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Nutritional Stability and Psychological Well-being: Analyzing the Connection in Psychosomatic and Rare Disease Populations

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Abstract
Nutritional stability plays a criticaly etoftenunder explored role in shaping psychological well-being, particularly among individuals living with psychosomatic conditions and rare diseases. These populations frequently experience complex interactions between physiological dysfunction, chronic stress, and mental healthv ulnerability. This article examines the bidirectional relationship between nutritional balance and psychological well-being, emphasizing how nutritional deficiencies, metabolic instability, and dietary uncertainty contribute to anxiety, depression, and psychosomatic symptom exacerbation. Using an integrative analytical approach, the study synthesizes findings from nutritional psychiatry, psychosomatic medicine, and rare disease research to highlight shared mechanisms such as inflammation, gut–brain axis dysregulation, hormonal imbalance, and neuro chemical alterations. Furthermore, the article explores the psychosocial burden of rare diseases—including diagnostic delay, social isolation, and treatment uncertainty—and how nutritional instability amplifies these stressors. The paper argues that maintaining nutritional stability should be considered a core component of holistic care models for psychosomatic and rare disease populations. By proposing a multidisciplinary framework that integrate snutritional assessment, psychological support, and medical management, this study contributes to advancing patient-centered interventions aimed at improving mental resilience, quality of life, and long-term health outcomes.
Keywords : Nutritional stability; Psychological well-being; Psychosomatic disorders; Rare diseases; Nutritional psychiatry; Mental health; Chronicillness; Gut–brain axis

Introduction

Nutritionalstability—defined as the consistent access to and intake of adequate macro- and micronutrientsnecessary for physiologicalfunctioning—has traditionally been examinedthrough a biomedicallensfocused on physicaloutcomessuch as growth, immunity, and metabolicregulation. However, a growing body of interdisciplinaryresearch highlights the influence of nutrition on mental health and psychologicalwell-being (Muscaritoli, 2021; Suárez-López et al., 2023). In the emergingfield of *nutritionalpsychiatry*, scholars identify multiple biologicalmechanismsconnectingdietquality to mental healthoutcomes, including inflammation, oxidative stress, and gut–brain axis pathways (Dal &Bilici, 2024; Jacka, 2025). Thesefindingsalignwithbroader public healthconcernsdocumented by global

institutions:foodinsecurity, whichunderminesnutritionalstability, islinked to elevatedpsychologicaldistress, anxiety, depression, and reducedquality of life in large, diverse populations (Alfonsi et al., 2024; International Food Policy Research Institute [IFPRI], 2025). Despitethisgrowingevidence, mostresearch has focused on general populations or specificcommon mental disorders, leavingcriticalknowledge gaps in twovulnerableclinicalcohorts: (1) individualswith*psychosomatic conditions*, whereemotionaldistress and somatic complaints co-occur, and (2) persons living with*rare diseases*, for whommetabolicdysregulation and complextreatmentregimensfrequentlydestabilizenutritionalstatus. Althoughstudies have documentedthatfoodinsecurityincreasespsychologicaldistressacrosscontexts (BMC Nutrition meta-analysis;Alfonsi et al., 2024), the unique interaction betweennutritionalstability and psychologicaloutcomes in thesespecialized populations remainspoorlycharacterized. Likewise, whilerandomizedcontrolled trials in nutritionalpsychiatry show promising but modesteffects of dietary interventions on depressivesymptoms, limitations in study design and sampleheterogeneityconstrainbroaderclinical translation (Liu et al., 2025).

Global reports from the United Nations and alliedagenciesfurtheremphasize the urgency of addressingnutritionaldeterminants of mental health. The *State of Food Security and Nutrition in the World* report identifies that billions globallylackaccess to nutritiousdiets, posing not only a physicalhealthcrisis but also a psychosocial risk factor for stress and mental disorders (United Nations agencies, 2024). Moreover, large epidemiologicalstudiesacross countries have demonstrated consistent associations betweenfoodinsecurity and anxiety, depression, and psychosocial problems in adolescents and adultsalike (Global Mental HealthResearch, 2025; Cambridge UniversityPress, 2025).

Takentogether, the extant literatureunderscoresfoundational links betweendiet and psychologicalhealthwhilerevealingcriticalgaps: few studies examine how nutritionalinstabilitycontributes to psychologicalsuffering in medicallycomplex populations, and thereislimitedintegration of clinical, psychosocial, and global policy perspectives. Addressingthese gaps isimperative for advancingholistic care modelsthatintegratenutritionalevaluationwithpsychological and medical management.

This article thereforeseeks to answer the followingprimaryquestions:

1. How doesnutritionalstability influence psychologicalwell-being in individualswithpsychosomatic conditions and rare diseases?
2. Whatbiological, behavioral, and social mechanismsunderpin the diet–mental healthrelationship in theseclinicalpopulations?
3. Whatevidence-basedstrategies can berecommended to integratenutritional support withincomprehensive care models for improved mental healthoutcomes?

By examiningthese questions, thisstudyaims to extendcurrentknowledgebeyondgeneral population research, bridging gaps in bothempiricalevidence and clinical application.

1. ConceptualFramework:NutritionalStability and PsychologicalHealth

1.1 Definition of NutritionalStability in Clinical and Psychosocial Contexts

Nutritionalstabilityrefers to the sustainedavailability, accessibility, and physiologicalutilization of adequatenutrientsrequired to maintainmetabolic balance, immune competence, and

neurologicalfunctioning over time. In clinicalcontexts, nutritionalstabilityiscommonlyassessedthroughindicatorssuch as dietaryadequacy, micronutrientsufficiency, metabolicregulation, and absence of chronic malnutrition or nutrient-relateddeficiencies (Muscaritoli et al., 2021). From a psychosocial perspective, nutritionalstabilityextendsbeyondbiologicalintake to encompassfoodsecurity, dietarypredictability, and the individual'sperceived control over nutritionalresources, all of which influence psychologicalresilience and stress regulation (FAO et al., 2024).

International organizationsemphasizethismultidimensionalunderstanding. The Food and Agriculture Organization (FAO) definesfoodsecurity as a condition in which all individuals have physical, social, and economicaccess to sufficient, safe, and nutritiousfoodthatmeetsdietaryneeds for an active and healthy life (FAO et al., 2024). Instability in any of these dimensions—whether due to illness, economicvulnerability, or treatment-relateddietary restrictions—can result in nutritional stress, which has been increasinglyassociatedwith adverse mental healthoutcomessuch as anxiety, depressivesymptoms, and emotionaldysregulation (Alfonsi et al., 2024).

1.2 PsychologicalWell-Being:Emotional, Cognitive, and Behavioral Dimensions

Psychologicalwell-beingis a multidimensionalconstructencompassingemotional balance, cognitive functioning, and adaptive behavior. The World HealthOrganization (WHO) conceptualizes mental health as a state of well-beingthat enables individuals to copewith stress, maintain productive functioning, and contributemeaningfully to society (WHO, 2022). Emotionalwell-beinginvolves affective states such as moodstability, emotionalregulation, and perceived life satisfaction. Cognitive well-being relates to attention, memory, decision-making, and perceived mental clarity, whilebehavioralwell-beingreflects motivation, coping strategies, and health-relatedbehaviors (Ryff& Keyes, 1995).

Emergingevidencesuggeststhatnutritionalinstabilitynegatively influences all three dimensions. Deficiencies in essential nutrients—such as omega-3 fattyacids, B-vitamins, iron, and zinc—have been linked to impairedneurotransmittersynthesis, neuroinflammation, and altered stress responses, therebyaffectingmood, cognition, and behavior (Jacka et al., 2020). Moreover, foodinsecurity and dietunpredictabilitycontribute to chronicpsychological stress, whichmayexacerbatemaladaptive coping behaviors, includingdisorderedeating patterns and reducedtreatmentadherence (Liu et al., 2025).

1.3 TheoreticalModelsLinking Nutrition and Mental Health

Severaltheoreticalframeworksexplain the relationshipbetweennutritionalstability and psychologicalhealth. The **biopsychosocial model**positsthat mental healthoutcomesemergefrom interactions betweenbiologicalfactors (nutrientavailability, inflammation), psychologicalprocesses (stress perception, emotionalregulation), and social determinants (foodsecurity, healthcareaccess) (Engel, 1977). This model isparticularly relevant in understanding how nutritionaldeficitsinteractwith psychosocial stressors in vulnerable populations.

Anotherprominentframeworkis the **gut–brain axis model**, which highlights bidirectional communication between the gastrointestinal system and the central nervous system. Nutritionalimbalances can alter gutmicrobiota composition, leading to neurochemical changes that influence mood, cognition, and stress regulation (Dal &Bilici, 2024). Additionally,

nutritionalpsychiatryintegratesepidemiological and clinicalevidence to argue thatdietaryqualityis a modifiable risk factor for mental disorders, comparable in importance to physicalactivity or sleep (Jacka, 2017).

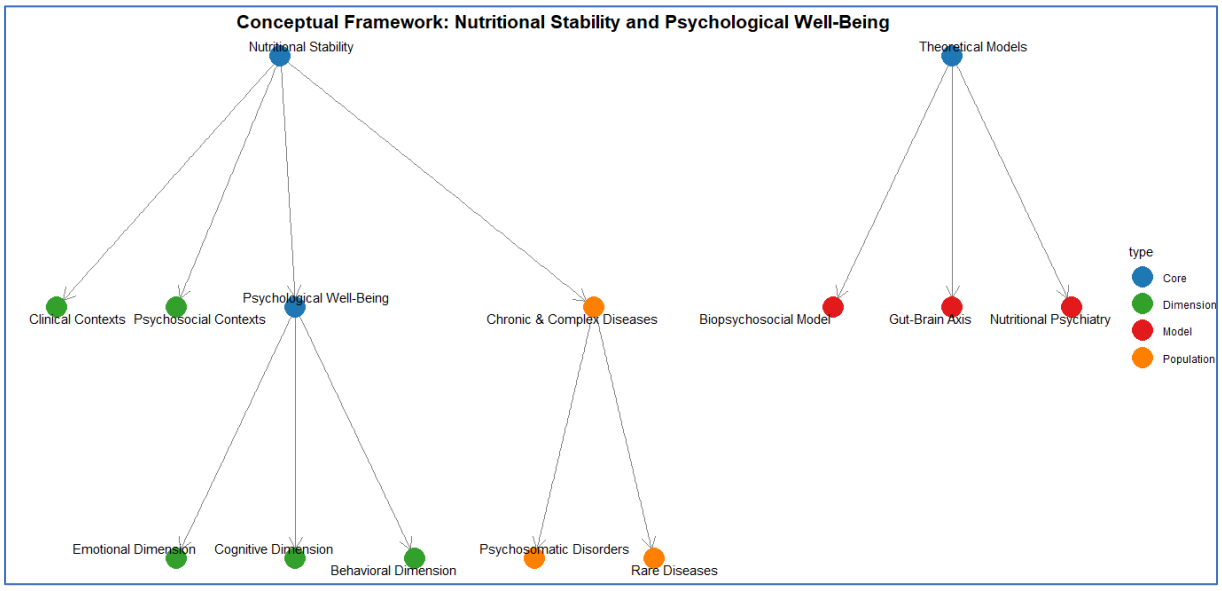
Together, thesemodelsunderscorethatnutritionalstabilityis not a peripheral factor but a foundationaldeterminant of psychologicalhealth.

1.4 Relevance to Chronic and ComplexDisease Populations

The conceptuallinkbetweennutritionalstability and psychologicalwell-beingisparticularlysalient for individuals living withchronic, psychosomatic, and rare diseases. These populations frequentlyexperiencemetabolic disruptions, treatment-relateddietary restrictions, gastrointestinal complications, and increasedrisk of malnutrition (EURORDIS, 2023). Psychosomaticdisorders, by definition, involve the interaction of psychologicaldistress and somaticsymptoms, makingthemespecially sensitive to nutritionalimbalancesthat affect stress physiology and emotionalregulation (Henningsen et al., 2018).

Similarly, individualswith rare diseasesoften face prolonged diagnostic delays, social isolation, and uncertaintyregardingprognosis, all of whichheightenpsychologicalvulnerability. Whencompounded by nutritionalinstability—whether due to diseasepathology or limitedaccess to specializeddiets—the risk of anxiety, depression, and reducedquality of life increasessubstantially (EURORDIS, 2023; WHO, 2022). Thus, integratingnutritionalstabilityintoconceptual and clinicalframeworksis essential for advancingholistic, patient-centered care in thesecomplex populations.

Fig 01



The conceptualframework plot (fig01)visuallyillustrates the complex and multidimensionalrelationshipsbetweennutritionalstability and psychologicalwell-being. At the center, nutritionalstabilityislinked to bothclinical and psychosocial dimensions, reflecting the dual nature of nutrition as both a biological and socio-environmentaldeterminant of health. Fromthiscore, arrowsextend to psychologicalwell-being, whichisfurthersubdividedintoemotional, cognitive, and behavioral dimensions, highlighting the diverse ways in whichnutritionaladequacy or deficiency can influence moodregulation,

mental clarity, and coping behaviors. The theoreticalmodels—comprising the biopsychosocial model, gut–brain axis, and nutritionalpsychiatry—mediate the pathwaybetween nutrition and mental health, providingmechanisticexplanations for observedclinicalphenomena. Finally, the frameworkemphasizes the relevance of these interactions for vulnerable populations, specificallyindividualswithchronic and complexdiseases, includingpsychosomaticdisorders and rare diseases, underscoring how nutritionalinstability can exacerbatepsychologicalvulnerability in these groups. The directionaledges and hierarchical structure of the plot conveyboth the causal and integrativepathways in the framework, while the color-codednodesdifferentiatecore concepts, dimensions, theoreticalmodels, and populations, making the multifacetedrelationshipseasier to interpret. Overall, the plot encapsulates the foundationalrole of nutrition in psychologicalhealth, highlighting the importance of integratedassessment and intervention strategies in clinical and psychosocial contexts.

2. PsychosomaticDisorders: Nutrition–Mind Interactions

2.1 Overview of PsychosomaticDisorders and Symptom Manifestation

Psychosomaticdisorders are clinical conditions in whichpsychologicalfactorssignificantly influence the onset, severity, or progression of physicalsymptoms. Thesedisorders do not imply the absence of organicpathology;rather, theyreflectcomplex interactions betweenemotionaldistress, neurobiologicalregulation, and somatic expression (Henningsen et al., 2018). Common psychosomatic manifestations includefunctional gastrointestinal disorders, chronicpain syndromes, cardiovascularsymptoms, dermatological conditions, and fatigue-relateddisorders, all of whichfrequentlycoexistwithanxiety, depression, or stress-relateddisorders (American Psychiatric Association [APA], 2022).

From a clinical perspective, symptom expression in psychosomaticdisordersisoftenmediated by heightened stress sensitivity, dysregulatedautonomicnervous system activity, and altered neuroendocrine responses. Patients mayexperiencerecurrentbodilysymptomsdespite normal or inconclusivebiomedicalfindings, which can lead to frustration, healthanxiety, and increasedhealthcareutilization (Löwe et al., 2022). Withinthiscontext, nutritionalfactorsact as bothphysiologicalmodifiers and psychosocial stressors, influencingsymptom perception, emotionalregulation, and coping capacity.

2.2 Role of MicronutrientDeficiencies and DietaryImbalance

Micronutrientdeficiencies have been increasinglyimplicated in the pathophysiology of psychosomaticsymptoms. Essential nutrientssuch as magnesium, iron, zinc, selenium, B-complexvitamins, and omega-3 fattyacidsplay a criticalrole in neurotransmittersynthesis, immune modulation, and neuromuscularfunction (Muscaritoli et al., 2021). Deficiencies in thesenutrients have been associatedwithsymptomscommonlyreported in psychosomaticdisorders, including fatigue, pain hypersensitivity, irritability, cognitive fog, and moodinstability (Jacka et al., 2020).

Dietaryimbalance—characterized by high intake of ultra-processedfoods and lowconsumption of nutrient-dense foods—has also been linked to increased inflammation and oxidative stress, whichmayamplifysomaticsymptom perception (Dal &Bilici, 2024). For example, irondeficiency has been associatedwithincreasedsomatic complaints and depressivesymptoms,

whilelowmagnesiumintake has been linked to heightened stress reactivity and muscle tension, bothcommonfeatures in psychosomatic conditions (Liu et al., 2025). Thesefindingssuggestthatnutritionalinadequacymay not onlycoexistwithpsychosomaticdisorders but activelycontribute to theirpersistence and severity.

2.3 Stress, Cortisol Regulation, and NutritionalVulnerability

Stress is a central mechanism in psychosomaticpathology, primarilymediatedthroughdysregulation of the hypothalamic–pituitary–adrenal (HPA) axis. Chronicpsychological stress leads to sustained cortisol secretion, which, over time, disrupts immune function, glucose metabolism, and gastrointestinal integrity (McEwen &Akil, 2020). Nutritionalvulnerabilityboth influences and isinfluenced by this process. Stress-induced hormonal changes can impair nutrient absorption, increasemicronutrientdepletion, and alter appetiteregulation, creating a feedback loopthatexacerbatesbothpsychologicaldistress and somaticsymptoms.

Severalnutrients are directlyinvolved in stress modulation and cortisol regulation. Vitamin C, B-vitamins, and omega-3 fattyacids have been shown to attenuate stress responses and reduce cortisol levels, whiledeficiencies in thesenutrients are associatedwithheightenedanxiety and stress sensitivity (Jacka, 2017). In psychosomatic patients, chronic stress combinedwithpoordietaryqualitymaythereforeintensifysymptom perception, emotionaldysregulation, and diseasechronicity, highlighting the need for integratednutritionalassessment in stress-relateddisorders.

2.4 Case-Based Evidence Linking Diet and SymptomSeverity

Clinical and observationalstudiesprovidegrowing case-basedevidencesupporting the relationshipbetweendietquality and psychosomaticsymptomseverity. For instance, randomizedcontrolled trials in patients withfunctional gastrointestinal disorders have demonstratedthatdietary interventions—such as increasedintake of wholefoods, fiber, and omega-3 fattyacids—are associatedwithreductions in abdominal pain, fatigue, and psychologicaldistress (Henningsen et al., 2018). Similarly, the SMILES trial, a landmarkstudy in nutritionalpsychiatry, showedsignificantimprovement in depressivesymptomsfollowingstructureddietary modification, indirectlysupportingsymptomimprovement in psychosomaticcontextswheredepression and somaticsymptomsoverlap (Jacka et al., 2017).

Real-world clinical observations further support thesefindings. Patients experiencingfoodinsecurity or inconsistentaccess to nutritiousdiets report higherlevels of somatic complaints, healthanxiety, and stress-relatedsymptomscompared to nutritionally stable counterparts (Alfonsi et al., 2024). Global health reports by the World HealthOrganizationemphasizethat populations exposed to chronic stress and nutritionalinstability—such as thoseaffected by conflict, poverty, or chronicillness—demonstratehigherprevalence of psychosomaticsymptoms and mental distress (WHO, 2022). Collectively, these cases illustratethatdietaryquality and nutritionalstability are modifiable factorswith tangible effects on symptomseverity and psychologicalwell-being in psychosomaticdisorders.

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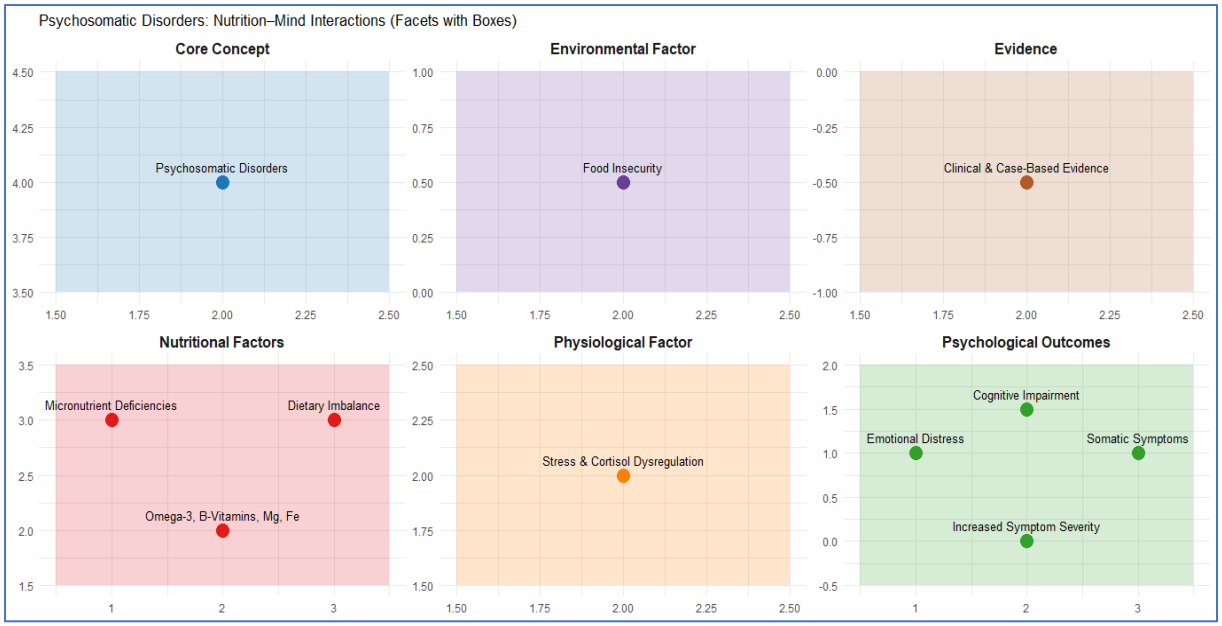
Fig 02.



The faceted box plot visually captures the multifactorial interactions underlyingpsychosomaticdisorders, emphasizing the pivotal role of nutrition, physiology, and environmentalcontext in shapingsymptom expression and psychologicaloutcomes. Eachfacetrepresents a key domain:NutritionalFactors (micronutrientdeficiencies, dietaryimbalance, specificnutrients), Physiological Factor (stress and cortisol dysregulation), PsychologicalOutcomes (emotionaldistress, cognitive impairment, somaticsymptoms, increasedsymptomseverity), Environmental Factor (foodinsecurity), Evidence (clinical and case-basedstudies), and the Core Concept (psychosomaticdisorders). The use of colored boxes groups relatedelementswithineachdomain, highlighting the interdependencies and the hierarchical structure of influences.

The plot illustratesthatnutritionalinadequacies—such as deficits in magnesium, iron, zinc, B-vitamins, and omega-3 fattyacids—converge with stress-mediatedphysiologicalmechanisms to exacerbatesomatic, emotional, and cognitive symptoms. Environmentalfactors like foodinsecurityfurtheramplifyvulnerability, creating a feedback loopthatperpetuatesnutritionalinstability and symptomseverity. The evidencefacetunderscores the empirical basis of theserelationships, drawingfromclinical trials and real-world observations thatdemonstrate how dietary interventions can mitigatesymptomburden. By organizingthese components intofacetswithvisualgrouping, the plot effectivelycommunicates the complex, multidimensionalpathwayslinking nutrition, stress, and psychosomaticsymptomatology, emphasizing the need for integratedassessment and intervention strategies in clinical practice.

3. Rare Diseases and Nutritional–Psychological Challenges

3.1 Characteristics and Epidemiology of Rare Diseases

Rare diseases are defined by lowprevalenceyet high clinicalcomplexity. In the European Union, a diseaseisclassified as rare whenit affects fewerthan 1 in 2,000 individuals, while in the United States the thresholdisfewerthan 200,000 affectedpersonsnationwide (EURORDIS, 2023; National Institutes of Health [NIH], 2024). Despitetheirindividualrarity, collectively rare diseases affect an estimated**300 million people worldwide**, representing a significant global health challenge (World HealthOrganization [WHO], 2023).

Rare diseases are predominantlychronic, progressive, and often life-threatening, withapproximately 70% having a geneticorigin and manymanifesting in earlychildhood (EURORDIS, 2023). Patients frequentlyexperienceprolonged diagnostic delays—averaging five to sevenyears—due to limitedclinical expertise and fragmentedhealthcarepathways (Shire, 2020). Thesecharacteristicscontribute not only to medicalvulnerability but also to profound psychosocial stress, positioning rare disease populations among the mostunderserved groups in global healthsystems.

3.2 Nutritional Complications ArisingfromGenetic and MetabolicDisorders

Nutritional complications are a commonyetunderrecognizedfeature of many rare diseases, particularlythosewithgenetic or metabolicetiologies. Inheritedmetabolicdisorders—such as phenylketonuria (PKU), mitochondrial diseases, and lysosomal storagedisorders—ofteninvolveimpairednutrientmetabolism, absorption, or utilization, necessitatinghighlyspecializeddietaryregimens (Singh et al., 2022). Failure to maintainnutritionalstability in these conditions can result in neurocognitive decline, fatigue, gastrointestinal dysfunction, and exacerbation of diseasesymptoms.

Additionally, rare neuromuscular and gastrointestinal disordersmay compromise feedingability, appetiteregulation, and digestive function, increasing the risk of malnutrition and micronutrientdeficiencies (Muscaritoli et al., 2021). Long-termreliance on restrictive or therapeuticdiets, whilemedicallynecessary, mayfurthercontribute to nutritionalmonotony, social isolation, and emotionalstrain. Thesenutritional challenges underscore the need for continuousdietary monitoring and psychosocial support in rare disease management.

3.3 PsychologicalBurden:Uncertainty, Stigma, and EmotionalDistress

Living with a rare disease imposes a substantialpsychologicalburdencharacterized by chronicuncertainty, social invisibility, and emotionaldistress. Patients and caregiversfrequently report feelings of anxiety, depression, helplessness, and fearrelated to disease progression, limitedtreatment options, and uncertainprognosis (Anderson et al., 2023). The rarity of these conditions often leads to social stigma and misunderstanding, which can intensify isolation and reduceaccess to peer support networks.

Global surveysconducted by EURORDIS revealthatindividualswith rare diseasesexperiencesignificantlylowerquality of life and higherlevels of psychologicaldistresscompared to the general population (EURORDIS, 2023). Caregivers are similarlyaffected, oftenfacing burnout, financialstrain, and emotional exhaustion. These psychosocial stressorsinteractwithbiologicalvulnerabilities, creating a compoundedrisk for mental healthdisorderswithin rare diseasecommunities.

3.4 Intersection of NutritionalInstability and Mental HealthDecline

The intersection of nutritionalinstability and psychologicaldistressrepresents a criticalyetinsufficientlyaddressed dimension of rare disease care. Nutritionalinstability—

whether due to disease-relatedmetabolicdysfunction, limitedaccess to specializedfoods, or socioeconomicbarriers—can exacerbatepsychologicalsymptoms by disruptingneurochemicalpathways, increasinginflammatoryresponses, and impairing stress regulation (Dal &Bilici, 2024). Conversely, psychologicaldistressmaynegatively affect appetite, dietaryadherence, and nutrient absorption, reinforcing a bidirectional cycle of decline. Empiricalevidence supports this interaction. Studiesinvolving patients withinheritedmetabolicdisordersdemonstratethatpoordietaryadherenceisassociatedwithincreasedanxiety, depressivesymptoms, and cognitive impairment (Singh et al., 2022). Furthermore, international health reports highlight that rare disease populations are disproportionatelyaffected by foodinsecurity due to the high cost and limitedavailability of specializeddiets, increasing the risk of bothnutritional and psychologicaldeterioration (WHO, 2023).

Thesefindingsemphasize the necessity of integratingnutritionalstabilityinto mental healthframeworks for rare diseases. Addressingnutritionalneeds in isolation frompsychological support risksoverlooking a fundamentaldeterminant of patient well-being. Instead, holistic care modelsthatrecognize the intertwined nature of nutrition and mental health are essential for improvingoutcomes in rare disease populations.

4. Biological and Psychosocial MechanismsConnecting Nutrition and Mental Health

4.1 Gut–Brain Axis and MicrobiotaAlterations

The gut–brain axis represents a bidirectional communication network linking the gastrointestinal system and the central nervous system through neural, endocrine, immune, and metabolicpathways. Nutrition plays a central role in modulatingthis axis by shaping the composition and function of the gutmicrobiota, which in turn influences neurotransmittersynthesis, stress reactivity, and emotionalregulation (Cryan et al., 2019). Alterations in dietary patterns—particularlylowintake of dietaryfiber and high consumption of ultra-processedfoods—have been associatedwithdysbiosis, a condition characterized by reducedmicrobialdiversity and increased pro-inflammatorybacteria.

In psychosomatic and rare disease populations, gut–brain axis disruption isespeciallyprevalent due to chronic stress, medication use, metabolicdysfunction, and restrictive diets (Dal &Bilici, 2024). Dysbiosis has been linked to increased intestinal permeability, allowinginflammatorymediators to influence brainfunction and contribute to anxiety, depression, and cognitive disturbances (Mayer et al., 2022). Thesemechanismsprovide a biologicalexplanation for the frequent co-occurrence of gastrointestinal symptoms and psychologicaldistress in psychosomaticdisorders and for neuropsychiatric manifestations in rare metabolicdiseases.

4.2 Inflammation, Oxidative Stress, and NeuropsychologicalEffects

Chroniclow-grade inflammation and oxidative stress constitute key biologicalpathwayslinkingnutritionalinstability to mental healthdecline. Nutritionaldeficiencies—particularly in antioxidantssuch as vitamins C and E, selenium, and polyphenols—reduce the body'sability to counteractoxidative damage, leading to neuronal vulnerability and impaired neurotransmission (Muscaritoli et al., 2021). Similarly, diets high in refinedsugars and saturated fats promotesystemic inflammation, which has been

consistentlyassociatedwithdepressivesymptoms and cognitive impairment (Miller & Raison, 2016).

In bothpsychosomatic and rare disease populations, inflammation maybeamplified by disease-related immune activation and chronicpsychological stress. Elevatedinflammatory markers such as C-reactiveprotein and pro-inflammatory cytokines have been observed in patients withsomaticsymptomdisorders and inheritedmetabolic conditions, correlatingwith fatigue, mooddisturbances, and reducedquality of life (Henningsen et al., 2018). Theseneuroinflammatoryprocesses affect brainregionsinvolved in emotionregulation and stress response, reinforcing the linkbetweennutritionalimbalance and psychologicaldysfunction.

4.3 Social Determinants of Nutrition in Rare and PsychosomaticDiseases

Beyond biologicalmechanisms, social determinantsplay a criticalrole in shapingnutritionalstability and mental healthoutcomes. Factorssuch as incomelevel, healthcareaccess, education, and foodavailability influence dietaryquality and predictability, particularly in populations managingchronic and rare conditions (FAO et al., 2024). Rare disease patients often face high out-of-pocketcosts for specializeddiets, supplements, and medicalfoods, increasing the risk of foodinsecurity and nutritional compromise.

Psychosomatic patients maysimilarlyencounterbarriersrelated to employmentinstability, healthcare stigma, and fragmented care, which affect theirability to maintain consistent dietary routines (WHO, 2022). International reports emphasizethatfoodinsecurityis not only a nutritional issue but also a psychosocial stressorthatsignificantlyincreases the risk of anxiety, depression, and emotional exhaustion (Alfonsi et al., 2024). These social determinantsthusinteractwithbiologicalvulnerabilities to intensify mental healthrisks in both groups.

4.4 BehavioralPathways:Appetite, Adherence, and Coping Strategies

Behavioralmechanismsrepresent a crucial linkbetween nutrition and mental health, mediating how individualsrespond to bothdisease-related stress and dietarydemands. Psychologicaldistresscommonlyaltersappetiteregulation, leading to eitherreducedintake or emotionaleating patterns that compromise nutritionaladequacy (Jacka et al., 2020). In rare disease populations, strict dietaryregimensmaycontribute to treatment fatigue, reducedadherence, and feelings of loss of autonomy, which can negatively affect mental well-being (Singh et al., 2022).

Coping strategiesalso influence dietarybehaviors. Adaptive coping—such as problem-solving and social support—has been associatedwithbetternutritionaladherence and psychologicaloutcomes, whereasmaladaptive coping, includingavoidance or denial, islinked to poorerdietquality and increasedsymptomburden (Löwe et al., 2022). Thesebehavioralpathways highlight the importance of integratingpsychological interventions withnutritional care to support sustainablehealthbehaviors and mental resilience.

5. Toward an Integrated Care Model

5.1 Importance of Multidisciplinary Intervention Strategies

The complexinterplaybetweennutritionalstability, psychologicalwell-being, and diseasepathology in psychosomatic and rare disease populations necessitates a shift fromfragmented, discipline-specific care towardintegrated, multidisciplinary intervention

strategies. Traditionalbiomedicalmodelsoftenprioritizesymptom management withoutsufficientlyaddressingunderlyingnutritional and psychosocial determinants, resulting in suboptimal outcomes and reducedquality of life (Engel, 1977;Henningsen et al., 2018). In contrast, integrated care modelsemphasizecoordinated interventions thatsimultaneouslyaddressbiological, psychological, and social dimensions of health.

International healthorganizationsincreasinglyadvocate for suchapproaches. The World HealthOrganization (WHO) highlights integrated, people-centeredhealth services as essential for managingchronic and complex conditions, particularlythoseinvolving mental health and long-term care needs (WHO, 2022). Evidence frompsychosomaticmedicine and rare disease care suggeststhatmultidisciplinary interventions improvesymptom control, enhancetreatmentadherence, and reducepsychologicaldistress by addressing the interdependentmechanismslinking nutrition and mental health (Muscaritoli et al., 2021).

5.2 Role of Nutritionists, Psychologists, and MedicalSpecialists

Effective integrated care requiresclearlydefined and collaborative rolesamonghealthcareprofessionals. **Clinicalnutritionists and dietitians** are central to assessingnutritionalrisk, designingindividualizeddietary plans, and monitoring nutrientadequacy, particularly in patients requiring restrictive or therapeuticdiets. Theirroleextendsbeyondnutritional prescription to patient education and support, which are critical for sustaining long-termadherence and preventingnutritionalinstability (Singh et al., 2022).

Psychologists and mental healthprofessionalscontribute by addressingemotionaldistress, maladaptive coping strategies, and illness-relatedanxiety. Psychological interventions—such as cognitive-behavioraltherapy, stress management, and psychoeducation—have demonstratedefficacy in reducingsymptomseverity in psychosomaticdisorders and improvingquality of life in rare disease populations (Löwe et al., 2022). Integrating mental health support withinnutritional and medical care enhances patient engagement and resilience.

Medicalspecialists, includinginternists, neurologists, gastroenterologists, and geneticists, play a crucial role in diagnosingunderlying conditions, managingdisease progression, and coordinating care across disciplines. Their collaboration withnutritionists and psychologistsensuresthattreatment plans are medicallyappropriate, nutritionallyfeasible, and psychologicallysupportive, therebyminimizingconflictingrecommendations and patient burden.

5.3 Policy and Clinical Implications for Rare Disease Management

At the policylevel, the integration of nutritional and psychological care has significant implications for rare disease management. Global advocacyorganizationssuch as EURORDIS and the WHO emphasize the need for national rare diseasestrategiesthatincorporatemultidisciplinary care pathways, includingaccess to specializednutritional support and mental health services (EURORDIS, 2023; WHO, 2023). However, manyhealthcaresystems continue to lackstructuredframeworks for deliveringsuchcomprehensive care.

Clinically, failure to addressnutritional and psychologicalneedscontributes to increasedhealthcareutilization, treatment non-adherence, and preventabledeterioration in mental health. Policymakers must thereforeprioritizereimbursementmechanisms for nutritional

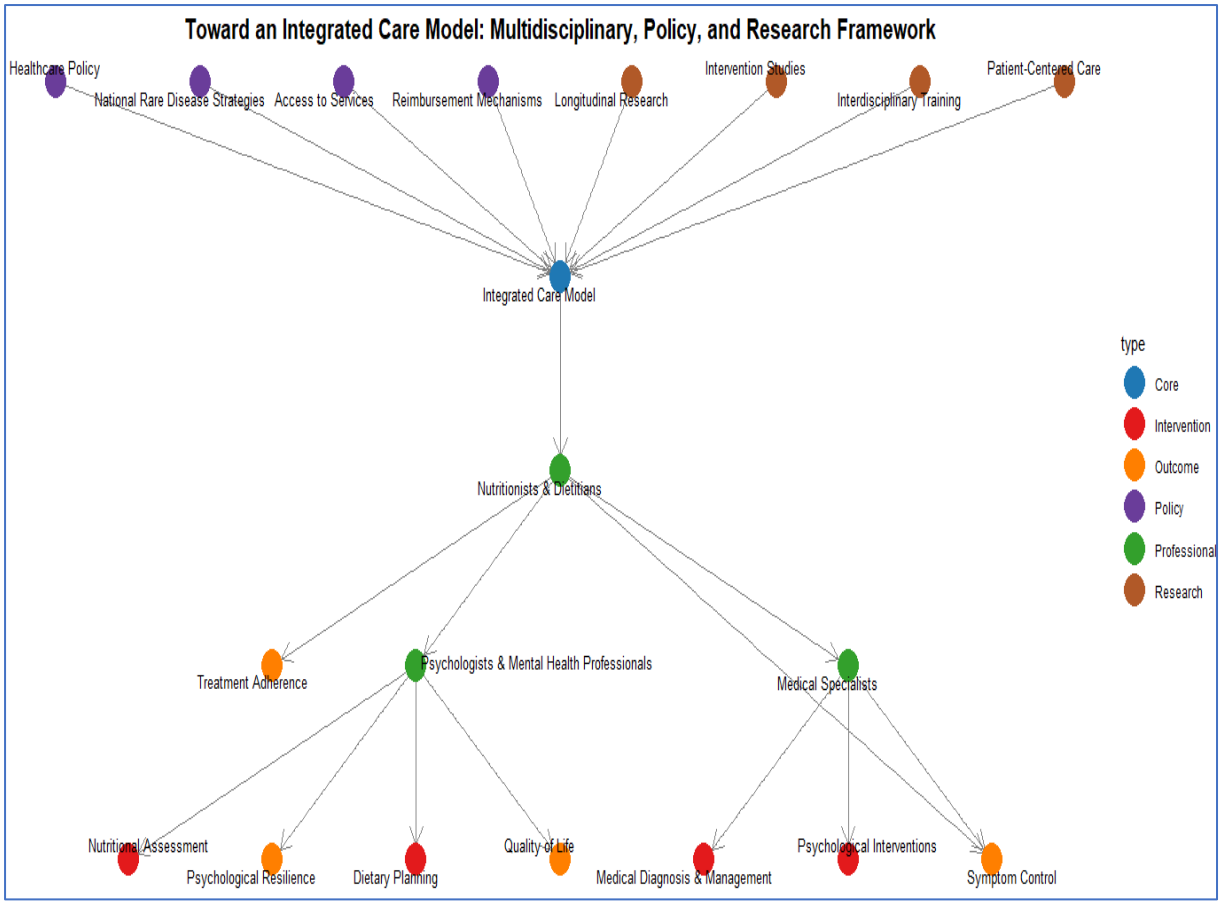
counseling, psychological services, and multidisciplinaryclinics. Ensuringequitableaccess to specializedmedicalfoods and nutritionalsupplementsisparticularlycritical, as economicbarriersremain a major source of nutritionalinstability and psychological stress for rare disease patients and theirfamilies (FAO et al., 2024).

5.4 Recommendations for Future Research and Practice

Future researchshouldadopt longitudinal and mixed-methods designs to better capture the dynamic interactions between nutrition, mental health, and disease progression in psychosomatic and rare disease populations. There is a pressing need for large-scale, cross-cultural studiesexamining how social determinants and healthcaresystems influence nutritionalstability and psychologicaloutcomes. Additionally, intervention studiesevaluatingintegrated care models—includingcombinednutritional and psychological interventions—remainlimited and warrant further exploration.

From a practicalstandpoint, healthcaresystemsshouldpromote routine nutritional and psychological screening as part of standard care for psychosomatic and rare disease patients. Training programs for healthcareprofessionalsshouldemphasizeinterdisciplinary collaboration and the psychosocial dimensions of nutrition. Finally, patient-centeredapproachesthatempowerindividuals and caregiversthrougheducation and shareddecision-making are essential for translatingintegrated care modelsintosustainableclinical practice.

Fig 03.



The integrated care model plot visuallyrepresents the multidimensionalframeworkrequired for effective management of psychosomatic and rare disease populations, highlighting the interplaybetweenprofessionals, interventions, outcomes, policy, and research. At the center, the corenode—Integrated Care Model—serves as the hub connectingmultidisciplinaryprofessionals, includingnutritionists, psychologists, and medicalspecialists, whose collaborative efforts are essential for addressingbothbiological and psychosocial determinants of health. Directededgesillustrate the flow fromprofessional actions to specific interventions, such as nutritionalassessment, dietary planning, psychologicaltherapy, and medicaldiagnosis, demonstrating how coordinated care translates intomeasurable patient outcomes, includingsymptom control, treatmentadherence, psychologicalresilience, and overallquality of life.

The plot furtheremphasizes the supportiveroles of policy and research, withnodesrepresenting national rare diseasestrategies, access to services, reimbursementmechanisms, longitudinal studies, intervention research, interdisciplinary training, and patient-centered care. Theseelementsfeed back into the integrated care model, indicatingthat structural, systemic, and evidence-based components are vital for sustainability and effectiveness. Color-codednodes and hierarchicallayoutclarify the distinct domainswhilehighlightingtheir interconnections, illustratingthatimproving patient outcomesrequiressimultaneous attention to clinical practice, professional collaboration, policyframeworks, and knowledgegeneration. Overall, the visualization captures the complex, multilevel nature of integrated care, providing a clear roadmap for translatingtheoreticalmodelsintoactionable, multidisciplinarystrategiesthatoptimizebothnutritionalstability and psychologicalwell-being in vulnerable populations.

Conclusion

This article underscores the pivotal role of nutritionalstability in shapingpsychologicalwell-being, particularlywithinpsychosomatic and rare disease populations. Evidence fromclinicalstudies, global health reports, and theoreticalframeworksdemonstratesthatnutritionalinadequacy—whether due to metabolicdysfunction, restrictive diets, or foodinsecurity—interactswithbiological, psychological, and social determinants to influence mood, cognition, and stress regulation. Psychosomaticdisorders and rare diseasesexemplify populations in whichthisinterplayisespeciallypronounced, as symptomburden, treatmentcomplexity, and social challenges exacerbatebothnutritional and mental healthvulnerabilities.

Biologicalmechanisms, includingdysregulation of the gut–brain axis, neuroinflammation, and oxidative stress, elucidate how dietdirectly influences neural functioning and psychologicalresilience. Simultaneously, psychosocial factorssuch as social determinants of nutrition, economicbarriers, stigma, and maladaptive coping strategies compound the risk of mental healthdecline. Case-based and epidemiologicalevidenceconsistently highlights thataddressingnutritionalstabilityis not merely a supportive intervention but a criticaldeterminant of holistichealthoutcomes.

The findings of thisreviewemphasize the necessity of integrated, multidisciplinary care modelsthat combine the expertise of nutritionists, psychologists, and medicalspecialists to

providecoordinated, patient-centered support. Suchmodels are vital for improvingtreatmentadherence, reducingpsychologicaldistress, and enhancingquality of life for individuals living withcomplex conditions.

Future researchshould focus on longitudinal, cross-cultural, and intervention-basedstudies to furtherclarify the causal pathwayslinking nutrition and psychologicalwell-being and to optimizeintegrated care strategies. Policymakers and healthcaresystems must prioritizeaccesstospecializednutritional support, mental health services, and multidisciplinary care, particularly for rare disease populations, to ensureequitable and effective management.

Ultimately, thisreview highlights thatnutritionalstabilityisboth a biologicalnecessity and a psychosocial safeguard, integral to sustaining mental health and overallwell-being in vulnerable populations. Addressing nutrition as a core component of holistic care can transformclinical practice, reducediseaseburden, and promoteresilienceamongthosemost at risk.

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