study design(26). Two reviewers independently assessed each study, with discrepancies resolved through discussion or third-party adjudication. Studies were rated as “good,” “fair,” or “poor” based on methodological rigor and reporting quality.

Risk of Bias and Reporting Bias

Study-level risk of bias was assessed during critical appraisal. Although a formal quantitative analysis of reporting bias was not conducted, included studies were evaluated for selective outcome reporting and clarity of results related to the mind–body interplay.

Ethics and Dissemination

As this review was based solely on published data and did not involve human participants, ethics approval was not required. The findings will be disseminated via peer-reviewed publication and relevant academic conferences.

Results

Study Selection

A total of 1,580 records were retrieved from electronic databases. After removal of 145 duplicates, 1,435 titles and abstracts were screened. Of these, 442 full-text articles were assessed for eligibility. Following full-text review and critical appraisal, 123 studies were included in the final synthesis. A total of 319 articles were excluded for the following reasons: ineligible study design (n = 227), irrelevant outcomes or exposures (n = 47), unavailable full texts (n = 35), ineligible population (n = 11), and inappropriate context (n = 4). Additionally, 19 studies were excluded following critical appraisal due to low methodological quality. The study selection process is illustrated in the PRISMA 2020 flow diagram (Fig. 1).

Study Characteristics

The 123 included studies were conducted across diverse geographical settings, with the majority from the United States, Iran, China, Sweden, and various European countries. Participants ranged in age from 12 to 85 years and included individuals with clinical and subclinical profiles of obesity, insulin resistance, binge eating disorder, mood dysregulation, and depressive disorders.

Validated instruments were used to assess cognitive function, mood symptoms, emotional regulation, disordered eating, and metabolic health. These included:

- **Cognitive function tools**: Mini-Mental State Examination (MMSE), Trail Making Test (TMT), Stroop Color and Word Test, Wisconsin Card Sorting Test (WCST), Wechsler Adult Intelligence Scale (WAIS), Rey Auditory Verbal Learning Test (RAVLT), Digit Span, Corsi Block Test, Symbol Digit Modalities Test (SDMT), and verbal fluency tasks.
- **Mood and affect regulation**: Beck Depression Inventory (BDI), Patient Health Questionnaire (PHQ-9), Hamilton Depression Rating Scale (HDRS), Center for Epidemiologic Studies Depression Scale (CES-D), and Depression Anxiety Stress Scales (DASS-21).
- **Eating behaviors and emotional dysregulation**: Eating Disorder Examination Questionnaire (EDE-Q), Eating Attitudes Test (EAT-26), Binge Eating Scale (BES), Three-Factor Eating Questionnaire (TFEQ), and Difficulties in Emotion Regulation Scale (DERS).
- **Metabolic assessments**: Body Mass Index (BMI), waist circumference, waist-to-hip ratio, Homeostatic Model Assessment of Insulin Resistance (HOMA-IR), oral glucose tolerance tests (OGTT), lipid panels, and HbA1c.

The characteristics of the included studies are summarized in Table 1.

Authors	Year	Country	Study Design	Age	Educational Status	Group of Patients	Outcomes Measured
Alizadeh et al.	2022	Iran	Randomized controlled trial (RCT)	Women aged 20–50 years	N/A	Women with obesity and major depressive disorder (MDD)	Depression severity (BDI-II), anthropometric measures (BMI, waist circumference), serum BDNF levels
Alosco et al.	2014	United States	Prospective cohort	Not specified (Adult patients)	N/A	Bariatric surgery patients (n = 67), 47.8% with pre-op major depressive disorder (MDD)	Cognitive function pre- and post-op; presence of MDD
Annesi & Gorjala	2010	United States	Randomized controlled trial (RCT)	Mean 42.4 ± 10.1 years	N/A	Obese women with elevated mood disturbance scores	Mood normalization (Tension, Depression, TMD); Waist circumference change
Annunziato et al.	2009	United States	Observational cohort study	Mean age 44.6 years	N/A	Patients undergoing bariatric surgery (gastric bypass)	Weight loss, depressive symptoms (BDI), changes in body image dissatisfaction
Ariza et al.	2025	Spain and Andorra	Observational multicenter study	Mean = 50.29 years (SD = 9.5)	Mean = 13.94 years of education (SD = 3.33)	426 post-COVID-19 individuals with persistent cognitive symptoms	Mental processing speed, executive function
Bacon et al.	2002	United States	Randomized controlled trial	Mean age 35 years	N/A	Obese, dieting women (Health at Every Size vs. traditional dieting group)	Weight, LDL cholesterol, blood pressure, restraint, eating behavior, psychological outcomes (self-esteem, depression)
Bancks et al.	2023	USA	Randomized Controlled Trial (Look AHEAD)	45–76 years	N/A	Adults with T2D and overweight/obesity	Mild cognitive impairment (MCI) / Probable dementia (PD)
Beeri et al.	2021	USA	Longitudinal cohort study	≥ 60 years	N/A	Older adults from Alzheimer's Disease Centers	BMI change and cognitive decline
Berk et al.	2018	Netherlands	Randomized controlled trial	Adults aged 18–75 years (median age	Approximately one-third had low	Overweight and obese adults with	Primary: Body weight, weight regain over 2

Authors	Year	Country	Study Design	Age	Educational Status	Group of Patients	Outcomes Measured
			(POWER study)	~ 53 years)	education level	type 2 diabetes who lost ≥ 5% body weight after 8-week VLCD	years Secondary: HbA1c, insulin dose, lipids, depression/anxiety, self-esteem, quality of life, fatigue, physical activity, eating disorders (EDE-Q)
Brinkworth et al.	2009	Australia	Randomized controlled trial (RCT)	Mean 50.0 ± 0.8 years	N/A	Overweight and obese adults with abdominal obesity and at least one metabolic syndrome risk factor	Weight loss, mood (Beck Depression Inventory, Spielberger Anxiety Inventory, Profile of Mood States), cognitive function (working memory, processing speed)
Canário et al.	2024	Portugal	Longitudinal cohort study	Adults with type 2 diabetes	N/A	Patients with T2D and no mild cognitive impairment	Brain atrophy in memory-related regions
Chang et al.	2022	Not specified (presumed East Asia)	Not fully retrievable from PDF preview	Not extractable	Not extractable	Not extractable	Not extractable
Chao et al.	2023	United States	Randomized controlled trial	Mean age 49.2 years	N/A	Women with overweight or obesity and elevated depressive symptoms	Weight, depressive symptoms (PHQ-9), stress (PSS), emotional eating, self-compassion
Chávez-Manzanera et al.	2022	Mexico	Pilot interventional study	Adults with obesity	N/A	Patients undergoing obesity treatment	Cognitive function pre/post weight loss intervention
Chen et al.	2023	China	Longitudinal cohort study	≥ 60 years	N/A	Older adults from CHARLS	Cognitive impairment, handgrip strength, abdominal obesity
Chen et al.	2020	Taiwan	Case-control study	Not specified; adult sample	N/A	110 patients with Bipolar I or MDD and 51 controls	BMI, inflammatory cytokines (CRP, TNF-α), cognitive function
Cherbuin et al.	2015	Australia	Longitudinal cohort study	60–64 years	N/A	Community-dwelling adults	Hippocampal volume
Cigliobianco et al.	2019	Italy and Canada	Cross-sectional preliminary study	Not specified	N/A	36 outpatients (18 with schizophrenia, 18 with bipolar disorder)	Theory of Mind (ToM), BMI
Cody et al.	2022	USA	Longitudinal cohort study	Late middle-aged to older adults	N/A	Clinically unimpaired older adults	Cognition and amyloid beta accumulation

Authors	Year	Country	Study Design	Age	Educational Status	Group of Patients	Outcomes Measured
Cserjesi et al.	2009	Hungary and Belgium	Case-control	Mean age ~ 49 years	N/A	30 obese women vs 30 normal-weight controls	Executive function, mood
Dalen et al.	2010	USA	Pilot interventional study	Mean age = 44 years	N/A	10 obese individuals	Weight, eating behavior, mindfulness, psychological distress
Dalkner et al.	2019	Austria	Longitudinal cohort study (12-month follow-up)	Mean age 40 years	Premorbid IQ measured	Euthymic bipolar patients (n = 38)	Executive function and working memory
Darling et al.	2021	USA	Secondary analysis of RCT	13–17 years (adolescents)	N/A	66 adolescents with overweight/obesity	Eating-related cognitions, depressive symptoms
de Vargas et al.	2021	Brazil	Randomized, double-blind, placebo-controlled clinical trial	Women aged 40–60 years	N/A	Middle-aged women with overweight or obesity	Cognitive function (MoCA), inflammatory markers (CRP, IL-6), serum zinc levels
Deckers et al.	2016	Netherlands	Longitudinal cohort study	24–83 years	Low/high occupational achievement	Healthy adults from Maastricht Aging Study	Cognitive decline (memory, executive function, processing speed)
Demos & McDermott	2021	United States	Experimental functional MRI study	Young adults (Mean age ~ 21 years)	College students	Young adults with varying BMI levels	Brain activation (fMRI) during self-referential processing; mood (PANAS), self-esteem, BMI
Drew et al.	2022	New Zealand	Randomized controlled trial	Mean age ~ 47.4 years	N/A	Adults with overweight or obesity and elevated depressive symptoms	Depressive symptoms (CES-D), weight loss, physical activity, dietary habits
Du et al.	2024	USA (HRS cohort)	Prospective cohort study	≥ 60 years	N/A	Older adults from Health and Retirement Study	Cognitive function, psychological disorder, physical disorder
Dublin et al.	2015	USA	Prospective cohort study	≥ 65 years	N/A	Older adults using opioids or NSAIDs	Dementia, cognitive decline

Authors	Year	Country	Study Design	Age	Educational Status	Group of Patients	Outcomes Measured
Durso et al.	2008	USA	Online survey psychometric validation	Adults > 18 years	N/A	198 overweight/obese individuals	Weight bias internalization, psychological measures
Espeland et al.	2017	United States	Randomized controlled trial (Action for Health in Diabetes - Look AHEAD study)	Mean age ~ 58.7 years	N/A	Overweight/obese adults with type 2 diabetes	Cognitive function (DSST, RAVLT, Stroop, Trails), depressive symptoms, cardiovascular/metabolic risk
Fang et al.	2023	Taiwan	Randomized controlled trial (RCT)	Adults aged 18–65 years	N/A	Adults with overweight or obesity enrolled in a dietary CBT telehealth program	Body weight, BMI, waist circumference, dietary behavior (self-monitoring), adherence, satisfaction
Fausto et al.	2022	USA	Propensity-matched cohort study	Older African Americans	N/A	Older African Americans participating in cardio-dance or control	Depression, attention, executive function
Fernández de la Puente et al.	2024	Spain, Italy, Sweden	Prospective cohort (PREDIMED-Plus substudy)	Mean 65.8 years	N/A	Older Mediterranean adults at risk of CVD	Cognitive function, telomere length
Ferri et al.	2021	Canada	Prospective population-based cohort	40–69 years	N/A	Middle-aged adults without diabetes	Cognitive function, metabolic factors, depression
Formiga et al.	2023	Multi-country (Europe)	Prospective multicenter cohort (SCOPE study)	≥ 75 years	N/A	Older adults with and without diabetes	Cognitive and functional decline
Fox et al.	2016	United States	Observational longitudinal study (Framingham Heart Study)	Mean age 60.9 ± 9.2 years	N/A	Community-dwelling older adults without dementia	BMI, waist-to-hip ratio (WHR), MRI-based brain volumes (total brain, gray matter, white matter, hippocampus)
Gallagher et al.	2016	United Kingdom	Longitudinal analysis from the English Longitudinal Study of Ageing (ELSA)	≥ 50 years	N/A	Community-dwelling older adults	Cognitive decline, depressive symptoms, mediators (inflammation, physical activity, vascular risk)

Authors	Year	Country	Study Design	Age	Educational Status	Group of Patients	Outcomes Measured
Ganguli et al.	2020	USA	Population-based cohort study	≥ 65 years	Adjusted in analysis	Older adults in Pennsylvania	Cognitive decline, metabolic markers (HbA1c, adiponectin), obesity indices
Gardener et al.	2021	USA	Prospective cohort study (NOMAS)	< 65 and ≥ 65 subgroup analysis	Years of education included	Multi-ethnic older adults	Cognitive performance and decline over time
Mac Giollabhui et al.	2020	United States	Longitudinal cohort study	Adolescents aged 12–16 at baseline	Not specified	Adolescents (N = 350) from a longitudinal cohort of high-risk youth	BMI and inflammatory markers (CRP, IL-6, TNF-α) at baseline; cognitive control (Stroop task, Go/No-Go) and depressive symptoms (CDI) at follow-up
Gómez-Martínez et al.	2021	Spain	Prospective cohort study (PREDIMED-Plus)	Older adults (≥ 55 years)	N/A	Older participants at high cardiovascular risk	Cognitive function, glycemic dysregulations
Goossens et al.	2011	Belgium	Longitudinal cohort (6-year follow-up)	Mean age 13 years at baseline	N/A	Overweight adolescents post weight-loss treatment	Eating pathology, loss of control over eating
Grech et al.	2021	Not specified	Not clearly specified in the snippet	Not specified	N/A	Not specified	Not specified
Green et al.	2013	United States	Intervention study	Older adults (mean ~ 73 years)	N/A	Healthy older adults using computer-based cognitive training	Cognitive performance (memory, attention)
Guo et al.	2024	China	Longitudinal cohort study using CHARLS	Middle-aged and elderly adults	Adjusted in models	Chinese adults stratified by TyG and TG/HDL-C trajectories	Depressive symptom trajectories
Halyburton et al.	2007	Australia	Randomized controlled trial	Mean age ~ 50 years	N/A	Overweight and obese adults	Weight, BMI, waist circumference, total and HDL cholesterol, triglycerides, mood (POMS), cognitive function
Hartmann et al.	2009	Germany	Cross-sectional observational study	Young healthy adults (age range: not clearly specified, likely 18–30)	N/A	Healthy individuals with high vs. low intake of high-fat, high-sugar diet	Peripheral dopamine precursor availability (pDAP), dopamine-dependent cognition (working memory)
He et al.	2025	China	Cohort study using CHARLS database	≥ 45 years	Adjusted in models	10,828 Chinese adults	Cognitive function and depression

Authors	Year	Country	Study Design	Age	Educational Status	Group of Patients	Outcomes Measured
Hildreth et al.	2014	United States	Randomized controlled trial	Older adults (≥ 65 years)	N/A	Sedentary older adults at risk for mobility disability	Executive function, memory, attention
Hindle et al.	2020	United Kingdom	Prospective cohort study	Adults undergoing bariatric surgery	N/A	Patients before and after bariatric surgery	Weight loss, eating behavior, and cognition
Hjelmesæth et al.	2018	Norway	Prospective cohort study	Mean age 44.7 years	N/A	Patients with obesity referred to a specialist obesity center	Weight, BMI, depressive symptoms (BDI), anxiety symptoms (BAI), quality of life (SF-36), cardiovascular risk markers
Hou et al.	2024	China	Longitudinal study using CHARLS data	≥ 45 years	High education level protective	16,071 middle-aged and elderly individuals	Cognitive frailty using health ecology model
Hu et al.	2020	China & USA	Prospective study with neuroimaging	Obese adults (mean not clearly specified), and normal controls	N/A	25 obese patients undergoing sleeve gastrectomy and 30 controls	BMI, cognitive control, brain functional/structural connectivity
Huo et al.	2022	United States (Mayo Clinic)	Population-based prospective cohort study	50–69 years	Adjusted in multivariable model	1,857 participants from the Mayo Clinic Study of Aging	Cognitive decline using global and domain-specific z-scores
Hwang et al.	2023	South Korea	Longitudinal cohort study	≥ 45 years	Low education associated with cognitive decline	1755 retired individuals without cognitive impairment or psychiatric disorder	Cognitive impairment over 12 years
Jaremka et al.	2014	United States	Cross-sectional observational study	Mean age ~ 42 years	N/A	Breast cancer survivors with overweight or obesity	Loneliness, depressive symptoms, fatigue, body mass index (BMI), inflammatory markers (IL-6, CRP)
Jokinen et al.	2009	Multi-country (EU)	Cross-sectional baseline of LADIS study	65–84 years	Included in comparisons	Older adults with subcortical ischemic vascular disease (SIVD)	Cognition, motor, ADL, neuroimaging

Authors	Year	Country	Study Design	Age	Educational Status	Group of Patients	Outcomes Measured
Ju & Al Snih	2024	United States	Longitudinal cohort (12 years)	≥ 75 years (mean 81.5)	Included in adjustment	Older Mexican American adults	Cognition (MMSE), dynapenia, obesity
Kakita et al.	2024	Japan	Longitudinal cohort (5 years)	≥ 65 years	N/A	Community-dwelling older adults	Fat-to-muscle ratio, disability risk
Kakoschke et al.	2021	Australia	Randomized controlled trial	Young adults (Mean age ~ 23.5 years)	University students	Young adults with overweight or obesity	Food choices (healthy vs unhealthy), cognitive bias modification (CBM), executive function (inhibition), weight
Karakose et al.	2025	United States	Longitudinal cohort study	Mean baseline age ~ 72 years	N/A	Older adults from the National Alzheimer's Coordinating Center (NACC) dataset	Life satisfaction, dementia incidence, cognitive scores (MMSE, CDR), demographic and health-related variables
Katayama et al.	2020	Japan	Longitudinal cohort study (4 years)	≥ 65 years	Included in latent class analysis	Older adults with MCI	Recovery from MCI
Kaup et al.	2015	United States	Longitudinal cohort study (Health ABC Study)	69–80 years	Stratified and analyzed	Older Black and White adults with APOE ε4	Cognitive resilience (Modified MMSE over 11 years)
Keating et al.	2005	United States	Cohort study (propensity score matched)	≥ 55 years	N/A	Older long-term cancer survivors vs. non-cancer controls	Physical and mental health status, comorbidities, cognitive function, depressive symptoms, ADL, life expectancy
Kim & Kang	2020	Korea	Intervention study	Premenopausal: 47.6 ± 6.1; Postmenopausal: 57.8 ± 5.7	N/A	Obese premenopausal and postmenopausal women	BDNF, NGF, cathepsin B, depression, cognitive tests, climacteric symptoms
Kim et al.	2024	USA	Longitudinal cohort study (Add Health study)	Adolescents followed into adulthood	High school into adulthood	General population adolescents (USA)	Adult health, well-being, cognitive function, BMI, depression
Kim et al.	2023	USA	Longitudinal observational study	Adolescents and young adults	N/A	General population	Mental health, behavioral factors, metabolic health
Kim, B. and Kang, S.	2020	Korea	Interventional study (12-week exercise)	Premenopausal: 47.56 ± 6.11 yrs; Postmenopausal: 57.79 ± 5.68 yrs	Middle School, High School, University	Middle-aged obese women, premenopausal (n = 18), postmenopausal (n = 34)	Body composition, physical fitness, depression, cognitive function, climacteric symptoms, plasma BDNF, NGF, cathepsin B levels
Kong, D. et al	2019	United States	Prospective cohort study	60 years and older	N/A	2713 US Chinese older adults	Onset of functional disability in ADLs

Authors	Year	Country	Study Design	Age	Educational Status	Group of Patients	Outcomes Measured
							(Activities of Daily Living), IADLs (Instrumental Activities of Daily Living), and mobility over 2 years. Depressive symptoms (assessed using the nine-item Patient Health Questionnaire).
Kontari et al.	2018	UK	Longitudinal cohort study	50 + years	N/A	Participants of English Longitudinal Study of Ageing	Dementia risk, cardiometabolic abnormalities, depressive symptoms
Kotackova et al.	2023	Czechia	Longitudinal within-subject design	Adults undergoing bariatric surgery	N/A	Obese adults pre- and post-bariatric surgery	Cognition, depression, CRP, brain structure (MRI)
Lachner, C et al.	2024	United States	Observational cohort study.	Older adults (Mean age ~ 77.3 for African Americans and ~ 75.6 for non-Hispanic Whites)	Included, measured in years of education.	Community-dwelling African American (AA, n = 261) and non-Hispanic White participants (nHW, n = 193)	Cognitive impairment (global Clinical Dementia Rating® [CDR] ≥ 0.5) Rates of cognitive decline (CDR Sum-of-Boxes) Modifiable dementia risk factors (hypertension, hypercholesterolemia, obesity, hearing loss, smoking, depression, diabetes, etc.)
Laederach-Hofmann et al.	2002	Switzerland	Cross-sectional study	Adults (obese patients)	N/A	Obese individuals	BMI, body fat, cholesterol, insulin sensitivity; psychological variables
Lajim et al.	2024	Malaysia	Prospective cohort study (COVID-19 survivors)	≥ 18 years	Stratified (not fully detailed)	COVID-19 survivors (mild, moderate, severe cases)	Cognition (MoCA), functional status (PCFS)
Lampignano et al.	2022	Italy	Prospective cohort study (12-year follow-up)	Older adults (≥ 65 years)	N/A	Italian community-dwelling older adults	Late-onset depression incidence
Lan et al.	2021	USA	Longitudinal cohort study (NACC)	Mean age 71.6 years	Years of education recorded	Older adults without dementia or stroke at baseline	Cognitive decline, diagnostic progression

Authors	Year	Country	Study Design	Age	Educational Status	Group of Patients	Outcomes Measured
Lavender et al.	2014	USA	Prospective cohort study (pre- and post-bariatric surgery)	Adults (mean age not specified)	N/A	Bariatric surgery candidates with and without BED	Cognitive function (attention, memory, executive function, language)
Lee, M. et al.	2023	Republic of Korea (South Korea)	Observational cohort study	Adult-onset craniopharyngioma (48.00 +/- 12.77 years) and non-functional pituitary adenoma (48.77 +/- 13.10)	N/A	Patients with hypothalamic damage (HD) due to craniopharyngioma (n = 29) and controls with non-functional pituitary adenoma (n = 31)	-Postoperative weight gain -Structural and functional MRI measures of brain activity (specifically responses to food images). -Food related cognition -Self-reported appetite, mood, eating behavior, food addiction, and other eating-associated behaviors. -Cognitive function via Go/NoGo and dot-probe tasks
Legenbauer et al.	2010	Germany	Prospective longitudinal study (4-year follow-up)	Adults (age not specified)	N/A	Obese individuals in a VLCD program	Weight loss maintenance; mental disorders; eating patterns
Lin, Y-H et al.	2021	Taiwan	6-year cohort study	Adults aged > 65 years	No MetS group: 13.9 (SD 3.6) years MetS group: 13.0 (SD 4.0) years	Community-dwelling older adults (N = 467 at baseline)	Successful aging (defined using an extended definition including physiological, psychological, and sociological/economic domains) Metabolic Syndrome (MetS) status at baseline
Liu et al.	2024	China (Shanghai)	Prospective cohort study (Shanghai Aging Study)	Older adults aged ≥ 60 years	Years of education included as covariate; not stratified in results	Cognitively normal older adults (n = 1,547)	Incident dementia over 5 years; dietary antioxidants intake
Liu et al.	2021	China	Longitudinal cohort study (CHARLS)	≥ 45 years (Mean: 58.4 years)	31.1% attended primary school or above	Middle-aged and elderly Chinese adults (N = 9006)	Global cognition, mental intactness, episodic memory (measured at 3 time points); association with physical performance (grip strength, chair stands, standing balance)
Lopez, K.E. et al.	2021	United States	Analysis of a multisite	Adolescents between 14–18 years	N/A	Adolescents with overweight and obesity seeking	Intervention engagement (percent engagement, defined as actual

Authors	Year	Country	Study Design	Age	Educational Status	Group of Patients	Outcomes Measured
			randomized controlled trial			treatment (BMI ≥ 85th percentile for age and sex)	intervention dosage received/total dosage intended) Executive functioning (EF), as measured by the Behavior Rating Inventory of Executive Function-2 (BRIEF-2) Depressive symptoms, as measured by the Center for Epidemiological Studies Depression Scale for Children (CES-DC)
Loukou, S. et al.	2024	Greece	Randomized controlled clinical trial	Elderly participants between 55 and 85 years old	Minimum educational level of five years	55 patients with mild Alzheimer's disease (AD)	Cognitive and functional performance (MMSE, FRSSD, FUCAS, ADAS-Cog, CDR) Psychiatric symptoms (GDS, NPI)
Lutes, L.D. et al.	2018	United States	Prospective randomized pragmatic effectiveness pilot trial	Adult patients (18–75 years)	highest education level completed	Adult patients with T2D from the rural southeastern United States diabetes belt who had uncontrolled T2D (HbA1c ≥ 7.0) and either depressive (PHQ-2 > 3) or distress (DDS-2 > 3) symptoms (n = 139)	Change from baseline to 12 months in HbA1c (glycemic control) Diabetes-related distress (DDS-17) Depressive symptoms (PHQ-9) Diabetes self-care activities (Diabetes Empowerment Scale and SDSCA)
Lutski et al.	2018	Israel	Longitudinal cohort study (BIP neurocognitive study)	Men aged ~ 57 at baseline, with follow-up at ~ 72 years	N/A	Men with cardiovascular disease from original BIP trial (n = 200)	Cognitive decline using NeuroTrax battery; Mediterranean diet adherence
Lv. N., et al.	2020	United States	2-arm pilot randomized	Adults ≥ 18 years	N/A	105 adults with obesity and depression	Neurobiological mechanisms (neural circuits, gut microbiome,

Authors	Year	Country	Study Design	Age	Educational Status	Group of Patients	Outcomes Measured
			controlled trial (RCT)				and proinflammatory cytokines) Health behaviors (diet, physical activity, and cognitive behaviors) Health outcomes (weight loss and depression outcomes)
Ma et al.	2024	China	Longitudinal observational study (12-month follow-up)	18–45 years (First-episode schizophrenia patients)	Mean years of education: 10.81 ± 3.15	Patients with first-episode schizophrenia (N = 372)	Cognitive function (measured via MCCB) and body weight (BMI); analyzed bidirectional relationship over 12 months
Mahboobi et al.	2022	Iran	Randomized, double-blind, placebo-controlled clinical trial	18–50 years (Mean age: ~35 years)	Not reported	Adults with obesity and depressed mood (N = 100), divided into intervention (probiotic + magnesium) and placebo groups	Cognitive function, mood (BDI-II), intestinal barrier function (zonulin), inflammation (hs-CRP, IL-6), serum magnesium
Mansur et al.	2021	Canada	Randomized, double-blind, placebo-controlled clinical trial	18–65 years (Adults with bipolar disorder)	Not specified	Adults with bipolar disorder and BMI ≥ 25 kg/m² (N = 60), receiving liraglutide or placebo	Cognitive function (RBANS), metabolic parameters (weight, BMI, insulin resistance), psychiatric symptoms
Maraldi et al.	2007	Italy	Longitudinal cohort (ILSA study)	Older adults, aged ≥ 65 years (mean age ~ 74)	Education categorized into levels and adjusted in analysis	Community-dwelling Italians with and without diabetes (n > 3,000)	Cognitive impairment incidence; MMSE score changes over 4 years
May et al.	2024	USA (Adolescent Brain Cognitive Development Study)	Longitudinal cohort study	Adolescents aged 9–10 at baseline	Parental education used as covariate; not detailed	11,875 children enrolled in ABCD study across 21 sites	Neurocognitive functioning (NIH Toolbox), BMI z-scores, obesity trajectories
Moon et al.	2024	South Korea	Randomized controlled trial (SUPERBRAIN-MEET study)	Adults aged 60–79 years with mild cognitive impairment	Mean education: 10.6 years	Community-dwelling older adults with MCI (N = 330), randomized into multidomain interventions via face-to-face or video platforms, or control	Cognitive function (primary outcome: changes in K-MMSE score), secondary: depression, quality of life, physical and social activity

Authors	Year	Country	Study Design	Age	Educational Status	Group of Patients	Outcomes Measured
Morsund et al.	2019	Norway	Randomized controlled trial (cognitive remediation therapy)	Adults with obesity, mean age ~ 42 years	Secondary/higher education included as demographic; not analyzed separately	Obese adults eligible for obesity treatment programs; randomized to cognitive remediation vs. control	Executive function, working memory, mental flexibility
Mortimer et al.	2017	Australia	Prospective observational study	Women undergoing chemotherapy (age range not specified, likely 30–65)	N/A	Early-stage breast cancer patients receiving chemotherapy (n ≈ 100)	Fatigue, cognitive performance, mental/physical functioning (objective and subjective measures)
Murayama et al.	2025	Japan	Prospective cohort study (JAGES study)	Older adults aged ≥ 65 years	Education used as a covariate in regression; categories not detailed	Community-dwelling Japanese older adults (n = 10,005), cognitively normal at baseline	Cognitive decline measured using MMSE over 3 years; BMI and frailty as exposures
Musselman et al.	2019	United States	Randomized, double-blind, placebo-controlled pilot trial	Mean age ~ 51 years	N/A	Women with obesity and major depressive disorder (MDD)	Depressive symptoms (MADRS), weight, glucose, insulin, cortisol, inflammatory markers (e.g., IL-6, CRP)
Nam et al.	2015	USA (University of Pittsburgh)	Cross-sectional and longitudinal study	Mean age 60.4 years (range not specified)	Adjusted for education level in analyses; not specifically reported	94 adults with obesity (BMI > 30) and 48 lean controls; free of dementia or neurological disorder	Cognitive performance (executive function, memory, processing speed); brain imaging (white matter integrity)
Napoli et al.	2014	Italy	Cross-sectional study	Mean age: 47.7 ± 13.3 years	Not specified	Adults with type 2 diabetes (N = 84); stratified by metabolic syndrome and cognitive function	Cognitive function (MMSE), metabolic parameters, insulin resistance (HOMA-IR), inflammation (hs-CRP)
Nikendei et al.	2016	Germany	Randomized controlled trial	Mean age: 32.5 years	All participants were medical students	Medical students with depressive symptoms (N = 47); assigned to group-based cognitive behavioral intervention or control	Cognitive performance (VLMT, TMT A/B), depressive symptoms (BDI-II), perceived stress (PSS)
Oh et al.	2024	USA	Retrospective cohort	Older adults with cognitive impairment	N/A	Older adults newly prescribed gabapentin	Cognitive/behavioral changes
Ortega et al.	2024	Switzerland, Canada, Netherlands	Longitudinal, multi-cohort	Adults ≥ 55 years	N/A	Older adults from 3 population cohorts	Cognition (MMSE + domains) & diet-derived inflammatory markers
Paans et al.	2020	Netherlands	Longitudinal cohort study	Mean age: 57.2 years (Range: 35–74)	Not specified	Adults from the general population (N = 1149); part of the Lifelines Cohort Study	Depression (IDS), anxiety (BAI), cognitive functioning (RFFT, Stroop, verbal memory), BMI, metabolic syndrome

Authors	Year	Country	Study Design	Age	Educational Status	Group of Patients	Outcomes Measured
Peters et al.	2019	UK	Prospective cohort	Adults ≥ 80 years	N/A	Older adults on antihypertensive treatment	Cognitive function (3MS)
Połtyn-Zaradna et al.	2025	Poland	Cross-sectional (PURE cohort)	Older adults	N/A	Adults in the PURE-Poland study	Hearing loss, cognition (MoCA), frailty
Poulton et al.	2024	New Zealand	Prospective longitudinal cohort study (Dunedin Study)	Participants followed from birth to midlife (age 45)	Not specified	General population cohort born in 1972–73 in Dunedin (N = 1037)	BMI trajectories, cognitive ability (IQ), physical health, socioeconomic outcomes, brain aging
Rapoport et al.	2000	UK	Randomized controlled trial	Mean age 47.5 years	N/A	Overweight women (BMI ≥ 28)	Weight, mental health, dietary behavior, cardiovascular risk
Restivo et al.	2016	Canada	Longitudinal, interventional (pre-post bariatric surgery)	Adults 18–60 years	N/A	Obese adults with/without mood disorders and lean controls	Cognitive performance (neuropsych tests, fMRI)
Rouch et al.	2014	France	Prospective cohort study (PROOF)	Mean age 65.6 years	Included as covariate	Elderly community residents (n = 657)	Self-rated health and life satisfaction
Salmoirago-Blotcher	2021	United States	Randomized Controlled Trial (2×2 factorial design), Proof-of-Concept Feasibility Study	Mean 70.1 years (SD = 6.8), ≥ 55 years	88.9% with some college-level education	Older adults (n = 36) at risk of dementia; physically inactive with ≥ 2 risk factors	Feasibility, acceptability, and cognitive function (ZAVEN composite score)
Schmitz et al.	2018	Netherlands & UK	Prospective cohort	Adults 45–75 years	Categorized into low/medium/high	Participants from Rotterdam and Whitehall II studies	Cognitive decline, depressive symptoms, metabolic factors
Soldevila-Domenech et al.	2021	Spain	Cross-sectional study	≥ 60 years (mean not explicitly stated)	Educational level included as a covariate (not fully detailed)	Community-dwelling older adults (N = 86); assessed for obesity and cognitive function	Cognitive function (Stroop, TMT, digit span, MMSE), body composition (BMI, WHR, WC), physical activity
Spitznagel et al.	2013	United States	Prospective longitudinal cohort study	Mean age ~ 43.7 years	N/A	Patients undergoing bariatric surgery (LABS project participants)	% weight loss (WL), BMI, cognitive function (executive function, memory)

Authors	Year	Country	Study Design	Age	Educational Status	Group of Patients	Outcomes Measured
Strassnig et al.	2015	USA	Interventional study	Adults with severe mental illness	N/A	Overweight/obese outpatients with schizophrenia or bipolar disorder	Cognition, psychiatric symptoms, neuromuscular performance
Teong et al.	2021	Malaysia	Cross-sectional study	Mean age: 33.5 ± 9.0 years	Majority had tertiary education	Overweight and obese adults (BMI ≥ 23, N = 160); stratified by physical activity and adiposity indices	Cognitive performance (CANTAB: executive function, memory, attention), physical activity, BMI, waist circumference, body fat percentage
Veit et al.	2021	Germany	Cross-sectional neuroimaging study	Adolescents aged 14–19 years	Not specified	Adolescents with obesity and normal weight controls (N = 126 total; 59 obese)	Cognitive control (go/no-go fMRI task), emotional regulation, impulsivity, brain activity (insula, prefrontal cortex)
Vidmar et al.	2022	United States	Randomized controlled trial	Adolescents aged 14–18 years (mean ~ 15.5)	Not specified	Adolescents with obesity (N = 117); randomized to mHealth alone, mHealth + coaching, or in-person weight loss intervention	Food addiction symptom count (YFAS-C), depressive symptoms (CES-DC), perceived stress (PSS), executive function (BRIEF-2), BMI
Vreeken, D et al.	2023	Netherlands	Prospective cohort (BARICO study)	Mean age 46.1 years (range 35–55)	N/A	146 adults with severe obesity, pre- and post-bariatric surgery	Cognition, inflammatory markers, adipokines, mood
Vuong, A.M. et al.	2024	United States (Cincinnati, HOME Study)	Prospective birth cohort	Adolescents aged ~ 12; maternal mean age 29.5	Maternal: >77% had > high school education	223 mother–adolescent dyads	Executive function via BRIEF2 and prenatal OPE exposure
Wang, X et al.	2024	China	Longitudinal cohort (CHARLS, 4-year follow-up)	Adults ≥ 45 years; mean 56.2 years	11.3% illiterate; 41.4% elementary; 44.5% middle school	5061 adults cognitively normal at baseline	Global cognition, episodic memory, mental intactness
Xu, H et al.	2024	Sweden	Population-based cohort (SCREAM project)	65 + years; mean age 75 ± 8	N/A	305,122 older adults, free from dementia at baseline	Dementia incidence (all-cause, subtypes)
Xue, Y et al.	2024	China	Prospective population-based cohort study (CHARLS)	Adults ≥ 45 years; mean age 58.6	Illiteracy: >43% in subgroups; data from Table 2	10,186 Chinese adults, free of CVD at baseline	CVD (heart disease, stroke) incidence

Outcomes of Synthesized Findings

Obesity and Executive Dysfunction

Fifty six studies demonstrated consistent associations between obesity and impairments in executive functions, including working memory, cognitive flexibility, and response inhibition. These findings were observed across adolescent, adult, and older adult populations and were independent of psychiatric comorbidities.

Depression as a Mediator of Cognitive Impairment

Forty one studies showed that depression significantly mediated or moderated the relationship between metabolic dysfunction and cognitive impairment. Poorer performance in verbal memory, attention, and processing speed was consistently associated with higher depressive symptom scores.

Cognitive Improvement Following Bariatric Surgery

Eleven studies examined cognitive trajectories following bariatric surgery, reporting improvements in attention, executive function, and verbal fluency, typically observed within 6 to 12 months post-operatively. These changes were evident across various bariatric techniques.

Insulin Resistance and Cognitive Function

Three studies supported a negative association between insulin resistance and cognitive performance, with significant effects seen in learning, abstract reasoning, and verbal memory. These associations persisted even in non-obese individuals and after adjustment for age, sex, and socioeconomic status.

Disordered Eating and Emotional Dysregulation

One study demonstrated that disordered eating behaviors—particularly binge eating and emotional eating—were associated with greater emotional lability and cognitive inflexibility, predominantly among adolescents and young adults.

Sociocultural Moderators

Twelve studies emphasized the impact of sociocultural factors, including gender roles, ethnicity, and socioeconomic status, on the experience and reporting of cognitive and emotional difficulties. These findings underscore the importance of culturally sensitive diagnostic tools and interventions.

Table 2
Synthesized Findings and Number of Contributing Studies per Thematic Category

Obesity and executive dysfunction	Depression mediates cognitive impairment	Bariatric surgery and cognitive recovery	Insulin resistance and cognitive deficits	Disordered eating and mood lability	Sociocultural context moderates cognitive-emotional interaction
Alizadeh et al. (2022)	Annesi & Gorjala (2010)	Alosco et al. (2014)	Formiga et al. (2023)	Dalen et al. (2010)	Cody et al. (2022)
Ariza et al. (2025)	Annunziato et al. (2009)	Canário et al. (2024)	Napoli et al. (2014)		Katayama et al. (2020)
Bancks et al. (2023)	Bacon et al. (2002)	Fang et al. (2023)	Laederach-Hofmann et al. (2002)		Kakita et al. (2024)
Brinkworth et al. (2009)	Berk et al. (2018)	Hindle et al. (2020)			Fox et al. (2016)
Chávez-Manzanera et al. (2022)	Chao et al. (2023)	Hu et al. (2020)			Liu et al. (2024)
Chen et al. (2023)	Darling et al. (2021)	Lan et al. (2021)			Chang et al. (2022)
Chen et al. (2020)	Demos & McDermott (2021)	Liu et al. (2021)			Cigliobianco et al. (2019)
Cserjesi et al. (2009)	Drew et al. (2022)	Loukou, S. et al. (2024)			Lin, Y-H et al. (2021)
Dalkner et al. (2019)	Durso et al. (2008)	Mansur et al. (2021)			Strassnig et al. (2015)
Deckers et al. (2016)	Espeland et al. (2017)	Restivo et al. (2016)			Xu, H et al. (2024)
Fausto et al. (2022)	Ferri et al. (2021)	Wang, X et al. (2024)			Grech et al. (2021)
Ganguli et al. (2020)	Gallagher et al. (2016)				Cherbuin et al. (2015)
Green et al. (2013)	Mac Giollabhui et al. (2020)				
Hartmann et al. (2009)	Goossens et al. (2011)				
Hildreth et al. (2014)	Guo et al. (2024)				
Jokinen et al. (2009)	Halyburton et al. (2007)				
Ju & Al Snih (2024)	He et al. (2025)				
Kakoschke et al. (2021)	Hjelmesæth et al. (2018)				
Kim et al. (2023)	Hou et al. (2024)				
Lachner, C et al. (2024)	Hwang et al. (2023)				
Lajim et al. (2024)	Jaremka et al. (2014)				
Lavender et al. (2014)	Karakose et al. (2025)				
Lopez, K.E. et al. (2021)	Keating et al. (2005)				
Lutes, L.D. et al. (2018)	Kim & Kang (2020)				
May et al. (2024)	Kim et al. (2024)				
Morsund et al. (2019)	Kim, B. and Kang, S. (2020)				
Musselman et al. (2019)	Kong, D. et al (2019)				
Nam et al. (2015)	Kontari et al. (2018)				
Paans et al. (2020)	Kotackova et al. (2023)				
Poulton et al. (2024)	Lampignano et al. (2022)				

Obesity and executive dysfunction	Depression mediates cognitive impairment	Bariatric surgery and cognitive recovery	Insulin resistance and cognitive deficits	Disordered eating and mood lability	Sociocultural context moderates cognitive-emotional interaction
Rouch et al. (2014)	Lee, M. et al. (2023)				
Soldevila-Matías et al. (2024)	Legenbauer et al. (2010)				
Spitznagel et al. (2013)	Lv. N., et al. (2020)				
Teong et al. (2021)	Ma et al. (2024)				
Vidmar et al. (2022)	Mahboobi et al. (2022)				
Vuong, A.M. et al. (2024)	Moon et al. (2024)				
Xue, Y et al. (2024)	Nikendei et al. (2016)				
Dublin et al. (2015)	Rapoport et al. (2000)				
Połtyn-Zaradna et al. (2025)	Schmitz et al. (2018)				
Huo et al. (2022)	Veit et al. (2021)				
Lutski et al. (2018)	Vreeken, D et al. (2023)				
Peters et al. (2019)					
Kaup et al. (2015)					
de Vargas et al. (2021)					
Salmoirago-Blotcher (2021)					
Gómez-Martínez et al. (2021)					
Oh et al. (2024)					
Gardener et al. (2021)					
Beeri et al. (2021)					
Mortimer et al. (2017)					
Maraldi et al. (2007)					
Murayama et al. (2025)					
Du et al. (2024)					
Fernández de la Puente et al. (2024)					
Ortega et al. (2024)					

Methodological Quality

All included studies were assessed using the appropriate JBI critical appraisal tools, depending on their study design. Methodological quality was evaluated across multiple domains, including clarity of aims, methodological appropriateness, transparency of data collection, credibility of findings, and the use of validated assessment instruments. A total of nineteen studies were excluded from the final synthesis on the basis of low methodological quality. Specifically, these studies scored “No” or “Unclear” in more than five appraisal domains or had fewer than 70% of their responses rated as “Yes” (Table 1,2,3,4). In many cases, the studies demonstrated insufficient credibility due to methodological inconsistencies, unclear participant descriptions, or lack of validated outcome measures. These limitations significantly reduced their potential contribution to the meta-aggregated synthesis. The exclusion of these studies was conducted in accordance with JBI methodological guidance to ensure rigor, reduce bias, and enhance the trustworthiness of the review findings.

Critical Appraisal Results

Table 2
Critical Appraisal of Eligible Cohort Study

Citation	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
Rapoport L, Clark M, Wardle J. 2000.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Rouch I, Achour-Crawford E, Roche F, Castro-Lionard C, Laurent B, Ntougou Assoumou G, et al. 2014.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bancks MP, Lovato J, Balasubramanyam A, Coday M, Johnson KC, Munshi M, et al. 2023.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Beeri MS, Tirosh A, Lin HM, Golan S, Boccara E, Sano M, et al. 2022.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Beth Spitznagel M, Alosco M, Strain G, Devlin M, Cohen R, Paul R, et al. 2013.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
CanÃ¡rio N, CrisÃ³stomo J, Duarte JV, Moreno C, Quental H, Gomes L, et al. 2024.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ChÃ¡vez-Manzanera E, RamÃrez-Flores M, Duran M, Torres M, RamÃrez M, Kaufer-Horwitz M, et al. 2022.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Chen Z, Ho M, Chau PH. 2023.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cherbuin N, Sargent-Cox K, Fraser M, Sachdev P, Anstey KJ. 2015.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cody KA, Koscik RL, Erickson CM, Berman SE, Jonaitis EM, Williams VJ, et al. 2022.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Dalkner N, Bengesser S, Birner A, Rieger A, Seebauer J, Platzer M, et al. 2021.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Deckers K, van Boxtel MPJ, Verhey FRJ, KÃ¶hler S. 2017.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Du M, Liu M, Liu J. 2024.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Dublin S, Walker RL, Gray SL, Hubbard RA, Anderson ML, Yu O, et al. 2015.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fausto BA, Azimipour S, Charles L, Yarborough C, Grullon K, Hokett E, et al. 2022.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FernÃ¡ndez De La Puente M, Marti A, Canudas S, Zalba G, Razquin C, Boccardi V, et al. 2024.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ferri F, DeschÃªnes SS, Power N, Schmitz N. 2021.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Gallagher D, Kiss A, Lanctot K, Herrmann N. 2016.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ganguli M, Beer JC, Zmuda JM, Ryan CM, Sullivan KJ, Chang CCH, et al. 2020.	Y	Y	Y	Y	Y	Y	Y	Y	Y	N/A	Y
Gardener H, Caunca M, Dong C, Cheung YK, Rundek T, Elkind MSV, et al. 2020.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
GÃ³mez-MartÃnez C, Babio N, JÃºlvez J, Becerra-TomÃ¡s N, MartÃnez-GonzÃ¡lez MÃ, Corella D, et al. 2021.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Goossens L, Braet C, Verbeken S, DecaluwÃ© V, Bosmans G. 2011.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Green MW, Elliman NA. 2013.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Guo T, Zou Q, Wang Q, Zhang Y, Zhong X, Lin H, et al. 2024.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
He J, Zhang H, Wu Z, Jin L, Ji Y. 2025.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Hildreth KL, Grigsby J, Bryant LL, Wolfe P, Baxter J. 2014.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Hindle A, De la Piedad Garcia X, Hayden M, Oâ€™Brien PE, Brennan L. 2020.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Hou D, Sun Y, Liu Z, Sun H, Li Y, Wang R. 2024.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Hu Y, Ji G, Li G, Manza P, Zhang W, Wang J, et al. 2021.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Huo N, Vemuri P, Graff-Radford J, Syrjanen J, Machulda M, Knopman DS, et al. 2022.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Citation	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
Hwang IC, Ahn HY. 2023.	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Jokinen H, Kalska H, Ylikoski R, Madureira S, Verdelho A, Gouw A, et al. 2009.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ju RH, Al Snih S. 2024.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Kakita D, Harada K, Kurita S, Morikawa M, Nishijima C, Fujii K, et al. 2024.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Karakose S, Luchetti M, Stephan Y, Sutin AR, Terracciano A. 2025.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Katayama O, Lee S, Bae S, Makino K, Shinkai Y, Chiba I, et al. 2020.	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
Kaup AR, Nettiksimmons J, Harris TB, Sink KM, Satterfield S, Metti AL, et al. 2015.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Keating NL, NÃ¸rredam M, Landrum MB, Huskamp HA, Meara E. 2005.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Kim B, Kang S. 2020.	Y	Y	Y	Y	Y	Y	Y	Y	Y	N/A	Y
Kim B, Samuel LJ, Thorpe RJ, Crews DC, Szanton SL. 2023.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Kim ES, Wilkinson R, Okuzono SS, Chen Y, Shiba K, Cowden RG, et al. 2024.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Kong D, Solomon P, Dong X. 2019.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Kontari P, Smith KJ. 2019.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Kotackova L, Marecek R, Mouraviev A, Tang A, Brazdil M, Cierny M, et al. 2023.	N/A	N/A	Y	Y	Y	Y	Y	Y	Y	N/A	Y
Lachner C, Craver EC, Babulal GM, Lucas JA, Ferman TJ, White RO, et al. 2024.	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
Lajim D, Mazlan M, Amin SM, Suhaimi A. 2024.	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Lampignano L, Sardone R, D'Urso F, Altamura M, Piccininni C, Griseta C, et al. 2022.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Lan YT, Blacker D, Yuan C, Chibnik LB, Hofman A, Ma Y. 2021.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Lavender JM, Alosco ML, Spitznagel MB, Strain G, Devlin M, Cohen R, et al. 2014.	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y
Lee SY, Nyunt MSZ, Gao Q, Gwee X, Chua DQL, Yap KB, et al. 2023.	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
Legenbauer TM, de Zwaan M, MÃ¼hlhans B, Petrak F, Herpertz S. 2010.	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
Liu S, Luo J, Xiao Z, Wu W, Liang X, Zhao Q, et al. 2024.	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y
Liu Y, Gu N, Jiang L, Cao X, Li C. 2021.	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y
Lutski M, Weinstein G, Ben-Zvi S, Goldbourt U, Tanne D. 2022.	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y
Mac Giollabhui N, Swistun D, Murray S, Moriarity DP, Kautz MM, Ellman LM, et al. 2020.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Maraldi C, Volpato S, Penninx BW, Yaffe K, Simonsick EM, Strotmeyer ES, et al. 2007.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
May AC, Hendrickson RC, Pagulayan KF, Schindler AG. 2024.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Morsund ÃH, EllekjÃ¦r H, Gramstad A, Reiestad MT, Midgard R, Sando SB, et al. 2019.	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Mortimer JE, Waliany S, Dieli-Conwright CM, Patel SK, Hurria A, Chao J, et al. 2017.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Murayama H, Iizuka A, Machida M, Amagasa S, Inoue S, Fujiwara T, et al. 2025.	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
Nam S, Al Snih S, Markides K. 2016.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Citation	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
Oh G, Moga DC, Fardo DW, Harp JP, Abner EL. 2024.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ortega N, SchÃ¼tte L, de Crom TOE, Voortman T, Okereke OI, Vinceti M, et al. 2024.	Y	Y	Y	Y	Y	U	Y	Y	U	U	Y
Peters R. 2019.	Y	Y	Y	Y	Y	U	Y	Y	Y	Y	Y
PoÅ‚tyn-Zaradna K, Pazdro-Zastawny K, SzczeÅ›niak D, Basiak-RasaÅ‚a A, WoÅ‚yniec M, ZatoÅ„ska K, et al. 2025.	Y	Y	Y	Y	Y	U	Y	U	U	U	Y
Restivo MR, McKinnon MC, Frey BN, Hall GB, Taylor VH. 2016.	Y	Y	Y	Y	Y	U	Y	Y	U	U	Y
Schmitz N, DeschÃªnes SS, Burns RJ, Danna SM, Franco OH, Ikram MA, et al. 2018.	Y	Y	Y	Y	Y	U	Y	Y	U	U	Y
Simon MS, Barton B, Zagler A, Engl K, Rihs L, Glocker C, et al. 2023.	U	U	Y	Y	N	U	Y	N	U	U	Y
Soria-Contreras DC, Wang S, Liu J, Lawn RB, Mitsunami M, Purdue-Smithe AC, et al. 2025.	Y	Y	Y	Y	Y	U	Y	Y	U	U	Y
Takeuchi H, Kawashima R. 2022.	U	U	Y	Y	Y	U	Y	Y	Y	U	Y
Van Zutphen EM, Rijnhart JJM, Rhebergen D, Muller M, Huisman M, Beekman A, et al. 2021.	Y	Y	Y	Y	Y	U	Y	Y	U	U	Y
Vreeken D, Seidel F, Custers EM, Olsthoorn L, Cools S, Aarts EO, et al. 2023.	Y	Y	Y	Y	Y	U	Y	Y	U	U	Y
Vuong AM, Percy Z, Yang W, Godbole AM, Ospina M, Calafat AM, et al. 2024.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Wang X, Luo L, Zhao J, Guo X, Tao L, Zhang F, et al. 2024.	Y	Y	Y	Y	Y	Y	Y	Y	U	U	Y
Xu H, Eriksdotter M, Garcia-Ptacek S, Ferreira D, Ji D, Bruchfeld A, et al. 2024.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Xue Y, Yang X, Liu G. 2024.	Y	Y	Y	Y	Y	Y	Y	Y	U	U	Y
Yaffe K, Blackwell T, Kanaya AM, Davidowitz N, Barrett-Connor E, Krueger K. 2004.	Y	Y	Y	Y	Y	N	Y	Y	N	N	Y
Yang J, Jacobson LP, Becker JT, Levine A, Martin EM, Munro CA, et al. 2018.	Y	Y	Y	Y	Y	U	Y	Y	U	U	Y
Camacho-Barcia L, MunguÃa L, Lucas I, de la Torre R, Salas-SalvadÃ³ J, PintÃ³ X, et al. 2021.	Y	Y	Y	Y	Y	U	Y	Y	U	U	Y
Palacios N, Scott T, Sahasrabudhe N, Gao X, Tucker KL. 2020.	Y	Y	Y	Y	Y	U	Y	Y	N	U	Y
Grech O, Clouter A, Mitchell JL, Alimajstorovic Z, Ottridge RS, Yiangou A, et al. 2021.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Formiga F, BadÃa-Tejero AM, Corsonello A, Ã„rnlÃ¶v J, Carlsson AC, Mattace-Raso F, et al. 2023.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
%	96.34	96.34	100.0	100.0	98.78	82.92	100.0	97.56	71.95	69.51	100.0

Table 3
Critical Appraisal of Eligible Qualitative Research

Citation	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Rieber N, Giel KE, Meile T, Enck P, Zipfel S, Teufel M. 2013.	U	Y	Y	Y	Y	U	U	U	Y	Y
Rosas LG, Xiao L, Lv N, Lavori PW, Venditti EM, Snowden MB, et al. 2021.	U	Y	Y	Y	Y	U	U	U	Y	Y
Ahmadzad-Asl M, Dinarvand B, Bodaghi F, Shariat SV, Sabzvari Z, Talebi M, et al. 2022.	U	Y	Y	Y	Y	N	N	N	Y	Y
%	0.0	100.0	100.0	100.0	100.0	0.0	0.0	0.0	100.0	100.0

Table 4
Critical Appraisal of Eligible Quasi-Experimental Study

Citation	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Alizadeh M, Dehghanizade J. 2022.	Y	Y	Y	Y	Y	Y	Y	Y	Y
Hartmann H, Pauli LK, Janssen LK, Huhn S, Ceglarek U, Horstmann A. 2020.	Y	Y	Y	Y	Y	Y	Y	Y	Y
Musselman D, Shenvi N, Manatunga A, Miller AH, Lin E, Gletsu-Miller N. 2019.	Y	Y	Y	N	Y	Y	Y	Y	Y
Nikendei C, SchÃ¤fer H, Weisbrod M, Huber J, Geis N, Katus HA, et al. 2016.	Y	Y	Y	N	Y	U	Y	Y	Y
Strassnig MT, Signorile JF, Potiaumpai M, Romero MA, Gonzalez C, Czaja S, et al. 2015.	Y	Y	Y	Y	U	U	Y	Y	Y
%	100.0	100.0	100.0	60.0	80.0	60.0	100.0	100.0	100.0

Table 5
Critical Appraisal of Eligible Randomized Controlled Trial

Citation	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
Annunziato RA, Timko CA, Crerand CE, Didie ER, Bellace DL, Phelan S, et al. 2009.	Y	Y	Y	N	N	Y	Y	N	Y	Y	Y	Y	Y
Bacon L, Keim NL, Van Loan MD, Derricote M, Gale B, Kazaks A, et al. 2002.	Y	U	Y	N	N	U	Y	N	Y	Y	Y	Y	Y
Berk KA, Buijks HIM, Verhoeven AJM, Mulder MT, Ã–zcan B, van â€™t Spijker A, et al. 2018.	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y
Chao AM, Zhou Y, Erus G, Davatzikos C, Cardel MI, Foster GD, et al. 2023.	Y	Y	Y	N	N	Y	Y	N	Y	Y	Y	Y	Y
Cheatham RA, Roberts SB, Das SK, Gilhooly CH, Golden JK, Hyatt R, et al. 2009.	Y	Y	Y	N	N	Y	Y	N	Y	Y	Y	Y	Y
Coates AM, Morgillo S, Yandell C, Scholey A, Buckley JD, Dyer KA, et al. 2020.	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Crichton GE, Murphy KJ, Howe PRC, Buckley JD, Bryan J. 2012.	U	U	Y	U	U	U	Y	Y	Y	Y	Y	Y	Y
de Vargas LDS, Jantsch J, Fontoura JR, Dorneles GP, Peres A, Guedes RP. 2023.	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
Demos McDermott KE, Leblond TL, Dunsiger SI, Rothman AJ, Wing RR. 2022.	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Drew RJ, Morgan PJ, Young MD. 2022.	Y	Y	Y	N	N	Y	Y	N	Y	Y	Y	Y	Y
Espeland MA, Luchsinger JA, Baker LD, Neiberg R, Kahn SE, Arnold SE, et al. 2017.	Y	Y	Y	N	N	Y	Y	N	Y	Y	Y	Y	Y
Fang YY, Lee JI, Wu NY, Chang CI, Huang MC, Lee CY, et al. 2023.	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fox CK, Kaizer AM, Rudser KD, Nathan BM, Gross AC, Sunni M, et al. 2016.	Y	Y	Y	N	N	Y	Y	N	Y	Y	Y	Y	Y
Halyburton AK, Brinkworth GD, Wilson CJ, Noakes M, Buckley JD, Keogh JB, et al. 2007.	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
HjelmesÃ¦th J, Rosenvinge JH, Gade H, Friborg O. 2019.	Y	Y	Y	N	N	Y	Y	N	Y	Y	Y	Y	Y
Jaremka LM, Derry HM, Bornstein R, Prakash RS, Peng J, Belury MA, et al. 2014.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Kakoschke N, Zajac IT, Tay J, Luscombe-Marsh ND, Thompson CH, Noakes M, et al. 2021.	Y	Y	Y	N	N	Y	Y	N	Y	Y	Y	Y	Y
Karl JP, Thompson LA, Niro PJ, Margolis LM, McClung JP, Cao JJ, et al. 2015.	Y	U	Y	N	N	N	Y	Y	Y	Y	Y	Y	Y
Krikorian R, Shidler MD, Summer SS. 2023.	Y	U	Y	Y	U	U	Y	Y	Y	Y	Y	Y	Y
Lin YH, Chiou JM, Chen TF, Lai LC, Chen JH, Chen YC. 2021.	Y	Y	Y	N	N	Y	Y	N	Y	Y	Y	Y	Y
Lopez KE, Salvy SJ, Fink C, Werner J, Wee CP, Hegedus E, et al. 2021.	Y	Y	Y	N	N	Y	Y	N	Y	Y	Y	Y	Y
Loukou S, Papantoniou G, Pantazaki A, Tsolaki M. 2024.	Y	Y	Y	N	N	Y	Y	N	Y	Y	Y	Y	Y
Lutes LD, Cummings DM, Littlewood K, Solar C, Carraway M, Kirian K, et al. 2018.	Y	Y	U	N	N	Y	Y	N	Y	Y	Y	Y	Y

Citation	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
Lv N, Ajilore OA, Ronneberg CR, Venditti EM, Snowden MB, Lavori PW, et al. 2020.	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Lv N, Hallihan H, Xiao L, Williams LM, Ajilore OA, Ma J. 2023.	Y	Y	Y	N	N	Y	Y	N	Y	Y	Y	Y	Y
Ma K, Zhou T, Pu C, Cheng Z, Han X, Yang L, et al. 2024.	Y	Y	Y	N	N	Y	Y	N	Y	Y	Y	Y	Y
Mahboobi S, Ghasvarian M, Ghaem H, Alipour H, Alipour S, Eftekhari MH. 2022.	Y	Y	Y	N	N	Y	Y	N	Y	Y	Y	Y	Y
Mansur RB, Delgado-Peraza F, Subramaniapillai M, Lee Y, Iacobucci M, Nasri F, et al. 2021.	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
Moon SY, Park YK, Jeong JH, Hong CH, Jung J, Na HR, et al. 2025.	Y	Y	Y	N	N	U	Y	N	Y	Y	Y	Y	Y
Brinkworth GD, Buckley JD, Noakes M, Clifton PM, Wilson CJ. 2009.	Y	Y	Y	N	N	U	Y	N	Y	Y	Y	Y	Y
Napoli N, Shah K, Waters DL, Sinacore DR, Qualls C, Villareal DT. 2014.	Y	Y	Y	N	N	Y	Y	N	Y	Y	Y	Y	Y
Paans NPG, Bot M, Brouwer IA, Visser M, Gili M, Roca M, et al. 2020.	Y	U	Y	U	U	U	Y	Y	Y	Y	Y	Y	Y
Poulton A, Gauci N, Khalifa H, Hibbert EJ, Poulton AS. 2024.	Y	U	Y	Y	Y	U	Y	U	U	Y	Y	Y	Y
Salmoirago-Blotcher E, Trivedi D, Dunsiger S, Harris K, Breault C, Yang Santos C, et al. 2021.	Y	U	Y	U	U	U	Y	Y	Y	Y	Y	Y	Y
Soldevila-Domenech N, Forcano L, VintrÃ³-Alcaraz C, Cuenca-Royo A, PintÃ³ X, JimÃ©nez-Murcia S, et al. 2021.	Y	U	Y	U	U	U	Y	U	Y	Y	Y	Y	Y
Soldevila-MatÃas P, SÃ¡nchez-OrtÃ-JV, Correa-Ghisays P, BalanzÃ¡-MartÃnez V, Selva-Vera G, Sanchis-Sanchis R, et al. 2024.	Y	U	Y	U	U	U	Y	Y	Y	Y	Y	Y	Y
Teong XT, Hutchison AT, Liu B, Wittert GA, Lange K, Banks S, et al. 2021.	Y	U	Y	U	U	U	Y	Y	Y	Y	Y	Y	Y
Veit R, Schag K, Schopf E, Borutta M, Kreutzer J, Ehlis AC, et al. 2021.	Y	U	Y	U	U	U	Y	U	Y	Y	Y	Y	Y
Vidmar AP, Yamashita N, Fox DS, Hegedus E, Wee CP, Salvy SJ. 2022.	Y	U	Y	U	U	U	Y	U	Y	Y	Y	Y	Y
Wen HJ, Tsai CL. 2020.	Y	U	Y	U	U	U	Y	Y	Y	Y	Y	Y	Y
Annesi JJ, Gorjala S. 2010.	Y	U	Y	U	U	U	Y	Y	Y	Y	Y	Y	Y
Krikorian R, Eliassen JC, Boespflug EL, Nash TA, Shidler MD. 2010.	Y	U	Y	Y	Y	U	Y	U	U	Y	Y	Y	Y
%	97.61	64.28	97.61	19.04	16.66	59.52	100.0	33.33	95.23	100.0	100.0	100.0	100.0

Discussion

This systematic review addresses the intricate relationship among cognitive function, metabolic alterations, disordered eating behaviors, and mood dysregulation, reinforcing the critical need to examine these domains together rather than in isolation. The data indicate that cognitive impairments, particularly in executive function, memory, and attentional domains, are prevalent among individuals with eating disorders and are frequently associated with concurrent metabolic disturbances and mood disorders such as depression and anxiety.

The association between metabolic dysfunction—including obesity, insulin resistance, and nutritional deficits—and cognitive impairment has been repeatedly documented across populations. This review observed that depressive symptoms significantly mediate the link between metabolic disturbance and poorer cognitive outcomes in eating disorder populations, a finding congruent with evidence suggesting that mood dysregulation can exacerbate or reveal underlying cognitive vulnerabilities(27, 28). The biological plausibility for this relationship is supported by neuroimaging and biomarker studies, which

demonstrate that dysfunction in the prefrontal cortex and chronic stress responses can impair cognitive flexibility, control, and higher executive processes—factors essential for emotional regulation and adaptive eating behaviors(29, 30).

Current research demonstrates that the relationship between metabolic parameters and cognitive function is complex and not uniformly direct or robust across all studies. Although metabolic and nutritional rehabilitation are cornerstones in treating cognitive sequelae of disordered eating, multiple studies reveal that cognitive deficits — especially executive dysfunction and memory impairment — may persist even after normalization of metabolic indices or stabilization of body weight. This persistence suggests a multifactorial etiology in which premorbid neurodevelopmental factors, genetic vulnerabilities, or entrenched psychological traits (sometimes termed "trait vulnerabilities") play a considerable role in cognitive outcomes, beyond the effects of acute nutritional status(31, 32).

For example, Beeri et al. (2022) found that while metabolic control improved some cognitive outcomes, a significant number of individuals continued to experience cognitive deficits, raising the possibility that these impairments may be enduring or only partially reversible(31). Similar patterns have been observed in both aging and obesity research, where cognitive decrements can predate metabolic syndrome or persist after significant weight loss(29, 32). Thus, there is a growing consensus that neuropsychological intervention—targeting enduring cognitive dysfunction—remains necessary alongside metabolic rehabilitation. This also underscores the need for longitudinal studies to better disentangle causal pathways and identify which cognitive deficits are state-dependent versus trait-like.

The rationale for mind-body interventions (such as mindfulness, yoga, and cognitive-behavioral therapy) lies in their demonstrated ability to enhance psychological well-being, reduce maladaptive stress responses, and modestly improve metabolic outcomes (33, 34). These practices promote greater self-awareness and cognitive flexibility, which can facilitate healthier eating behaviors and emotion regulation. Mindfulness-based interventions, for instance, have been shown to reduce binge eating and emotional eating, improve mood stability, and enhance working memory and attention in individuals with eating disorders or obesity(33–35).

Despite these potential benefits, outcome variability across different populations is significant and highlights the importance of culturally competent care. Studies increasingly show that cultural background, health literacy, socioeconomic status, and community support strongly influence both the prevalence of disordered eating and the response to mind–body or behavioral interventions(34). For example, individuals from ethnic minorities or lower socioeconomic strata may face additional stressors, barriers to care, or divergent beliefs regarding mental health and somatic symptoms, which influence both engagement in and benefit from intervention. Therefore, further research is warranted to optimize assessment tools, adapt interventions to be culturally sensitive, and explore social determinants of health in the context of cognitive recovery and eating disorder management.

The review also identifies emotion regulation difficulties as a core transdiagnostic feature underlying disordered eating behaviors. Poor emotional awareness, impulse control, and affective instability are strongly associated with both symptom severity and poorer cognitive performance, further reinforcing the clinical utility of interventions that target emotion regulation as part of a comprehensive treatment plan(35).

The principal findings of this systematic review highlight a consistent and robust co-occurrence of cognitive impairment, metabolic alterations, and mood dysregulation among individuals experiencing disordered eating behaviors. Notably, depressive symptoms exert a pronounced influence on this triadic relationship, significantly mediating or moderating the impact of metabolic dysfunction on cognitive performance. This interplay reflects a complex biopsychosocial framework whereby cognitive deficits—frequently involving executive function, attention, and memory—are not only a consequence of metabolic or nutritional disturbances but are also intimately tied to mood-related factors such as depression and anxiety. This multi-domain convergence underscores that disordered eating is not solely a behavioral or metabolic issue but a multidimensional condition involving intertwined neurocognitive and affective components (34).

Clinically, these findings advocate for an integrated treatment model that breaks down the traditional silos separating mental and physical health care. Effective management of eating disorders should equally prioritize the assessment and treatment of cognitive dysfunction, metabolic health, and mood disturbances, recognizing their dynamic interactions. Regular screening for cognitive impairments and emotional problems should become a routine component in clinical settings catering to eating disorder populations, enabling early identification and intervention for potentially persistent neuropsychological deficits. Multidisciplinary approaches are warranted, combining nutritional rehabilitation with cognitive remediation therapies aimed at improving executive skills and memory, alongside mind–body interventions such as mindfulness, yoga, and stress reduction techniques which can enhance emotional regulation and metabolic outcomes.

Moreover, treatment plans need to be tailored to individual patient needs and cognizant of the patient's cultural and socioeconomic context. Sociocultural factors—including ethnicity, socioeconomic status, and social support—moderate the manifestation and trajectory of eating disorders, as well as the patient's engagement with and responsiveness to treatment. Culturally appropriate psychoeducational programs and preventive measures are essential to address body image concerns and eating behaviors within diverse populations, improving access and adherence to interventions(34). The integration of sociocultural sensitivity into clinical care enhances therapeutic alliance and promotes holistic recovery.

Study limitations

There are several limitations that need to be acknowledged. The included studies displayed heterogeneity in terms of design, population characteristics, and assessment tools, limiting comparability and generalizability of the findings. Many studies utilized cross-sectional designs, preventing definitive conclusions regarding causality and the directionality of observed associations(28). Publication bias remains a concern, as studies reporting significant findings are likelier to be published. Additionally, not all studies accounted for important confounders such as comorbid psychiatric or medical conditions, or medication effects, which could influence cognitive outcomes and metabolic status. Research gaps also persist in the simultaneous, dynamic assessment of cognitive,

metabolic, and affective domains, and the included studies were predominantly from Western populations, highlighting the need for broader cross-cultural inquiry.

In summary, this review highlights the complex, multidimensional nature of eating disorders and related cognitive and metabolic dysfunctions. The findings strongly advocate for a holistic, individualized approach to treatment and underscore the necessity for further large-scale, longitudinal, and culturally diverse research to clarify mechanisms and optimize clinical outcomes.

Conclusion

This qualitative systematic review offers a comprehensive synthesis of evidence linking cognitive function, metabolic alterations, disordered eating behaviors, and mood dysregulation across diverse populations. Drawing on 123 methodologically robust studies, the findings highlight the intricate interplay between somatic and psychological domains, supporting a biopsychosocial framework of understanding human health. Specifically, obesity and insulin resistance were consistently associated with executive dysfunction and cognitive decline, while depression emerged as a central mediator in these associations. Improvements in cognitive performance following bariatric surgery, as well as the cognitive-emotional consequences of disordered eating, further reinforce the mind–body connection. Additionally, sociocultural factors were shown to shape how these relationships are expressed and experienced, underscoring the need for culturally sensitive approaches in both assessment and intervention.

The synthesis emphasizes the importance of integrated clinical care models that simultaneously address metabolic, cognitive, and emotional health. Future research should adopt longitudinal and interdisciplinary approaches to better elucidate causal pathways and to inform personalized, holistic treatment strategies. Overall, this review contributes to a growing body of literature advocating for the integration of psychological and physiological dimensions in health assessment, particularly in populations at risk for cognitive and metabolic comorbidity.

Abbreviations

Abbreviation	Full Term
JBI	The review adhered to the Joanna Briggs Institute
CENTRAL	Cochrane Central Register of Controlled Trials
MMSE	Mental State Examination
TMT	Trail Making Test
WCST	Wisconsin Card Sorting Test
WAIS	Wechsler Adult Intelligence Scale
RAVLT	Rey Auditory Verbal Learning Test
SDMT	Symbol Digit Modalities Test
BDI	Beck Depression Inventory
HDRS	Hamilton Depression Rating Scale
BES	Binge Eating Scale
TFEQ	Factor Eating Questionnaire
DERS	Difficulties in Emotion Regulation Scale
BMI	Body Mass Index

Declarations

The authors recognize the importance of equity, diversity, and inclusion in research. This review considers a broad range of populations and contexts, including studies from both high-income and low- and middle-income countries, to ensure that diverse voices and experiences are represented in the synthesis. The reviewers are committed to minimizing bias by considering sociocultural and geographic factors that may influence the relationship between cognitive function, metabolic health, disordered eating, and mood disorders.

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Author contributions

VP & SSC contributes equally to every step of the publication

Conflicts of interest

There is no conflict of interest in this project. The authors declare no personal, financial, professional, or intellectual bias related to the conduct or outcomes of this review.

References

1. Duncan AE, Ziobrowski HN, Nicol GE (2017) The Prevalence of Past 12-Month and Lifetime < scp > DSM-IV Eating Disorders by < scp > BMI Category in < scp > US Men and Women. Eur Eat Disorders Rev 25(3):165–171
2. Santomauro D, Melen S, Mitchison D, Vos T, Whiteford H, Ferrari AJ (2021) The Hidden Burden of Eating Disorders: An Extension of Estimates From the Global Burden of Disease Study 2019. Lancet Psychiatry 8(4):320–328
3. Stănculete MF, Chiarioni G, Dumitraşcu DL, Dumitraşcu DI, Popa S (2021) Disorders of the Brain-Gut Interaction and Eating Disorders. World J Gastroenterol 27(24):3668–3681
4. Copeland W, Angold A, Costello EJ, Egger HL (2013) Prevalence, Comorbidity, and Correlates of DSM-5 Proposed Disruptive Mood Dysregulation Disorder. Am J Psychiatry 170(2):173–179
5. Zhu R (2023) Cognitive Process Difference Among Anorexia Nervosa, Bulimia Nervosa and Binge Eating Disorder. J Educ Humanit Social Sci 8:2452–2459
6. Bould H, Stavola BD, Lewis G, Micali N (2018) Do Disordered Eating Behaviours in Girls Vary by School Characteristics? A UK Cohort Study. Eur Child Adolesc Psychiatry 27(11):1473–1481
7. Melville H, Lister NB, Libesman S, Seidler AL, Cheng C, Kwan J et al (2025) The Prevalence of Binge Eating and Binge Eating Disorder in Adults Seeking Obesity Treatment. Proceedings of the Nutrition Society. ;84(OCE1)
8. Melisse B, Furth EFv, Hoek HW (2024) Systematic Review of the Epidemiology of Eating Disorders in the Arab World. Curr Opin Psychiatry 37(6):388–396
9. Rosen DS (2010) Identification and Management of Eating Disorders in Children and Adolescents. Pediatrics 126(6):1240–1253
10. AlShebali M, AlHadi AN, Waller G (2020) The Impact of Ongoing Westernization on Eating Disorders and Body Image Dissatisfaction in a Sample of Undergraduate Saudi Women. Eating and Weight Disorders - Studies on Anorexia Bulimia and Obesity. 26(6):1835–1844
11. Cho M, Kim MY, Shin GS (2021) Factors Affecting the Eating Behavior Disorders of Korean College Students. Open Nurs J 15(1):55–61
12. Leibenluft E (2011) Severe Mood Dysregulation, Irritability, and the Diagnostic Boundaries of Bipolar Disorder in Youths. Am J Psychiatry 168(2):129–142
13. Pianucci L, Sonagra M, Greenberg BA, Priestley DR, Gmuca S (2021) Disordered Eating Among Adolescents With Chronic Pain: The Experience of a Pediatric Rheumatology Subspecialty Pain Clinic. Pediatr Rheumatol. ;19(1)
14. Gowey MA, Khodneva Y, Tison SE, Carson AP, Cherrington A, Howard VJ et al (2018) Depressive Symptoms, Perceived Stress, and Metabolic Health: The REGARDS Study. Int J Obes 43(3):615–632
15. Watanabe K, Sakuraya A, Kawakami N, Imamura K, Ando E, Asai Y et al (2018) Work-related Psychosocial Factors and Metabolic Syndrome Onset Among Workers: A Systematic Review and Meta-analysis. Obes Rev 19(11):1557–1568
16. Frempong GA (2025) New Insights Into Stress Metabolomics. Looking for New Diagnostic Biomarkers
17. Rodrigues ME, de Bekhbat S, Houser M, Chang MC, Walker J, Jones DI (2017) Chronic Psychological Stress and High-Fat High-Fructose Diet Disrupt Metabolic and Inflammatory Gene Networks in the Brain, Liver, and Gut and Promote Behavioral Deficits in Mice. Brain Behav Immun 59:158–172
18. Roohafza H, Sadeghi M, Talaei M, Pourmoghaddas Z, Sarrafzadegan N (2012) Psychological Status and Quality of Life in Relation to the Metabolic Syndrome: Isfahan Cohort Study. Int J Endocrinol 2012:1–5
19. Tosun AS, Zincir H (2019) The Effect of a Transtheoretical Model–based Motivational Interview on Self-efficacy, Metabolic Control, and Health Behaviour in Adults With Type 2 Diabetes Mellitus: A Randomized Controlled Trial. Int J Nurs Pract. ;25(4)
20. Noghabi AD (2021) Psychological Factors of Metabolic Syndrome. J Biomedical Res Environ Sci 2(7):641–643
21. Islam MdS, Page-Hefley S, Hernandez AP, Whelchel L, Crasto C, Viator W et al (2023) Change in Urinary Inflammatory Biomarkers and Psychological Health With Gut Microbiome Modulation After Six Months of a Lifestyle Modification Program in Children. Nutrients 15(19):4243
22. Wei GX, Gong ZQ, Yang Z, Zuo X (2017) Mind-Body Practice Changes Fractional Amplitude of Low Frequency Fluctuations in Intrinsic Control Networks. Front Psychol. ;8
23. Hart J (2011) Neuroimaging for Mind–Body Medicine: Understanding the Brain's Critical Role. Altern Complement Ther 17(3):152–155
24. Skrzypiec AE, Shah RS, Schiavon E, Baker EH, Skene N, Pawlak R et al (2013) Stress-Induced Lipocalin-2 Controls Dendritic Spine Formation and Neuronal Activity in the Amygdala. PLoS ONE 8(4):e61046
25. 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 [Internet]. 2021 Mar 29 [cited 2025 Jul 6];372. Available from: https://www.bmj.com/content/372/bmj.n71
26. JBI Critical Appraisal Tools | JBI [Internet] [cited 2025 Jul 6]. Available from: https://jbi.global/critical-appraisal-tools
27. Bancks MP, Lovato J, Balasubramanyam A, Coday M, Johnson KC, Munshi M et al (2023) Association of Type 2 Diabetes Subgroups With Cognitive Status Without Modification From Lifestyle Intervention. Journal of Clinical Endocrinology and Metabolism [Internet]. ;108(6):e334–42. Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85159739983&doi=10.1210%2fclinem%2fdgac706&partnerID=40&md5=d46c7deee7db5dc2a9f18ba47e060cff

28. Schmitz N, Deschênes SS, Burns RJ, Danna SM, Franco OH, Ikram MA et al (2018) Cardiometabolic dysregulation and cognitive decline: Potential role of depressive symptoms. British Journal of Psychiatry [Internet]. ;212(2):96–102. Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85043515287&doi=10.1192%2fbjp.2017.26&partnerID=40&md5=76130d3334120cffbeb4cb43ebfd335e
29. Cherbuin N, Sargent-Cox K, Fraser M, Sachdev P, Anstey KJ (2015) Being overweight is associated with hippocampal atrophy: The PATH Through Life Study. Int J Obes [Internet]. ;39(10):1509–14. Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-84943449948&doi=10.1038%2fijo.2015.106&partnerID=40&md5=6494e8c35bffb7459eb24c07cf954376
30. Green MW, Elliman NA (2013) Are dieting-related cognitive impairments a function of iron status? British Journal of Nutrition [Internet]. ;109(1):184–92. Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-84872045723&doi=10.1017%2fS0007114512000864&partnerID=40&md5=24a531046487e1dbc48bb4959cbd0bdf
31. Beeri MS, Tirosh A, Lin HM, Golan S, Boccara E, Sano M et al (2022) Stability in BMI over time is associated with a better cognitive trajectory in older adults. Alzheimer's and Dementia [Internet]. ;18(11):2131–9. Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85123177231&doi=10.1002%2falz.12525&partnerID=40&md5=61efbe52dd9d7eca68cf965ba6ac14bb
32. Beth Spitznagel M, Alosco M, Strain G, Devlin M, Cohen R, Paul R et al (2013) Cognitive function predicts 24-month weight loss success after bariatric surgery. Surgery for Obesity and Related Diseases [Internet]. ;9(5):765–70. Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-84885066785&doi=10.1016%2fj.soard.2013.04.011&partnerID=40&md5=8604e921a06a637b182f00886a77ed3a
33. Rieber N, Giel KE, Meile T, Enck P, Zipfel S, Teufel M (2013) Psychological dimensions after laparoscopic sleeve gastrectomy: Reduced mental burden, improved eating behavior, and ongoing need for cognitive eating control. Surgery for Obesity and Related Diseases [Internet]. ;9(4):569–73. Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-84881160118&doi=10.1016%2fj.soard.2012.05.008&partnerID=40&md5=99c44b606b0c0bb8d85ce0161b9fc1db
34. Annunziato RA, Timko CA, Crerand CE, Didie ER, Bellace DL, Phelan S et al (2009) A randomized trial examining differential meal replacement adherence in a weight loss maintenance program after one-year follow-up. Eat Behav [Internet]. ;10(3):176–83. Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-68049104341&doi=10.1016%2fj.eatbeh.2009.05.003&partnerID=40&md5=6af39550d39bcb579547083781797d92
35. Lavender JM, Alosco ML, Spitznagel MB, Strain G, Devlin M, Cohen R et al (2014) Association between binge eating disorder and changes in cognitive functioning following bariatric surgery. J Psychiatr Res [Internet]. ;59:148–54. Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-84908337975&doi=10.1016%2fj.jpsychires.2014.08.004&partnerID=40&md5=528c8c57db6e6dc5118e4910a3e9cfc1

Figures

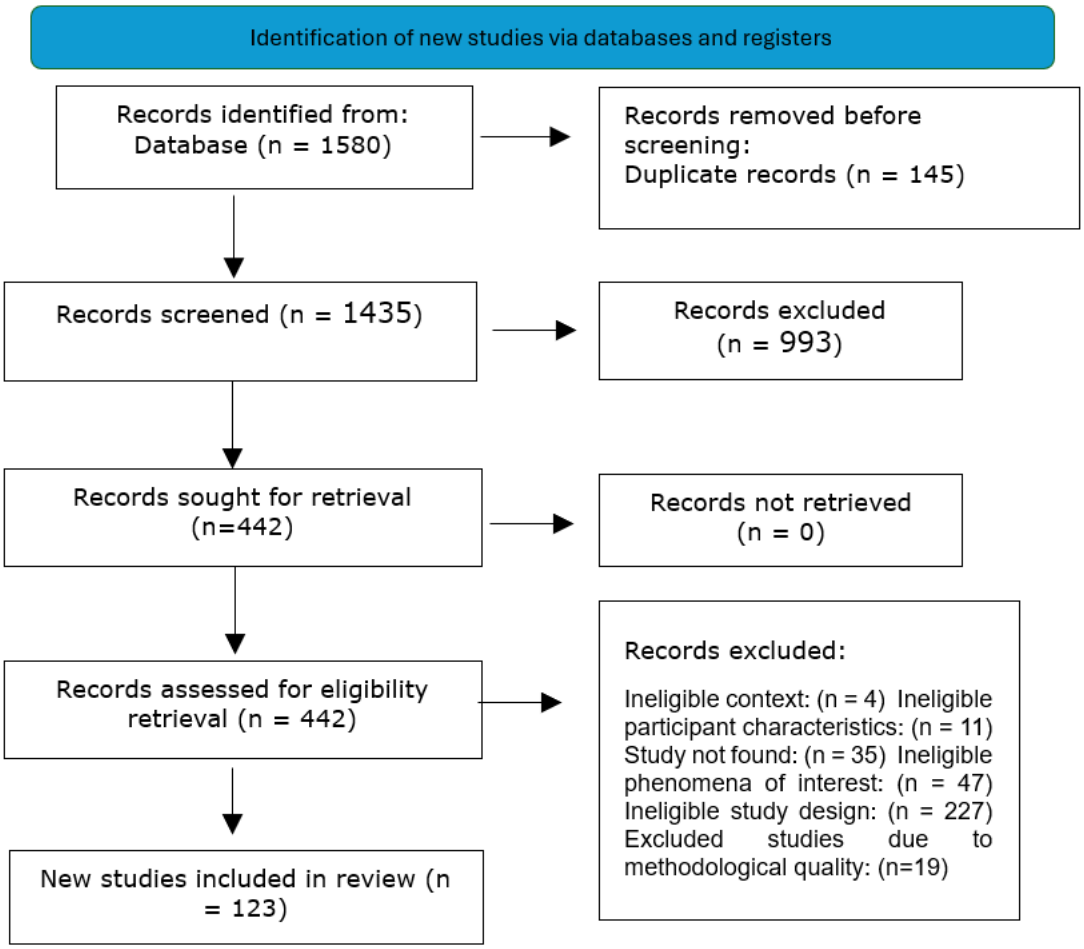


Figure 1

PRISMA flow chart

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