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NUTRITIONAL COMPLICATIONS OF HYPEREMESIS GRAVIDARUM: PREVENTING THIAMINE DEFICIENCY, WERNICKE ENCEPHALOPATHY AND REFEEDING SYNDROME.

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Abstract

Hyperemesis gravidarum (HG) can transform a common early-pregnancy symptom complex into a state of sustained nutritional deprivation in which dehydration, weight loss, electrolyte abnormalities and micronutrient depletion become central clinical problems. Thiamine deficiency is particularly important because prolonged low intake can compromise thiamine-dependent cerebral energy metabolism and culminate in Wernicke encephalopathy (WE), a preventable neurological emergency that is frequently incomplete in its classical presentation. Nutritional risk can also intensify during recovery: rapid carbohydrate delivery after starvation may provoke insulin-mediated intracellular shifts of phosphate, potassium and magnesium, increase thiamine demand and precipitate refeeding syndrome. This focused narrative review examines HG as a starvation-to-refeeding continuum and synthesizes evidence on diagnosis, nutritional-risk screening, maternal and fetal consequences, thiamine depletion, WE, refeeding physiology, and escalation of oral, enteral and parenteral nutrition. Particular attention is given to the point at which symptom management should be accompanied by formal nutrition assessment and to the role of the clinical dietitian in coordinating thiamine protection, electrolyte-aware feeding progression and post-discharge recovery. Current evidence is strongest for clinical recognition and preventive principles but remains heterogeneous for HG-specific malnutrition thresholds, feeding protocols and dietitian-led interventions. A practical clinical nutrition approach therefore requires early recognition of declining intake and weight trajectory, anticipatory thiamine protection in high-risk patients, cautious nutrition restoration when refeeding risk is present, and multidisciplinary follow-up to support maternal recovery without losing sight of fetal nutritional needs.

1. INTRODUCTION

Pregnancy is a period in which adequate nutrition supports maternal adaptation, placental function and fetal growth; in hyperemesis gravidarum (HG), however, the immediate clinical challenge can become the inability to retain sufficient food and fluids at all. HG is the severe end of nausea and vomiting of pregnancy, and the contemporary Windsor definition centres on severe nausea and/or vomiting beginning before 16 weeks of gestation, inability to eat or drink normally and marked restriction

of daily activities (Jansen et al., 2021; Nelson-Piercy et al., 2024). The condition affects approximately 0.3–3.6% of pregnancies and remains an important cause of emergency attendance and hospital care in early pregnancy (Fiaschi et al., 2016; Nelson-Piercy et al., 2024; Nana et al., 2026). Nausea and vomiting are much more common across pregnancy generally, underscoring that HG represents a distinct severe phenotype rather than routine pregnancy sickness (Einarson et al., 2013; Fejzo et al., 2019).

The nutritional burden of HG develops through a progressive interaction between restricted intake and ongoing losses. Persistent vomiting, food aversion, smell and taste sensitivity, and poor fluid tolerance can markedly reduce energy, protein and micronutrient intake, while recurrent emesis contributes to dehydration and electrolyte disturbance (Tan et al., 2020; Maslin et al., 2021a; Maslin and Dean, 2022). With continued nutritional deprivation, hepatic glycogen availability falls, fat oxidation and ketogenesis increase, and prolonged energy deficit can drive proteolysis and loss of lean tissue (Maslin and Dean, 2022; Nana et al., 2026). The clinical significance therefore lies not in ketonuria alone—which correlates poorly with HG severity—but in the duration and depth of inadequate intake, percentage weight loss, functional decline and biochemical evidence of depletion (Koot et al., 2020; Jansen et al., 2024). Contemporary mechanistic studies have also implicated placental and appetite-related signalling, particularly GDF15-associated pathways, in susceptibility to severe pregnancy nausea and HG (Fejzo et al., 2018; Fejzo et al., 2024); the present review, however, focuses on the downstream nutritional consequences once intake becomes compromised.

Among micronutrients, thiamine (vitamin B1) deserves particular attention because it is required for pyruvate dehydrogenase, α-ketoglutarate dehydrogenase and transketolase, linking thiamine status directly to carbohydrate oxidation, redox balance and neuronal energy metabolism (Kareem et al., 2023a; Oudman et al., 2019). Body stores are limited, so sustained vomiting and restricted intake can lead to progressive depletion over a period of weeks, especially when pregnancy-related metabolic demand and repeated glucose exposure coexist (Oudman et al., 2019; Kareem et al., 2023a). Severe deficiency may precipitate Wernicke encephalopathy (WE), an acute neurological syndrome in which ocular abnormalities, altered mental state and gait or coordination disturbance occur in variable combinations rather than as a reliably complete triad (Oudman et al., 2019; Fiorentini et al., 2023; Abouelbaqua et al., 2025). Nutritional danger does not necessarily resolve when vomiting improves. After prolonged low intake, rapid carbohydrate reintroduction can produce an insulin-dominant transition from catabolism to anabolism, driving phosphate, potassium and magnesium into cells while increasing thiamine-dependent metabolic demand and sodium-water retention (da Silva et al., 2020; Reber et al., 2019). The resulting refeeding syndrome can involve biochemical deterioration alone or progress to neuromuscular, respiratory, cardiovascular and neurological dysfunction (Friedli et al., 2017; da Silva et al., 2020). HG-specific reports remain uncommon but demonstrate severe hypophosphataemia, rhabdomyolysis, hepatic abnormalities, fetal loss and coexisting WE, illustrating that starvation, thiamine depletion and refeeding physiology can overlap within the same clinical course (Mayer and McGill, 2019; Ramrattan et al., 2022; Amoo et al., 2026).

These complications are therefore best viewed as a starvation-to-refeeding continuum rather than isolated events. This perspective places clinical nutrition alongside antiemetic therapy and fluid management from the early stages of care, because nutritional risk can evolve before classical neurological signs or severe laboratory abnormalities become evident (Dean et al., 2018; Maslin et al., 2021b; Clark et al., 2024). For this focused narrative review, PubMed/MEDLINE and reference lists of recent guidelines, systematic reviews and key primary studies were searched using terms covering HG, malnutrition, thiamine, Wernicke encephalopathy, refeeding syndrome and nutrition support; the search was updated through 8 August 2026. The review

integrates nutritional-risk recognition, starvation and thiamine-related neurological vulnerability, refeeding hazards, maternal-fetal consequences and clinical nutrition strategies for safe recovery.

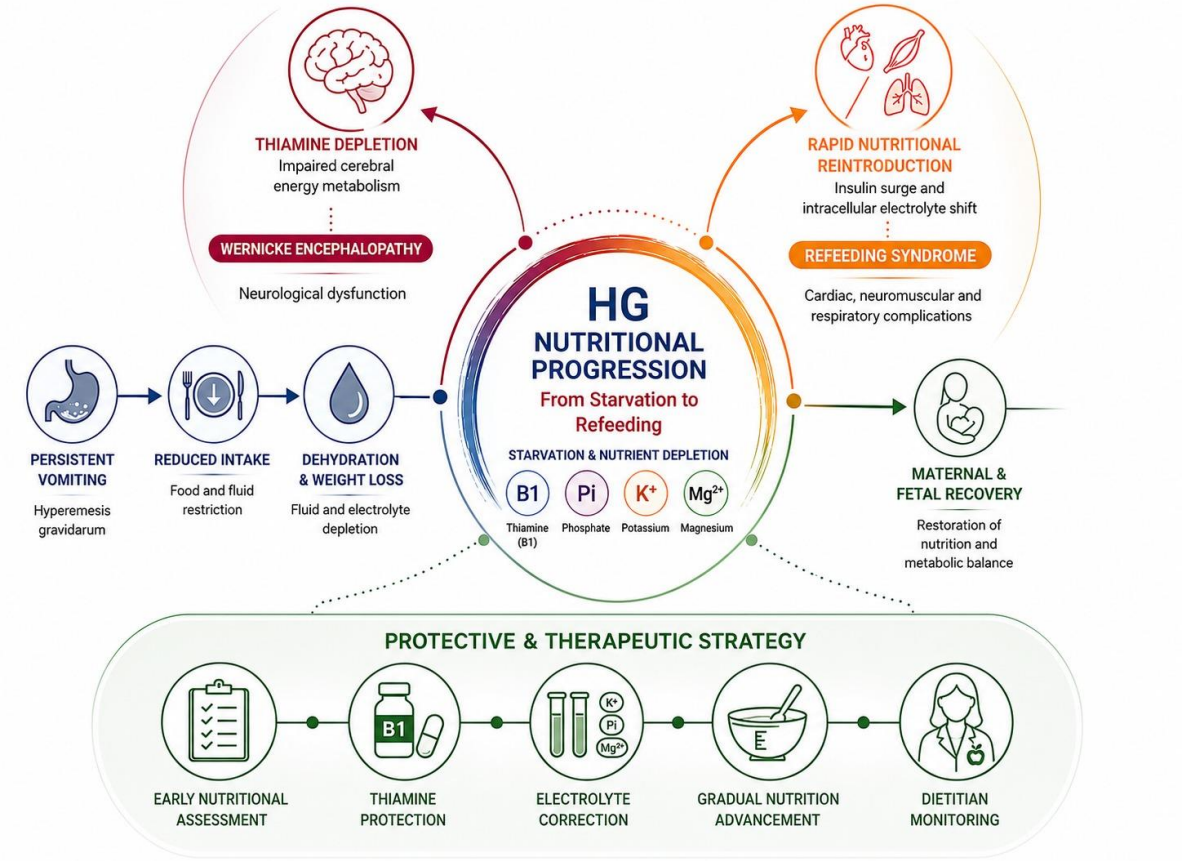


Figure 1. Nutritional progression of hyperemesis gravidarum from persistent vomiting to maternal–fetal recovery. Persistent vomiting, reduced intake and dehydration/weight loss culminate in starvation and nutrient depletion, including thiamine and intracellular electrolyte depletion. Thiamine depletion may impair cerebral energy metabolism and precipitate Wernicke encephalopathy, whereas rapid nutritional reintroduction may trigger insulin-mediated electrolyte shifts and refeeding syndrome. Early nutritional assessment, thiamine protection, electrolyte correction, gradual nutrition advancement and dietitian monitoring support recovery.

2. Diagnosis and Nutritional Risk Screening

2.1 Clinical definition and severity

The historical absence of a uniform definition has complicated both clinical care and comparison between HG studies. The Windsor consensus definition improved consistency by identifying four mandatory features: symptom onset before 16 weeks of gestation, severe nausea and/or vomiting, inability to eat and/or drink normally, and marked limitation of daily activities; signs of dehydration are contributory rather than mandatory (Jansen et al., 2021). Current RCOG guidance adopts a similarly symptom- and function-centred approach and emphasizes that ketonuria is not required to diagnose HG or to determine access to treatment (Nelson-Piercy et al., 2024). This shift is clinically important because a patient can be nutritionally compromised before a fixed weight-loss threshold, ketone concentration or hospital-admission criterion is reached (Koot et al., 2018; Jansen et al., 2024).

2.2 Dietary intake and weight-loss assessment

Symptom scores are useful but cannot substitute for direct nutritional assessment. The Pregnancy-

Unique Quantification of Emesis (PUQE) score quantifies nausea, vomiting and retching, while the HyperEmesis Level Prediction (HELP) score captures a broader burden of severe disease (Koren et al., 2002; MacGibbon et al., 2021). From a nutrition perspective, the more actionable variables are pre-pregnancy weight, current weight, percentage and rate of weight loss, number of days with minimal intake, foods and fluids that remain tolerable, and evidence of muscle or fat loss (Birkeland et al., 2015; Maslin and Dean, 2022). Serial measurements are preferable to a single body mass index because overweight or obesity can mask clinically important tissue loss, and inadequate gestational weight gain may carry outcome implications independent of symptom severity (Fejzo et al., 2009; Hsieh et al., 2025).

2.3 Dehydration and electrolyte assessment

Hydration assessment should integrate history, examination and biochemical context rather than one marker (Armstrong et al., 2016; Nelson-Piercy et al., 2024). Urea, creatinine, sodium and potassium are commonly assessed when intravenous therapy is required, while magnesium and phosphate become particularly important when intake has been negligible, weight loss is substantial or nutrition is restarted after starvation (Clark et al., 2024; da Silva et al., 2020). Acid-base, renal and hepatic abnormalities can occur in severe illness and should be interpreted alongside vomiting pattern, fluid intake and medication exposure (Dean et al., 2018; Nana et al., 2026).

2.4 Malnutrition screening

General adult malnutrition frameworks emphasize weight loss, reduced intake, muscle or subcutaneous-fat loss, fluid accumulation and functional decline, but pregnancy complicates interpretation because physiological weight gain and body-composition change alter baseline expectations (White et al., 2012; Cederholm et al., 2017). No widely validated HG-specific malnutrition tool currently integrates pregnancy stage, symptom severity, intake duration and body-composition change (Maslin and Dean, 2022; Dean et al., 2021). Clinical dietitians should therefore treat repeated inability to meet nutritional needs, progressive weight loss or visible tissue depletion as reasons for escalation even when a generic screening score appears modest (Maslin et al., 2021b; Nana et al., 2026).

2.5 Thiamine-deficiency and refeeding-risk identification

Thiamine risk should be assessed prospectively because laboratory confirmation may be unavailable, slow or difficult to interpret in an acutely unwell patient. Prolonged vomiting, severe restriction, repeated admissions, marked weight loss, planned dextrose administration and initiation of enteral or parenteral nutrition all increase concern for thiamine depletion (Oudman et al., 2019; Nelson-Piercy et al., 2024). Refeeding risk similarly rises with several days of negligible intake, significant weight loss, low or falling phosphate, potassium or magnesium, and rapid increases in carbohydrate delivery (Reber et al., 2019; da Silva et al., 2020). The purpose of screening is therefore to identify the transition from symptomatic HG to nutritional depletion before neurological or cardiometabolic complications emerge.

3. Maternal and Fetal Consequences

3.1 Maternal metabolic and functional consequences

The maternal burden of HG extends beyond vomiting itself. Dehydration, electrolyte disturbance, weight loss and reduced mobility can coexist with renal or hepatic biochemical abnormalities, venous thromboembolism risk and profound impairment of daily functioning (Fiaschi et al., 2018; Nelson-Piercy et al., 2024; Nana et al., 2026). Severe weight loss may exceed 10–15% of pre-pregnancy weight in prolonged disease, and patients with higher starting body weight can still develop clinically important malnutrition despite remaining within a conventional 'normal' or 'high' BMI range (Fejzo et al., 2009; Mullin et al., 2012; Maslin and Dean, 2022). The psychological burden is also substantial, with systematic and prospective evidence documenting depression, anxiety, post-

traumatic stress symptoms and major disruption to work, relationships and willingness to undertake future pregnancies (Christodoulou-Smith et al., 2011; Mitchell-Jones et al., 2017; Mitchell-Jones et al., 2020; Heitmann et al., 2017). Historical cohort data also document that the severity and persistence of HG have contributed to decisions to terminate otherwise wanted pregnancies in a minority of affected patients (Poursharif et al., 2007).

3.2 Neurological complications

Neurological morbidity is most clinically distinctive when thiamine deficiency progresses to WE. A 2019 systematic review of 177 published HG-associated cases found prolonged vomiting and marked weight loss to be recurrent antecedents and highlighted delayed thiamine treatment and glucose exposure before adequate replacement as preventable hazards (Oudman et al., 2019). The 2023 review by Fiorentini et al. identified 82 cases in which ocular signs, confusion and ataxia were prominent, while a 2025 intensive-care case series showed that prodromal symptoms could precede the classical syndrome and that residual neurological disability was common (Fiorentini et al., 2023; Abouelbaqua et al., 2025). Recent case literature continues to report delayed recognition, reinforcing the need for treatment based on clinical suspicion rather than a complete triad (Szablewska et al., 2025).

3.3 Pregnancy and fetal outcomes

Associations between HG and pregnancy outcomes are heterogeneous and appear to be modified by disease severity, maternal weight trajectory and study design. Population-based studies and meta-analyses have reported increased risks of preterm birth, low birth weight or altered fetal growth in some cohorts, particularly when maternal weight regain is poor or disease is severe (Veenendaal et al., 2011; Vandraas et al., 2013; Meinich and Trovik, 2020; Liu and Zhou, 2024; Porgador et al., 2024). In the 2025 nuMoM2b analysis, inadequate gestational weight gain was a more consistent predictor of adverse short-term outcomes than nausea-vomiting severity alone, supporting the clinical relevance of nutritional recovery rather than symptom counting in isolation (Hsieh et al., 2025). Earlier reports raised concern about long-term metabolic and neurodevelopmental outcomes, but a large 2025 sibling-comparison study found that many apparent associations were attenuated after accounting for shared familial factors (Ayyavoo et al., 2013; Koot et al., 2017; Pont et al., 2025).

3.4 Limitations of current outcome evidence

Causal interpretation remains difficult because HG definitions, thresholds for admission, treatment exposure and nutritional measurements vary widely between studies (Koot et al., 2018; Jansen et al., 2020). Many cohorts use hospital coding as a proxy for severity, while actual energy intake, percentage weight loss, micronutrient status and duration of starvation are incompletely recorded (Grooten et al., 2015; Maslin et al., 2021a). This heterogeneity means that adverse outcomes should not be attributed to HG or to a single nutrient deficiency without considering confounding by baseline maternal health, socioeconomic factors, treatment delay and gestational weight gain (Liu and Zhou, 2024; Pont et al., 2025).

Table 1. Maternal and fetal consequences of severe hyperemesis gravidarum

Domain	Likely pathway	Clinical implication	Selected evidence
Maternal dehydration and electrolyte disturbance	Vomiting plus low fluid intake; renal and acid–base effects	Weakness, dizziness, arrhythmia risk, acute kidney injury in severe cases	Fiaschi et al., 2018; Nana et al., 2026

Domain	Likely pathway	Clinical implication	Selected evidence
Maternal malnutrition and tissue loss	Sustained energy/protein deficit and catabolism	Weight loss, reduced muscle reserve, functional decline, impaired recovery	Fejzo et al., 2009; Maslin and Dean, 2022
Neurological injury	Thiamine depletion with impaired cerebral energy metabolism	Wernicke encephalopathy, persistent cognitive/gait deficits	Oudman et al., 2019; Fiorentini et al., 2023
Preterm birth / low birth weight	Severe disease, poor weight gain and associated clinical factors	Higher risk reported in several cohorts, but effect sizes vary	Veenendaal et al., 2011; Porgador et al., 2024
Long-term offspring outcomes	Potential intrauterine exposure plus familial/genetic confounding	Earlier associations are not consistently sustained in sibling analyses	Koot et al., 2017; Pont et al., 2025

4. Nutritional Implications of Hyperemesis Gravidarum

4.1 Reduced energy, protein and fluid intake

The defining nutritional problem in HG is a sustained mismatch between nutrient requirements and the amount that can be consumed and retained. Food aversion, hypersensitivity to odours, altered taste, nausea provoked by meal volume and intolerance of fluids can narrow intake to a small and changing group of 'safe' foods (Tan et al., 2020; Havnen et al., 2019). Scoping evidence indicates that direct measurements of energy, protein and micronutrient intake in HG are surprisingly sparse, despite reduced intake being central to the clinical syndrome (Maslin et al., 2021a). Earlier biochemical work nevertheless demonstrated broad nutritional depletion in hospitalised patients, while studies of pregnancy-related nausea show measurable deterioration in diet quality even at less severe levels of illness (van Stuijvenberg et al., 1995; Crozier et al., 2017). Case literature further shows that prolonged HG can produce deficiencies beyond thiamine, including clinically important vitamin K deficiency (Shigemi et al., 2015). The practical implication is that nutritional adequacy cannot be inferred from the ability to tolerate isolated snacks or fluids; daily intake and weight trajectory should be followed over time.

Protein intake is especially relevant because persistent negative energy balance promotes use of endogenous protein as a metabolic substrate. Loss of lean tissue may reduce functional reserve and can be difficult to detect if routine assessment focuses only on total body weight (Maslin and Dean, 2022; Cederholm et al., 2017). Fluid restriction caused by nausea or fear of vomiting can compound the problem by limiting oral rehydration and making dry, energy-dense foods difficult to tolerate (Havnen et al., 2019; Dean et al., 2018). Consequently, the clinical nutrition target during active HG is often not immediate achievement of an ideal pregnancy diet but a staged increase in tolerable energy, protein and fluid intake while medical therapy reduces the symptom burden (Maslin and Dean, 2022; Jansen et al., 2024).

4.2 Starvation metabolism and maternal catabolism

When carbohydrate intake falls, hepatic glycogen stores become progressively depleted and metabolism shifts toward lipolysis, free-fatty-acid oxidation and ketone production. With

prolonged undernutrition, amino acids derived from tissue proteolysis also contribute to gluconeogenesis, potentially reducing skeletal-muscle reserve and worsening weakness (Maslin and Dean, 2022; Nana et al., 2026). Pregnancy itself is metabolically dynamic, so prolonged starvation occurs against a background of changing insulin sensitivity, plasma-volume expansion and fetal nutrient demand (Kareem et al., 2023a). Although urinary ketones were historically used as a marker of HG severity, evidence shows that ketonuria does not reliably track clinical severity; the more important signals are duration of low intake, rate of weight loss, functional deterioration and biochemical disturbance (Koot et al., 2020; Nelson-Piercy et al., 2024).

The clinical consequences of catabolism are not limited to energy deficit. Intracellular stores of phosphate, potassium and magnesium can fall during prolonged starvation even when serum concentrations initially remain within reference ranges, creating vulnerability when insulin rises during refeeding (Reber et al., 2019; da Silva et al., 2020). The same period of low intake reduces vitamin replenishment, including thiamine, so the patient may move simultaneously toward micronutrient deficiency and refeeding risk (Oudman et al., 2019; Amoo et al., 2026). This is why a sudden improvement in nausea does not automatically signify metabolic recovery.

4.3 Dehydration and electrolyte disturbances

Repeated vomiting and reduced fluid intake can produce extracellular-volume depletion, changes in renal perfusion and disturbances in sodium, potassium, chloride and acid-base balance (Dean et al., 2018; Clark et al., 2024). Loss of gastric hydrochloric acid can favour hypochloraemic metabolic alkalosis, whereas prolonged starvation, renal hypoperfusion or concurrent illness may create mixed biochemical patterns; interpretation should therefore follow the clinical context rather than a single expected profile (Dean et al., 2018; Nana et al., 2026). Potassium loss is particularly relevant because severe hypokalaemia can contribute to weakness and cardiac electrical instability, while magnesium depletion can complicate potassium correction and increase neuromuscular risk (Nana et al., 2026; da Silva et al., 2020). Phosphate is not routinely abnormal in all HG patients but becomes a high-priority analyte in severely depleted patients and after feeding begins because a rapid decline may signal refeeding physiology (Reber et al., 2019; Ramrattan et al., 2022). Fluid replacement can correct hypovolaemia, but hydration alone does not reverse protein-energy malnutrition or depleted micronutrient stores; nutritional assessment must therefore occur in parallel with intravenous therapy (Maslin et al., 2021b; Clark et al., 2024).

4.4 Thiamine depletion during prolonged dietary restriction

Thiamine is converted to thiamine pyrophosphate (TPP), an essential cofactor for pyruvate dehydrogenase and α-ketoglutarate dehydrogenase in oxidative metabolism and for transketolase in the pentose-phosphate pathway (Kareem et al., 2023a). These pathways are central to ATP generation and redox homeostasis, which explains the particular vulnerability of the brain when thiamine becomes limiting (Oudman et al., 2019). Human thiamine stores are small relative to daily metabolic use; therefore, weeks of restricted intake can produce clinically significant depletion, especially when vomiting prevents supplementation and carbohydrate is subsequently administered (Oudman et al., 2019; Fiorentini et al., 2023). Pregnancy is also associated with increased thiamine demand, and population data from thiamine-deficient settings demonstrate that subclinical deficiency can be common even without HG, potentially narrowing reserve further (Kareem et al., 2023b).

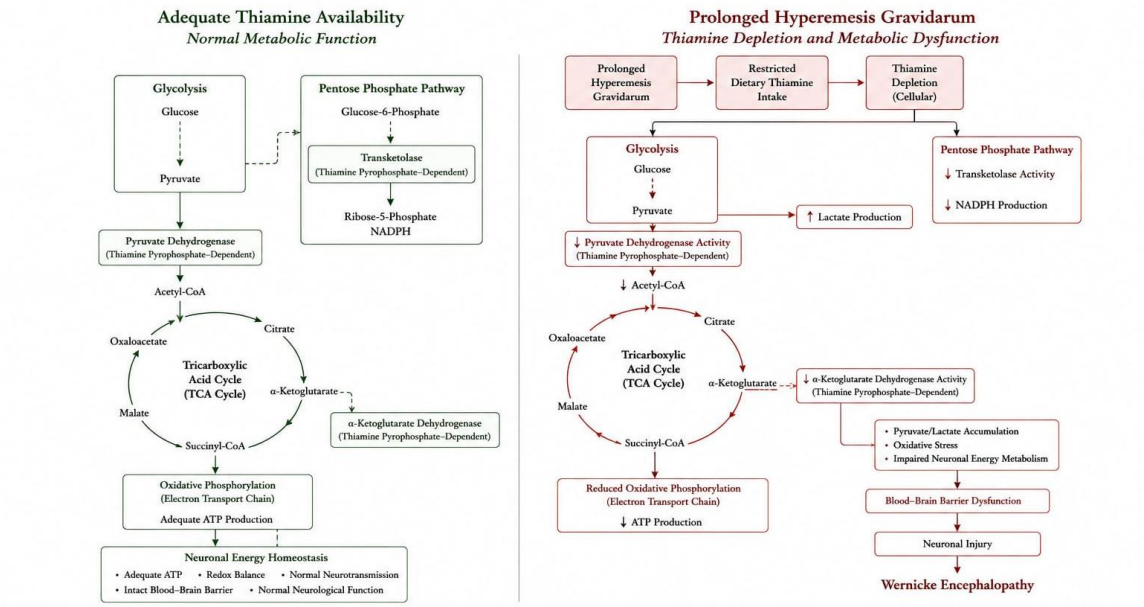
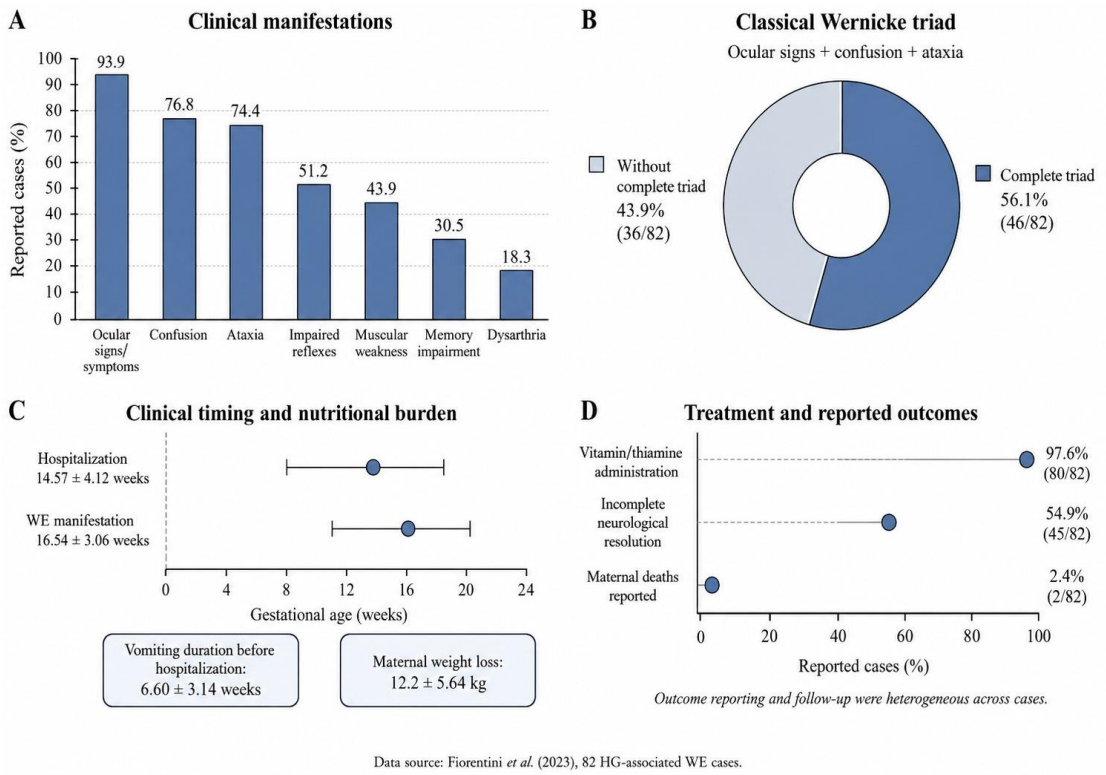


Figure 2. Thiamine-dependent energy metabolism and neurological injury during hyperemesis gravidarum. Adequate thiamine supports pyruvate dehydrogenase, α-ketoglutarate dehydrogenase and transketolase; depletion reduces ATP generation, increases lactate and oxidative stress, and contributes to blood–brain barrier dysfunction and Wernicke encephalopathy.

4.5 Wernicke encephalopathy

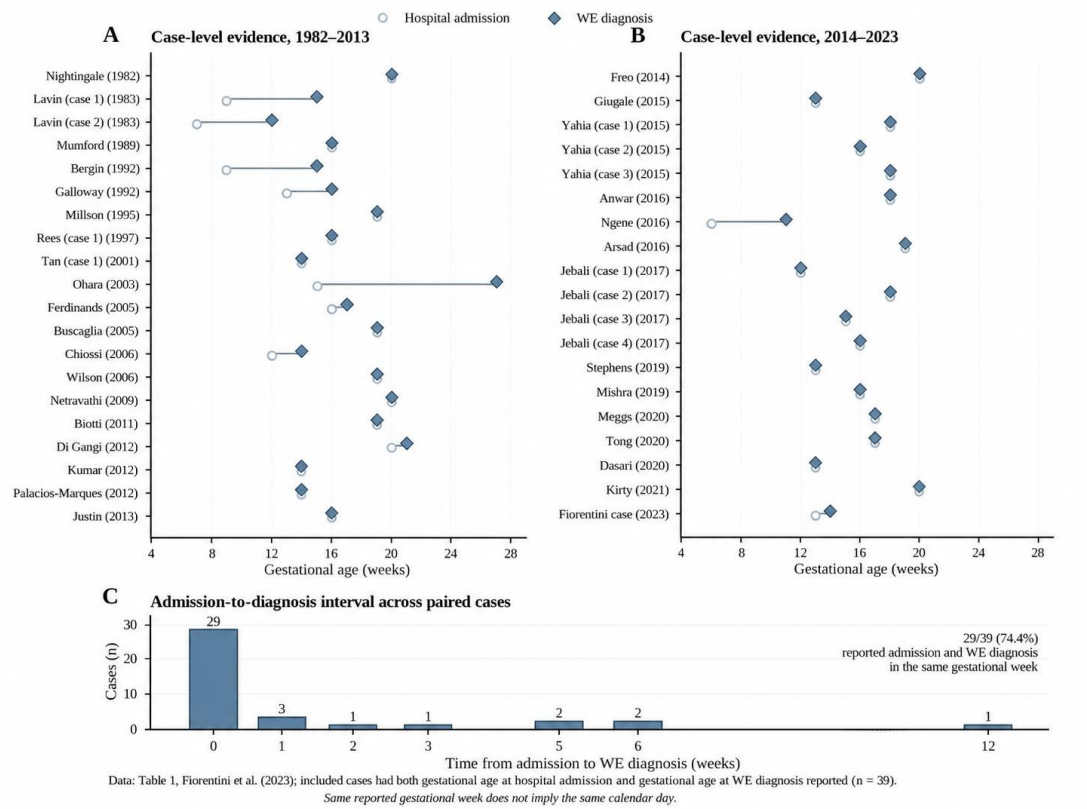
WE is the most recognised neurological consequence of severe thiamine deficiency in HG, but it remains a clinical diagnosis that can be missed when clinicians wait for the classic triad. Ocular abnormalities, altered mental status and gait or coordination disturbance occur with variable frequency, and additional findings can include hyporeflexia, muscular weakness, dysarthria and memory impairment (Oudman et al., 2019; Fiorentini et al., 2023). Caine's operational criteria, developed outside pregnancy, broaden recognition by considering dietary deficiency, oculomotor abnormalities, cerebellar dysfunction and altered mental state or memory impairment; contemporary HG case series have found this framework useful for early suspicion (Caine et al., 1997; Abouelbaqua et al., 2025). MRI can support the diagnosis but a normal or non-classical scan does not eliminate clinical concern, and treatment should not be delayed while awaiting confirmatory testing when WE is suspected (Oudman et al., 2019; Szablewska et al., 2025).



Graph 1. Clinical spectrum and reported outcomes of hyperemesis gravidarum-associated Wernicke encephalopathy in 82 published cases. Panels summarize major manifestations, completeness of the classical triad, clinical timing and nutritional burden, and reported treatment/outcomes. Data from Fiorentini et al. (2023).

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The case literature reveals a recurring chronology: several weeks of vomiting and major weight loss precede neurological deterioration, often around the late first or early second trimester (Oudman et al., 2019; Fiorentini et al., 2023). In the 2025 Moroccan intensive-care series, 12 of 76 admitted HG patients developed WE; the median period of vomiting before depletion was approximately 11 weeks, and residual neurological disability was common despite treatment (Abouelbaqua et al., 2025). The central clinical lesson is preventive: patients with prolonged vomiting should receive thiamine protection before high-carbohydrate exposure and before parenteral nutrition, rather than waiting for neurological symptoms to establish the diagnosis (Nelson-Piercy et al., 2024; Clark et al., 2024).



Graph 2. Case-level timing of Wernicke encephalopathy in hyperemesis gravidarum. Panels A and B show gestational age at hospital admission and at Wernicke encephalopathy diagnosis across published cases, while Panel C summarizes the admission-to-diagnosis interval among cases with paired timing data. Data from Fiorentini et al. (2023).

Table 2. Clinical characteristics of HG-associated Wernicke encephalopathy evidence

Source	Evidence type	Key clinical features	Clinical interpretation
Oudman et al., 2019	Systematic review; 177 published cases	Prolonged vomiting and substantial weight loss; frequent delayed thiamine treatment	Glucose before adequate thiamine and delayed recognition were recurrent preventable concerns
Fiorentini et al., 2023	Systematic review; 82 cases from 66 manuscripts	Ocular signs 93.9%, confusion 76.8%, ataxia 74.4%	Demonstrates heterogeneous neurological presentation and supports early prophylaxis

Source	Evidence type	Key clinical features	Clinical interpretation
Abouelbaqua et al., 2025	Retrospective ICU series; 12 WE cases among 76 HG admissions	Median ~11 weeks of vomiting before depletion; residual disability common	Shows prodromal signs and value of early clinical criteria
Szablewska et al., 2025	Case report	Cognitive disturbance, nystagmus, limb ataxia and postural instability	Neurological improvement followed intravenous thiamine
Amoo et al., 2026	Case report with concurrent refeeding syndrome	Severe HG followed by nutritional restoration and neurological deterioration	Illustrates overlap between thiamine depletion and refeeding physiology

4.6 Refeeding syndrome following nutritional restoration

Refeeding syndrome describes metabolic deterioration that follows a substantial increase in energy provision after starvation or severe undernutrition. During starvation, insulin concentrations fall and fat oxidation predominates, while total-body phosphate, potassium and magnesium can become depleted (Reber et al., 2019; Friedli et al., 2017). Reintroduction of carbohydrate raises insulin, stimulates cellular uptake of glucose and electrolytes, accelerates ATP and phosphorylated-intermediate synthesis, and increases thiamine utilisation (da Silva et al., 2020). At the same time, sodium and water retention can increase, creating a combined risk of hypophosphataemia, hypokalaemia, hypomagnesaemia, fluid overload and organ dysfunction (Reber et al., 2019; da Silva et al., 2020).

HG is a biologically plausible refeeding-risk state because severe disease combines prolonged negligible intake, weight loss, electrolyte depletion and subsequent exposure to oral food, dextrose-containing fluids, enteral feeds or parenteral nutrition (Mayer and McGill, 2019; Ramrattan et al., 2022). Case reports have described severe hypophosphataemia with rhabdomyolysis and hepatic abnormalities that can mimic obstetric pathology, emphasizing the importance of considering refeeding physiology when deterioration occurs after feeding begins (Ramrattan et al., 2022). A 2026 report of refeeding syndrome complicated by WE further illustrates that thiamine depletion and electrolyte shifts may coexist, making 'refeeding' a phase that requires active clinical surveillance rather than simply restoration of calories (Amoo et al., 2026).

Table 3. Starvation, thiamine deficiency and refeeding syndrome: mechanisms, indicators and complications

Stage	Dominant mechanism	Indicators	Potential complication
Persistent HG / starvation	Low intake, glycogen depletion, lipolysis and proteolysis	Weight loss, weakness, poor intake, dehydration	Progressive protein-energy and micronutrient depletion
Thiamine depletion	Reduced TPP-dependent carbohydrate oxidation	Ocular signs, confusion, ataxia may emerge	Risk of WE; neurological injury can become persistent

Stage	Dominant mechanism	Indicators	Potential complication
Early refeeding	Insulin surge and intracellular P/K/Mg shifts	Falling phosphate, potassium or magnesium after feeding	Arrhythmia, weakness, respiratory or neurological dysfunction
Fluid transition	Insulin-associated sodium and water retention	Rapid weight gain, oedema, cardiorespiratory symptoms	Fluid overload may amplify organ stress
Recovery	Gradual restoration of energy, protein, fluids and micronutrients	Improving intake, weight trajectory and biochemistry	Requires relapse prevention and follow-up

5. Clinical and Nutritional Management

5.1 Antiemetic treatment and restoration of oral intake

Nutritional rehabilitation is unlikely to succeed if nausea and vomiting remain uncontrolled, so medical and dietetic care must proceed in parallel. Contemporary reviews and guidelines support stepwise antiemetic therapy and fluid replacement according to severity, with escalation of care when oral intake, hydration or function cannot be maintained (Nelson-Piercy et al., 2024; Jansen et al., 2024; Clark et al., 2024). Evidence does not support one universally superior intervention across all patients, and older randomized evidence remains limited by small samples and inconsistent HG definitions (Tan et al., 2009; O'Donnell et al., 2016; Boelig et al., 2016). The nutritional objective during the acute phase is therefore pragmatic: reduce the gap between requirements and tolerable intake while avoiding advice that increases aversion or makes the patient feel that failure to eat is behavioural rather than physiological (Havnen et al., 2019; Doherty et al., 2023). Day-care and outpatient pathways have also been evaluated as alternatives to inpatient care for selected patients, with effects on admission burden and service use varying by setting (McCarthy et al., 2014; McParlin et al., 2016; Ucyigit, 2020). Real-world surveys and practice reviews likewise show substantial heterogeneity in treatment approaches and escalation pathways (MacGibbon, 2020; Mares et al., 2022).

5.2 Thiamine prophylaxis and neurological protection

Thiamine protection should be anticipatory in patients with prolonged vomiting or severely reduced intake. RCOG recommends thiamine for patients admitted with vomiting or markedly reduced dietary intake, particularly before administration of dextrose-containing fluids or parenteral nutrition (Nelson-Piercy et al., 2024). This recommendation is biologically supported by thiamine's central role in carbohydrate metabolism and by systematic case evidence linking delayed replacement and glucose exposure with HG-associated WE (Oudman et al., 2019; Fiorentini et al., 2023). When WE is clinically suspected, treatment is a medical emergency and should not be postponed for laboratory confirmation; exact route and dose should follow specialist/local protocols and pregnancy-specific guidance (Clark et al., 2024; Nana et al., 2026). The dietitian's role is to identify nutritional history and carbohydrate exposure that increase risk and to ensure planned increases in energy delivery are communicated to the medical team.

5.3 Fluid and electrolyte correction

Intravenous fluid therapy restores circulation and corrects vomiting-related losses but should be individualized according to clinical examination and laboratory findings (Nelson-Piercy et al., 2024; Clark et al., 2024). Potassium replacement is frequently required in significant vomiting,

while magnesium and phosphate deserve specific attention in patients with prolonged starvation or after feeding has begun (da Silva et al., 2020; Nana et al., 2026). The key refeeding principle is temporal: electrolyte values should be assessed before a major increase in calories and monitored closely during the early refeeding period in high-risk patients (Reber et al., 2019; da Silva et al., 2020). A falling phosphate, potassium or magnesium concentration after nutrition begins should trigger reassessment of the pace of feeding and medical replacement rather than automatic continuation of the planned caloric advance (da Silva et al., 2020).

5.4 Oral nutrition and tolerated dietary strategies

When oral intake is possible, individualized tolerance takes priority over prescriptive 'healthy pregnancy' rules during the acute phase. Patients often report aversions related to smell, temperature, texture and meal volume, and triggers can change over time (Tan et al., 2020; Havnen et al., 2019). Small, frequent eating opportunities, energy-dense tolerated foods, oral rehydration strategies and oral nutrition supplements can be trialled according to tolerance, although comparative evidence for specific HG diets remains limited (Maslin and Dean, 2022; Boelig et al., 2016). A randomized trial found that watermelon plus dietary advice improved some short-term outcomes compared with advice alone after hospitalization, but this single-food intervention should not be generalized into a universal HG prescription (Tan et al., 2023).

As symptoms improve, nutritional goals can shift from simple tolerance toward adequacy. Protein-containing foods or supplements should be incorporated as tolerated to support tissue recovery, while reintroduction of a broader diet can address micronutrient gaps created during restriction (Maslin et al., 2021a; Maslin and Dean, 2022). Prenatal vitamins may themselves worsen nausea in some patients, so timing and formulation may require medical and dietetic adjustment rather than abandonment of micronutrient support (Nana et al., 2026). The process should remain flexible because rigid food lists can reinforce aversion and reduce adherence.

5.5 Enteral nutrition

Enteral nutrition is considered when oral intake remains inadequate despite optimized medical treatment and the gastrointestinal tract is usable. Options described in HG include nasogastric, nasojejunal and jejunal feeding, with potential advantages of providing measurable nutrition while avoiding central venous catheter risks (Vaisman et al., 2004; Saha et al., 2009; Stokke et al., 2015). Observational reports have described successful weight stabilization in selected severe cases, but tolerability is a major limitation because nausea, tube discomfort, displacement and ongoing vomiting can lead to discontinuation (Stokke et al., 2015; Havnen et al., 2019).

The best randomized evidence does not support routine early nasogastric feeding for every hospitalized patient. In the MOTHER trial, 116 women were randomized to early enteral tube feeding plus standard care or standard care alone; early tube feeding did not improve birth weight or several secondary outcomes, and many participants discontinued the tube because of poor tolerance (Grooten et al., 2017). The result argues for selective rather than automatic enteral feeding, particularly in patients with marked ongoing weight loss, prolonged inadequate intake or repeated admissions in whom potential benefit may outweigh burden (Maslin and Dean, 2022; Nana et al., 2026). Any enteral regimen initiated after prolonged starvation should be advanced with the same attention to thiamine and electrolyte shifts as other forms of refeeding (da Silva et al., 2020).

5.6 Parenteral nutrition

Parenteral nutrition can deliver energy and nutrients when oral and enteral approaches are not feasible, but it should remain a specialist option because catheter-related and metabolic complications are clinically important in pregnancy (Peled et al., 2014; Cape et al., 2014). Retrospective evidence has reported improved outcomes in some severely affected patients

receiving total parenteral nutrition, but confounding by severity and treatment selection limits interpretation (Peled et al., 2014). Conversely, studies of PICC-based management have documented bacteraemia, thrombosis and other serious complications, and a later systematic review found substantial heterogeneity in reported PICC complication rates during pregnancy (Holmgren et al., 2008; Frolova et al., 2022). Parenteral nutrition should therefore be considered only within a multidisciplinary nutrition-support framework with line-care expertise, glucose and liver monitoring, micronutrient provision and explicit refeeding precautions (National Institute for Health and Care Excellence, 2017; Maslin and Dean, 2022).

Table 4. Comparison of oral, enteral and parenteral nutrition in severe hyperemesis gravidarum

Route	Typical role	Potential advantages	Limitations/risks	Priority monitoring
Oral nutrition	First-line whenever sufficient intake can be achieved	Least invasive; respects patient preference; supports normal eating	May remain quantitatively inadequate; aversions and vomiting limit variety	Intake, weight, hydration, protein and micronutrient adequacy
Enteral nutrition	Persistent inadequate oral intake despite medical therapy	Measurable nutrient delivery; avoids central venous catheter	Tube intolerance, displacement, vomiting; evidence for routine early NG feeding is weak	Tolerance, electrolytes, weight trajectory, refeeding risk
Parenteral nutrition	Selected refractory cases when oral/enteral routes fail or are not feasible	Can deliver nutrition despite severe GI intolerance	Line infection/thrombosis, metabolic complications, higher complexity	Glucose, liver tests, line complications, P/K/Mg, micronutrients and fluid balance

5.7 Controlled nutrition initiation in refeeding-risk patients

Patients identified as refeeding-risk require a controlled transition rather than unrestricted rapid escalation. General consensus guidance recommends assessing and correcting relevant electrolytes, providing thiamine before or alongside carbohydrate in high-risk patients, beginning nutrition conservatively and advancing according to biochemical and clinical response (Reber et al., 2019; da Silva et al., 2020). These recommendations were not developed specifically for pregnancy and should therefore be applied with obstetric and nutrition-support judgement rather than copied as a rigid HG protocol (Maslin and Dean, 2022). The important principle is coordination: the team should know how much carbohydrate and total energy are being added, when electrolytes will be rechecked, and what change would prompt slowing or pausing the advance (da Silva et al., 2020; Amoo et al., 2026).

5.8 Role of the clinical dietitian

The clinical dietitian links symptom burden with measurable nutritional risk. A UK survey of registered dietitians found considerable variation in referral criteria and local guidance for HG, indicating that access to nutrition expertise may depend more on service design than on a standardized clinical trigger (Maslin et al., 2021b). A structured dietetic assessment should document intake duration, tolerated foods and

fluids, percentage weight loss, evidence of muscle or fat loss, hydration barriers, relevant laboratory trends and prior nutrition support. The dietitian can then translate this information into a staged plan covering oral intake, supplements, enteral or parenteral nutrition, and refeeding precautions while coordinating with obstetricians, pharmacists, nurses and, when required, gastroenterology, neurology and specialist nutrition teams (Maslin and Dean, 2022; Clark et al., 2024).

Dietetic care also protects patients from two opposite errors: underfeeding because vomiting is treated as the only clinical problem, and over-aggressive feeding once symptoms improve. In the first situation, repeated hydration without meaningful nutrition can allow further tissue and micronutrient depletion; in the second, rapid carbohydrate delivery can expose a metabolically depleted patient to refeeding abnormalities (Maslin et al., 2021a; da Silva et al., 2020). Dietitians are therefore well positioned to monitor the nutritional trajectory rather than a single admission snapshot and to advocate for escalation before severe complications develop.

5.9 Discharge and nutritional follow-up

Discharge should reflect nutritional stability as well as control of vomiting. A patient who tolerates fluids after intravenous therapy may still be at risk of recurrent weight loss if energy and protein intake remain very low (Maslin and Dean, 2022; Doherty et al., 2023). Follow-up should review weight trajectory, symptom recurrence, hydration, adequacy and variety of oral intake, prescribed vitamin or electrolyte replacement and neurological symptoms. After marked weight loss or artificial nutrition, dietetic review can support stepwise dietary expansion and prevent a highly restricted 'survival diet' from persisting unnecessarily (Maslin et al., 2021b). Recurrence in future pregnancies is common, making preconception or early-pregnancy planning relevant after a previous severe episode (Dean et al., 2020; Nana et al., 2026).

Table 5. Clinical dietitian-led assessment and management pathway

Stage	Dietitian actions	Clinical purpose
Initial assessment	Quantify intake, % weight loss, hydration barriers, functional decline and biochemical risk	Identify malnutrition, thiamine depletion and refeeding risk early
Oral phase	Build a tolerated energy/protein/fluid plan; use supplements selectively	Reduce cumulative deficit while medical therapy controls symptoms
Escalation	Recommend case-by-case enteral support; contribute to PN decision if enteral route fails	Provide measurable nutrition without unnecessary delay
Refeeding-risk phase	Coordinate thiamine, carbohydrate/energy advancement and P/K/Mg monitoring	Prevent avoidable metabolic deterioration
Recovery/discharge	Broaden diet, monitor weight regain and micronutrient adequacy; plan follow-up	Support sustained maternal recovery and reduce recurrent deterioration

6. Research Gaps and Future Priorities

The evidence base remains uneven across the starvation-to-refeeding continuum. Diagnostic consensus has improved through the Windsor definition and contemporary guidelines, but nutrition-specific risk stratification has not advanced to the same degree (Jansen et al., 2021; Nelson-Piercy et al., 2024). Studies frequently report vomiting frequency, hospitalization and antiemetic use yet omit actual energy and protein intake, duration of near-starvation, serial body-composition measures and micronutrient biomarkers (Maslin et al., 2021a; Maslin and Dean, 2022). A validated HG-specific nutrition-risk framework that combines weight trajectory, intake duration, functional loss and biochemical indicators would therefore address an important clinical gap.

Thiamine prevention is supported by physiology, guidelines and a large accumulated case literature, but prospective data describing when biochemical depletion develops in HG are limited (Oudman et al., 2019; Fiorentini et al., 2023; Kareem et al., 2023a). The same is true of refeeding syndrome: published HG evidence remains case-based, so incidence, optimal monitoring intensity and pregnancy-specific thresholds for slowing nutrition are uncertain (Mayer and McGill, 2019; Ramrattan et al., 2022; Amoo et al., 2026). Multicentre registries could prospectively capture intake duration, weight loss, baseline and post-feeding phosphate/potassium/magnesium, thiamine exposure, nutrition route, feeding progression and maternal-fetal outcomes.

Dietitian-led care also requires direct evaluation. Current service surveys show variability in referral and practice, but few trials test whether early structured nutrition assessment reduces weight loss, readmission, artificial nutrition use or maternal-fetal complications (Maslin et al., 2021b; Dean et al., 2021). Future pragmatic studies should compare explicit referral triggers, structured oral nutrition pathways and post-discharge follow-up, while enteral nutrition research should target patients most likely to benefit rather than repeating routine early-feeding designs in broadly defined HG populations (Grooten et al., 2017). Core outcome reporting should also incorporate nutrition-specific endpoints such as percentage weight change, days of negligible intake, electrolyte trajectories, thiamine exposure, feeding tolerance and functional recovery. Pregnancy-specific validation of refeeding-risk criteria is particularly needed because current consensus thresholds are largely extrapolated from non-pregnant adults (da Silva et al., 2020). The field now needs to move from demonstrating that nutrition matters to defining when, how and for whom specific clinical nutrition interventions improve outcomes. This priority should be tested prospectively.

7. Conclusion

Hyperemesis gravidarum should not be viewed only as a disorder of severe nausea and vomiting. In prolonged disease, inability to sustain food and fluid intake can create a progressive nutritional state characterised by dehydration, weight loss, electrolyte depletion, protein-energy deficit and reduced thiamine availability (Maslin and Dean, 2022; Nana et al., 2026). Severe thiamine depletion can culminate in Wernicke encephalopathy, while the subsequent restoration of nutrition can introduce a second period of vulnerability through insulin-driven electrolyte shifts and refeeding syndrome (Oudman et al., 2019; da Silva et al., 2020). The most coherent clinical model is therefore a starvation-to-refeeding continuum in which prevention begins before neurological signs or profound biochemical abnormalities appear. Early nutrition-risk assessment, anticipatory thiamine protection, individualized correction of fluid and electrolyte deficits, cautious nutrition advancement when refeeding risk is present, and appropriate escalation from oral to enteral or parenteral support are complementary rather than competing interventions (Nelson-Piercy et al., 2024; Clark et al., 2024). Integrating clinical dietitians earlier into multidisciplinary HG care offers a practical route to identify nutritional deterioration, coordinate safe feeding and support recovery, while future prospective studies

must define HG-specific thresholds and outcomes for nutrition intervention.

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