

Best Evidence Summary of Home Enteral Tube Feeding Care Management in the Elderly

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Purpose: To evaluate and summarize the best evidence of home enteral tube feeding (HETF) care management in the elderly to provide an evidence-based basis for caregivers to implement care interventions.

Patients and Methods: Evidence on HETF care management in the elderly was retrieved from Chinese and international databases, guidelines, and websites of professional associations, including systematic reviews and expert consensus, using the keywords of home enteral nutrition, home tube feeding, old, elder, home care, etc. The literature considered in this study was published from April 2019 to April 2024. Two trained researchers independently evaluated the quality of the included literature, graded the literature using the JBI evidence pre-grading system, classified and summarized the extracted evidence.

Results: A total of 15 articles were included, including 1 clinical decision, 1 guideline, 3 best evidence summaries, 4 systematic reviews, 2 randomized controlled trials, and 4 quasi-experimental studies. 18 pieces of the best evidence were summarized in 3 aspects, including the NST administration, education of caregivers, and selection of nutrition formulas.

Conclusion: This study comprehensively summarized the best evidence of home enteral tube feeding care management in the elderly and provided a scientific basis for caregivers to implement care interventions. In home care settings, using evidence-based practices requires developing a comprehensive care management system based on the trinity of hospital, community and home, in order to reduce the incidence of HETF-related complications, improve the quality of life of the elderly with HETF, and provide a practical reference for NST members and caregivers.

Keywords: enteral nutrition, nutritional support, quality of life, complication prevention, patient education

Introduction

Due to the reality of high incidence of cancers, high requirements of Enteral Nutrition (EN) support and high prevalence of home health-care, older patients make up the majority of Home Enteral Nutrition (HEN).¹⁻⁵ Home Enteral Tube Feeding (HETF) is a viable option for people needed HEN when oral intake is insufficient to meet nutritional needs, and the types of tubes generally consists of nasogastric tubes, nasojejunal tubes, gastrojejunostomy fistulas, and jejunostomy fistulas, etc.⁶

Studies have reported that older patients with HETF had a higher incidence of HEN-related complications as the gradual decline of various organ functions and poor general condition,^{7,8} and the incidence related to home care for disabled elders is 16.46%, with caregivers' competence being one of the major influencing factors for this rate.^{9,10} Cross-sectional studies in China have reported low awareness of caring knowledge of HETF carers, with poor knowledge of feeding tube care, HEN preparations, HEN support devices, and how to prevent and deal with HETF complications.¹¹⁻¹³ As much as 40% to 80% of the medical information received by the elderly and their caregivers is forgotten immediately after discharge, and nearly half of the retained information is incorrect.¹⁴ The poor caring quality of caregivers is mainly due to their older age, lower cultural level, or lack of caring experience.¹⁵

There is also a phenomenon of discontinuity between hospitals, communities, and HETF users. One of the major problems is a lack of specific assessment tools for elderly with HETF. The Mini Nutritional Assessment (MNA) has been designed and validated to provide a single, rapid assessment of nutritional status in elderly patients home care settings,¹⁶ but it lacks contents of tube-related questions, thus we are unable to get information about tube feeding.

While limited medical resources cannot meet the whole and continuous guidance of the elderly with HETF,^{12,17–19} systematic and comprehensive evidence has not yet been formed, which is not conducive to the standardized management of HETF care for the elderly. Therefore, this study summarizes the best evidence of HETF care management for the elderly to provide a basis for constructing a scientific HETF care plan.

Materials and Methods

Establishment of the Problem

The PIPPOST method was employed to determine the research questions: (I) Population (P): The elderly undergoing HETF; (II) Intervention (I): Management of HETF care; (III) Profession (P): Nutritional support team (NST), including geriatric specialists, dietitians, rehabilitation therapists, psychologists, nutritional support pharmacists (NSP), nursing administrators, geriatric nurses, and community healthcare personnel; (IV) Outcome (O): Incidence of HETF-related complications, nutritional status, and quality of life; (V) Setting (S): Home, nursing homes, retirement communities; (VI) Type of Evidence (T): Guidelines, systematic reviews, expert consensus, evidence summaries, meta-analysis, best practices, randomized controlled trials (RCTs), and quasi-experimental studies.

Search Strategy

We conducted a comprehensive search according to the 6S pyramid through databases and websites as below: BMJ best practice, Up to Date, National Guideline Clearinghouse(NGC), Scottish Intercollegiate Guidelines Network(SIGN), National Institute for Health and Care Excellence(NICE), Canadian Medical Association(CMA) Infobase, Registered Nurses' Association of Ontario(RNAO), American Society for Parenteral and Enteral Nutrition(ASPEN), the European Society for Clinical Nutrition and Metabolism(ESPEN), Chinese Society for Parenteral and Enteral Nutrition(CSPEN), Joanna Briggs Institute(JBI) EBP database, EBSCO, Cochrane Library, Embase, PubMed, Web of Science, CINAHL, Yimaitong, China National Knowledge Infrastructure(CNKI), China Biology Medicine Disc(CBM), Wanfang, VIP and Chinese Medical Ace Base. Among them, BMJ best practice and Up to Date were selected as they rank the highest in 6S pyramid as “clinical decision support systems”, which cover a wide range of evidence-based practices including HETF. JBI and Cochrane Library were selected due to their high-quality, independent evidence relevant to HETF. ASPEN, ESPEN, CSPEN are authoritative institutions of enteral nutrition, which collect guidelines and consensus specifically related to HEN and HETF. EBSCO, Embase, PubMed, Web of Science, CINAHL and other Chinese databases provide comprehensive results of HETF-related original researches. English search terms included “home enteral tube feeding/home tube feeding/home enteral nutrition/home artificial nutrition/home artificial feeding/HETF”, “old/elder/elderly/geriatric”, “care/caring/nursing”, “management/administration”, “complication/adverse event/nutrition state/nutritional state/nutrition situation/quality of life/life quality/living quality/QoL”, “guideline/consensus/recommendation/evidence summary/systematic review/best practice/meta-analysis/randomized controlled trial/quasi-experiment.” The search was limited to articles published between April 1, 2019, and April 1, 2024. The detailed steps for searching English databases, using PubMed as an example, can be found in [Figure 1](#).

Inclusion and Exclusion Criteria

Inclusion criteria: (I) Study type: clinical decision, guideline, expert consensus, systematic review, recommended practice, evidence summary, meta-analysis, randomized controlled trial, quasi-experimental study published in English and Chinese; (II) Subjects: the elderly with HETF who are older than 65 years old; (III) Outcomes: Incidence of HETF-related complications, nutritional status, and quality of life.

Exclusion criteria: (I) Repeated published or translated literature; (II) Research proposal or report; (III) Conference abstracts; (IV) articles without access to the full text.

#1 home enteral nutrition[MeSH] OR home enteral feeding[MeSH]

#2 home enteral tube feeding[All Fields] OR home enteral nutrition[All Fields] OR home artificial nutrition[All Fields] OR home artificial feeding[All Fields] OR HETF[All Fields]

#3 #1 OR #2

#4 old[All Fields] OR elder[All Fields] OR elderly[All Fields] OR geriatric[All Fields]

#5 care[All Fields] OR caring[All Fields] OR nursing[All Fields]

#6 management[All Fields] OR administration[All Fields]

#7 complication*[All Fields] OR adverse event[All Fields] OR nutrition* state[All Fields] OR nutrition* situation[All Fields] OR nutrition* condition[All Fields] OR quality of life[All Fields] OR life quality[All Fields] OR living quality [All Fields] OR QoL [All Fields]

#8 guid*[Title] OR standard*[Title] OR consensus[Title] OR recommendation*[Title] OR evidence*[Title] OR best practice[Title] OR systematic review[Title] OR meta-analysis[Title] OR randomized controlled trial[Title] OR quasi-experiment[Title]

#9 #3 AND #4 AND #5 AND #6 AND #7 AND #8

Figure 1 Literature search strategy of PubMed.

Literature Quality Evaluation

Four experts who had systematically studied evidence-based methodology independently evaluated the quality of the Guidelines according to the Appraisal of Guidelines for Research and Evaluation II (AGREE II) updated in 2017.²⁰ The intraclass correlation coefficient (ICC) was used to test the consistency of the evaluation results. Clinical decision, expert consensus, systematic review, randomized controlled trial, and quasi-experiment studies were independently evaluated by two researchers according to the JBI literature quality assessment tool. Critical Appraisal for Summaries of Evidence (CASE)²¹ was used to evaluate clinical decision-making and evidence summaries. If there was a disagreement on the quality of the literature, a consensus was reached after consultation with the third researcher with higher qualifications. In case of conflicts between different sources of evidence, the principle of evidence-based, high-quality, and the latest published evidence should be given priority.

Evidence Extraction and Classification

The evidence was summarized by two nursing postgraduate students who had studied evidence-based nursing according to the following principles: (I) If the content was consistent, choose the evidence that was concise and easy to understand; (II) If the contents are complementary, they will be combined to form evidence according to linguistic logic; (III) If the content is in conflict, we adhere to the principles of prioritizing evidence based on its quality, credibility, and the latest authoritative publications. According to the JBI evidence pre-ranking system (2014),²² the included evidence was divided into grade 1 to 5, with grade 1 being the highest and 5 the lowest. After the extraction of the evidence, two researchers independently graded the evidence. In case of disagreement, the third researcher participated in the discussion and finally reached a consensus conclusion.

Results

Literature Search Results

A total of 565 relevant literature were obtained by preliminary retrieval, 400 were left after eliminating duplicate literature, 94 literatures were obtained after initial screening, and 15 literatures were finally included after reading the full text, including 1 clinical decision, 1 guideline, 3 evidence summaries, 4 systematic reviews, 2 randomized controlled

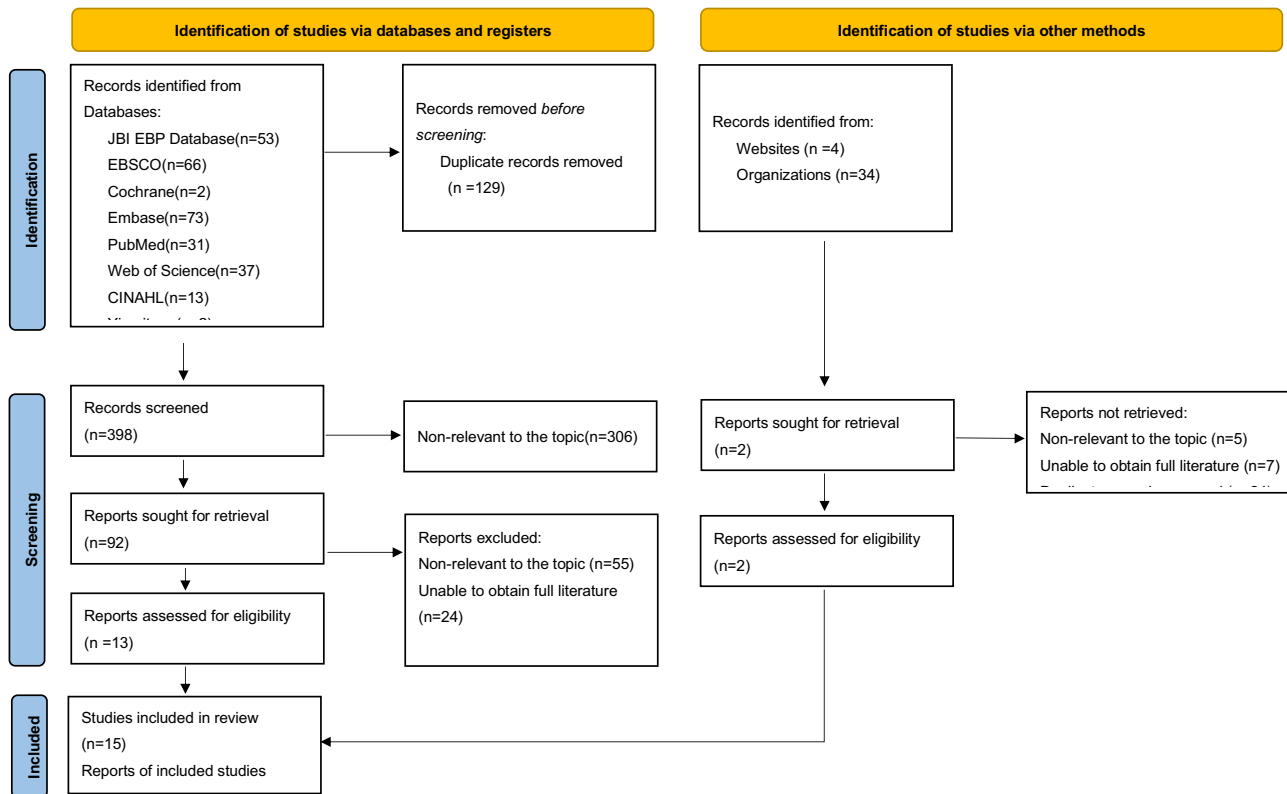


Figure 2 PRISMA flow chart of literature search and screening.
Notes: PRISMA figure adapted from Liberati A, Altman D, Tetzlaff J, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *Journal of clinical epidemiology*. 2009;62(10). Creative Commons.³⁷

trials, and 4 quasi-experimental studies. The literature screening process is shown in [Figure 2](#), and the general characteristics of the included literature are shown in [Table 1](#).

Results of Literature Quality Evaluation

Quality Evaluation of Clinical Decision-Making

A total of one clinical decision was included in this study,²³ and all items were evaluated as “yes” and approved for inclusion. The quality evaluation results are shown in [Table 2](#).

Table 1 Characteristics of Included Studies

No.	Included articles	Publication year	Source	Topic	Patterns	Type of articles
1	CROWLEY K. et al ²³	2024	UpToDate	Patient education: Enteral (tube) feeding (The Basics)	A brief introduction about enteral tube feeding to patients	Clinical decision
2	Bischoff S. C. et al ²⁴	2022	ESPEN	ESPEN practical guideline: Home enteral nutrition	Informing professionals and other HEN providers in a concise way about the indications and contraindications for HEN, as well as its implementation and monitoring	Guideline

(Continued)

Table I (Continued).

No.	Included articles	Publication year	Source	Topic	Patterns	Type of articles
3	Queiroz A. B. et al ²⁵	2023	JBI	Enteral Tube Feeding (Adults): Blenderized vs Commercial Formula	Comparing the characteristics of blenderized formula and commercial formula, and provide recommendations for enteral tube feeding adults	Evidence summary
4	Mi Y. et al ²⁶	2019	CBM	Prevention and management of enteral feeding intolerance in critically ill patients	Summarizing the best evidence and standardizing the implementation on the prevention and management of enteral nutrition feeding intolerance in critically ill patients for ICU nurses	Evidence summary
5	Niu Y. et al ²⁷	2023	CBM	Safety management of long-term home tube feeding in the elderly	A guidance for safety management of long-term home tube feeding for the elderly in home setting	Evidence summary
6	Uniat K. C. et al ²⁸	2022	Web of Science	Microbiological quality of enteral formulations handled at home	Reviewing the unsatisfactory microbiological quality of home-prepared enteral formulations	Systematic review
7	Mou J. et al ²⁹	2022	Web of Science	Experiences and needs of home caregivers for enteral nutrition	Systematically identifying, evaluating and synthesizing the qualitative evidence on HEN of caregivers	Systematic review
8	Byrnes C. et al ³⁰	2022	Web of Science	A scoping review of best practices in home enteral tube feeding	Reporting the importance of initial education to enable service users to adapt to HEN and the need for support from knowledgeable healthcare professionals.	Systematic review
9	Li C. et al ³¹	2021	CBM	Effect of semi-solid enteral nutrition on gastrointestinal tolerance in patients with tube feeding	Semi-curing enteral nutrition is helpful to reduce the incidence of diarrhea, abdominal distension and vomiting, and reduce the length of hospital stay for tube feeding patients	Meta-analysis
10	Kaźmierczak-Siedlecka et al ³²	2020	CINAHL	The use of <i>Lactobacillus plantarum</i> 299v (DSM 9843) in cancer patients receiving home enteral nutrition	Administration of <i>Lactobacillus plantarum</i> 299v may be effective in improvement of nutritional status, enteral nutrition tolerance, and quality of life of cancer patients receiving HEN	Randomized controlled trial
11	Lei Z. ³³	2023	CBM	Application of semi-cured homogenate diet with food thickener in senile patients with nasal feeding	Semi-cured homogenate diet can improve the nutritional status, reduce the incidence of gastroesophageal reflux, vomiting and diarrhea, and help achieve the nutritional target intake in senile patients	Randomized controlled trial

(Continued)

Table 1 (Continued).

No.	Included articles	Publication year	Source	Topic	Patterns	Type of articles
12	Chen Y. et al ¹⁸	2019	CNKI	Application of nutrition support team in elderly patients with home enteral nutrition	Through education of NST, the HEN caregivers can master the relevant knowledge and skills and improve the quality of HEN care for the elderly	Quasi-experimental study
13	Chen Y. et al ³⁴	2020	Wanfang	The application of daily goal health education in caregivers of elderly patients with home nutrition	Daily targeted health education and skill training for caregivers of elderly HEN patients can reduce the incidence of complications, relieve the mental stress of caregivers, and optimize the use of limited medical resources	Quasi-experimental study
14	Zhu R. et al ³⁵	2020	VIP	Effect of nasal feeding nursing training on caregivers of patients with nasal feeding at home	Targeted training of nasal tube feeding knowledge and skills of caregivers can reduce the incidence of complications	Quasi-experimental study
15	Madrid-Paredes A. et al ³⁶	2023	Pubmed	Impact of nutritional and educational support on home enteral nutrition	The nutritional assessment to prescribe individualized HEN to each patient, together with educational measures and training for both patients and trainers, improves nutritional status and reduces the onset of adverse events	Quasi-experimental study

Abbreviations: ESPEN, the European Society for Parenteral and Enteral Nutrition; JBI, the Joanna Briggs Institute; CNKI, China National Knowledge Infrastructure; CBM, China Biology Medicine Disc; HETF, home enteral tube feeding; HEN, home enteral nutrition.

Table 2 Quality Evaluation of Clinical Decision

	I	II	III	IV	V	VI
Patient education: Enteral (tube) feeding (The Basics) ²³	Yes	Yes	Yes	Yes	Yes	Yes

Quality Evaluation of Guidelines

A total of one guideline²⁴ was included in this study, and the ICC value was 0.785, with good evaluation consistency. The quality evaluation results are shown in Table 3, and the inclusion was approved.

Quality Evaluation of Systematic Reviews

A total of four systematic reviews were included in this study,^{28–31} and the evaluation results are shown in Table 4, all of which were approved for inclusion.

Quality Evaluation of Evidence Summaries

A total of three evidence summaries were included in this study.^{25–27} The evaluation of research items 3 and 4 of Queiroz²⁵ was “no”, the assessment of items 2 and 5 was “incomplete”, and the evaluation of the remaining items was “yes”, which was approved for inclusion. In the study of Mi et al²⁶ the assessment of item 2 was “incomplete”, the evaluation of item 3 was “no”, and the evaluation of other items was “yes”, which was approved for inclusion. In the study of Niu et al²⁷ the assessment of item 2 was “incomplete”, the evaluation of items 3 and 9 was “no”, and the assessment of the rest of the items was “yes”, and the inclusion was granted.

Table 3 Quality Evaluation of Guidelines

Included articles	Percentage of standardization by area (%)						Domain scores $\geq 60\%$	Domain scores $\geq 30\%$	Recommendation level
	Scope and purpose	Stakeholder involvement	Rigor of development	Clarity of presentation	Applicability	Editorial independence			
Bischoff S. C. et al ²⁴	95.83	81.94	75.52	87.50	45.83	95.83	5	6	B

Notes: Recommendation level: A, the score for each domain is $\geq 60\%$; B, ≥ 3 domains have scores $\geq 30\%$ and at least one $< 60\%$.

Table 4 Quality Evaluation of Systematic Review

	Uniat K. C. et al ²⁸	Mou J. et al ²⁹	Byrnes C. et al ³⁰	Li C. et al ³¹
I	Yes	Yes	Yes	No
II	Yes	Yes	Yes	Yes
III	Yes	Yes	Yes	Yes
IV	Yes	Yes	Yes	Yes
V	Yes	Yes	Unclear	Yes
VI	Yes	Yes	Yes	Yes
VII	Unclear	Yes	Yes	Yes
VIII	Yes	Yes	Yes	Yes
IX	Yes	Unclear	Unclear	Yes
X	Yes	Yes	Yes	Yes
XI	Yes	Yes	Yes	Yes

Table 5 Quality Evaluation of Quasi-Experimental Study

	I	II	III	IV	V	VI	VII	V III	IX
Chen Y. et al ¹⁸	Yes	Unclear	Yes	No	Yes	Yes	Unclear	Unclear	Yes
Chen Y. et al ³⁴	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zhu R. et al ³⁵	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear
Madrid-Paredes A. et al ³⁶	Yes	Yes	Yes	No	Yes	Yes	Yes	Unclear	Yes

Quality Evaluation of Randomized Controlled Trials

A total of two randomized controlled trials were included in this study.^{32,33} In the study of Kaźmierczak-Siedlecka et al³² the evaluation of items 3 and 11 was “unclear”, and the assessment of other items was “yes”, and the inclusion was granted. The evaluation of item 2 of Lei³³ was “no”, the evaluation of item 6, 8, 9, and 12 was “yes”, and the evaluation of the remaining items was “unclear”, so it was not included.

Quality Evaluation of Experimental Studies

A total of four quasi-experimental studies were included in this study,^{18,34–36} and the evaluation results are shown in Table 5, all of which were approved for inclusion.

Summary of Evidence

Finally, 18 pieces of evidence were extracted from 15 articles. Through extraction and summary, the best evidence for the management of home care for tube feeding in the elderly is divided into three aspects- nutrition support team (NST) management, training of caregivers, and selection of nutrition formulas. The evidence is shown in Table 6.

Discussion

The Administration of NST

The Establishment of NST Can Improve the Quality of HETF Care Management

One guideline,²⁴ one scoping review³⁰ and one quasi-experimental study¹⁸ all mentioned the establishment of NST, indicating the importance of NST in the care and management of HETF in the elderly. It is showed that the blood indexes and body surface indexes of elderly with NST support were significantly improved, and the improvement was more significant over time.¹⁸

The composition of NST may differ according to different scenarios and local conditions, but the core includes doctors, dietitians, and nurses.²⁴ Since this study focuses on the elderly who live at home, geriatricians and geriatric nurses are included

Table 6 Best Evidence for Management of Home Care for Tube Feeding in the Elderly

Category		Evidence Content	Evidence Level
NST management	The establishment of NST	1. Establish NST, including geriatricians, dietitians, nutrition support pharmacists, nursing managers, geriatricians, and community health care workers ^{24,29,30,36}	2c
	NST assessment and personalized management	2. Community and hospital to form follow-up teams to establish timely communication, operating standards, and procedures to avoid duplication of work or inconsistent information ²⁹ 3. All the elderly with HETF should get a professional evaluation and adequate intervention, especially in case of complications or emergencies ²⁴	I 5b
	Indicators of nutritional status, complications, and quality of life	4. NST should prescribe personalized HETF according to the evaluation results ^{24,29,32,36} 5. Indicators of nutritional status are mainly based on weight, body composition, and hydration status, but may also include laboratory measurements, such as serum albumin or transthyretin (prealbumin) ²⁴ 6. Complications monitoring should include tube-related complications and respiratory and digestive tolerance ²⁴	I 5b 5b
Training of caregivers	Training methods should be diversified and individualized	7. The NutriQoL [®] questionnaire should be used regularly to evaluate the quality of life of the elderly during HETF ²⁴ 8. Mutual support and help between home caregivers can not only provide psychological comfort and reduce the burden but also allow them to learn from each other and share experiences ²⁹ 9. Daily targeted health education, skill training, and workshops combined with a food model can be used for caregivers ³⁴	I 2c
	Training on the prevention and solution of complications	10. Education methods include oral education, graphic explanation, chatting Apps follow-up, Internet platform, etc. ²⁴ 11. Apply daily cleaning, disinfection, drying, and preservation of dietary appliances. The prepared homemade blenderized admixtures should be stored in the refrigerator at 4°C for 24 hours, and it is better to use right after preparation ¹⁸ 12. For the elderly with diarrhea, the temperature of the nutrition solution should be maintained at 38–42°C ²⁶ 13. Elevate the head of the bed to 30–45° before feeding. After feeding, keep the original position for 30–60 minutes before laying down ^{18,26}	2c 2c 5b 2c
		14. The diameter of the feeding tube should be at least 14Fr, and the homemade blenderized admixtures should be sieved with gauze to ensure that there are no large particles and avoid blockage ^{18,24,25} 15. Regularly flush the tube before and after feeding with at least 30mL of water of drinking quality in case of bolus administration or 4 hours if continuous feeding ^{18,24,25} 16. Call a doctor if the elderly have any of the following: tube blockage, prolapse or leakage; Signs of wound infection (if a gastrostomy tube is inserted) such as a fever of 100.4°F (38°C) or higher; Or if the place where the tube enters your body is red or swollen, feels warm to the touch, has discharge or pus, smells terrible, is very painful when touched, bleeds, or does not seem to be healing; Inability to defecate or pass gas, or have loose or hard stools; Stomach pain or cramping; Vomiting ²³	5b 5b 5b
Selection of nutrition formulas	The risk of homemade blenderized admixtures is higher than that of commercial formulas	16. The elderly without diarrhea, constipation, or special diseases should use standard commercial formulas under the guidance of NST ^{25,28}	Ic
	To standardize the preparation process of homemade blenderized admixtures	17. If there are special reasons to use homemade blenderized admixtures, dietitians can determine the formula, list standardized food combinations, regulate energy supply, and establish hygiene standards to prevent microbial contamination and infectious complications ^{24,25,28}	5b
	Semi-solid enteral nutrition can reduce the incidence of complications of gastric tube feeding	18. Semi-solid enteral nutrition can improve the nutritional status of the elderly with gastric tube feeding and reduce the incidence of diarrhea, abdominal distension, reflux, and vomiting ³¹	2a

in NST, which helps the team make decisions on the specific nutritional status and problems of the elderly. The close cooperation between NST and community medical staff can make the information interconnected and facilitate the unified operation standard, which plays a vital role in the follow-up of the nutritional status and the prevention of complications of the elderly.²⁴ In

particular, community dietitians can deal with common complications of HETF and issue prescriptions, thus reducing the need for the elderly to go to the hospital and relieving the economic burden.³⁰ In addition, nutritional support pharmacists (NSP) can provide comprehensive and detailed drug information for medical staff, the elderly, and caregivers to reduce drug-related problems, improve compliance, and increase the qualified rate of HETF prescription.³⁸ NST members work together to form an H2H (Hospital to Home) management model, which can improve the management level of home tube feeding care.³⁹

NST Assessment and Personalized Management of HETF in the Elderly

NST should prescribe personalized HETF for the elderly based on careful consideration of the diseases of the elderly, the type of feeding tube, nutritional tolerance, personal preferences, and cultural background.^{18,24,29,32,36} (Table 7) For example, for the elderly with diarrhea and constipation, a nutritional solution containing fiber should be used, which can reduce blood glucose and increase albumin and hemoglobin without aggravating diarrhea.^{40–42} The elderly with diabetes can use modified formulas that are lower in sugar, contain slowly digestible carbohydrates, and are rich in unsaturated fatty acids, primarily monounsaturated fatty acids, which improve blood glucose control.^{43,44} The elderly with cancer can use the nutrient solution supplemented with *Lactobacillus plantarum* 299v, which can effectively improve the nutritional status, tolerance, and quality of life of the elderly.³² Regular intake of specific protein-enriched enteral formula can enhance protein synthesis and reduce protein degradation, which is effective to prevent Sarcopenia.⁴⁵

For the monitoring of nutritional indicators, in addition to body mass index (BMI)/calf circumference (CC), ADL, and IADL, laboratory indicators such as prealbumin and albumin are surrogate markers for the adequacy of short-term and long-term dietary intake, respectively.⁴⁶ Among them, the half-life of prealbumin is about 1.9 days, which is a good predictor of whether the dietary energy and protein of the elderly are sufficient in the days before the test.⁴⁷ The normal range of serum prealbumin in most laboratories is 20–40 mg/dL, with a cut-off value of 16–20mg/dL and a low level of less than 16mg/dL.⁴⁸

NST evaluates the elderly with HETF and decides on intervention measures. However, due to the disparity of assessment standards across China and the lack of assessment tools specifically for the elderly with HETF, it is challenging to complete standardized and comprehensive evaluation and care of HETF, resulting in a high incidence of complications and a low quality of life for the elderly with HETF.⁴⁹ Therefore, it is necessary to develop an assessment tool specifically suitable for the elderly with HETF in the future to guide community medical staff and caregivers in carrying out more standardized care for this population.

NST Monitoring of Quality of Life

World Health Organization (WHO) defines quality of life (QoL) as an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. As HETF has a considerable physical, social, and psychological effect on the elderly, assessment of QoL is one of the important methods to qualify the effects of HEN. Support during and after tube insertion helps to reduce the impact on both, enabling them to make full use of their daily lives, sleep better, and enjoy an overall higher quality of life.⁵⁰ Spanish scholars have developed NutriQoL, a life quality assessment scale specifically for HEN, which supports self-

Table 7 Nutritional Solutions Associated with Common Diseases in the Elderly

Diseases	Nutritional solutions
Standard situation (patients without diarrhea, constipation or diabetes)	Standard commercial formula
Diarrhea/constipation	Fiber-containing feeds
Diabetes	Lower sugar content, containing slowly digestible carbohydrates and a fat content enriched in unsaturated fatty acids, especially monounsaturated fatty acids
Sarcopenia	Essential amino acid-enriched enteral diet
Cancer	Nutrient solution supplemented with <i>Lactobacillus plantarum</i> 299v

evaluation or peer evaluation and has good reliability and validity. It has been included in ESPEN guidelines and has become the main scale for quality of life with HEN.^{24,51}

It seems that a standardized care coordination model involving a multidisciplinary team could improve outcomes.⁵² Studies suggested that care coordination including education of HETF users and professionals, proper assessment, timely follow-ups, and continuous auditing and feedback by NSTs is positively associated with improved outcomes in HETF users.^{53,54} However, the effectiveness of a particular intervention or team composition needs further research.

Training of Caregivers

Education and Training Methods Should Be Diversified and Individualized

Due to the shortage of community nursing resources and high cost, home caregivers are mainly informal caregivers who often lack care knowledge and skills.⁵⁵ At the same time, the current HETF system in China is incomplete, and caregivers lack monitoring, follow-up, and guidance, resulting in a high incidence of HETF-related adverse events.⁵⁶ Considering the characteristics of most non-professional caregivers, education models of HETF can be diversified and carried out as early as possible to ensure caregivers have sufficient time to understand, such as the workshop plus food model, daily goal health education model, etc.^{15,34} Training methods can be individualized according to the education level of caregivers, including graphic explanation, chatting Apps follow-up, Internet management platforms, and communication between caregivers.^{29,54,57,58} So that the communication of hospitals, communities, and tube feeding families can break through the limitations of time and space, and realize the intelligence and humanization of care services. Targeted and diversified education methods can help caregivers consolidate their knowledge of tube feeding, acquire care abilities, and improve compliance with tube feeding care to reduce the incidence of complications of enteral nutrition for the elderly with tube feeding at home, relieve the psychological burden of caregivers, and optimize the use of limited medical resources to achieve continuous, whole process and systematic tube feeding care management.^{34,54}

Training on Prevention and Solution of Complications Related to HETF

A prospective, observational, multicenter real-life study showed educational support for both patients and trainers led to a significant reduction in all HEN-related adverse effects between the 3-month and 6-month visits.³⁶ Therefore, it is necessary to improve the basic knowledge of caregivers.

To prevent blockage, feeding tubes with a diameter of at least 14Fr must be selected, the blenderized admixtures must be sieved, and the tubes must be regularly flushed.^{18,24} It is helpful to raise the head of the bed during tube feeding and maintain it after tube feeding to prevent aspiration.^{18,24} The homemade blenderized admixtures were prepared and stored according to the schedule, and the dietary appliance was cleaned daily to prevent infection.²⁸ Heating the homemade blenderized admixtures to the appropriate temperature before use can prevent the occurrence of feeding intolerance, such as diarrhea and abdominal distension. Medical staff provide caregivers with educational content such as operation methods, daily care norms, and complication management, which is conducive to promoting caregivers' adaptation to HETF and enhancing the safety of HETF.³⁰

Selection of Nutrition Formulas

Commercial Formula is Better Than Homemade Blenderized Admixture

Currently, the typical formula of nutrient solutions for HETF in China are primarily homemade blenderized admixtures, that is, a paste thick fluid diet made from ordinary dishes. Dietitians should decide on the formula, list the standardized food combinations, normalize the supply of energy density, establish health standards to prevent microbial contamination and infectious complications, and adjust the formula at any time according to the condition of the elderly. However, studies have pointed out that the risk of using homemade blenderized admixtures is higher than that of commercial formulas, which not only have a higher rate of bacteria disqualification and lower nutrient content, but also have a higher risk of tube blockage.^{25,28,59,60} Therefore, the elderly without gastrointestinal-related complications or specific diseases should use standard commercial formulas under the guidance of experts.

To Standardize the Preparation Process of Homemade Blenderized Admixtures

Considering the advantages of low cost, convenient access, and high acceptance of homemade blenderized admixtures for the elderly,⁶⁰ the current status is hard to change in a short time, so it is necessary to strengthen the standardization of homemade blenderized admixtures preparation at this stage. Scientific and reasonable preparation can significantly improve the nutritional status, reduce the economic burden, and improve the quality of life of the elderly.¹⁵

The application of semi-solid enteral nutrition can reduce the incidence of gastric tube feeding complications

Semi-solid enteral nutrition refers to the mixing of pectin and liquid nutrient solution into semi-cured chyle in the stomach by injecting pectin and other substances through a feeding tube, which is close to the state of gastric grinding chyme and more in line with the needs of the human body. After the semi-solid nutrient solution enters the stomach, it will cause the relaxation of the proximal part of the stomach and promote the secretion of digestive juice, thus inhibiting the occurrence of reflux, vomiting, abdominal distension, and diarrhea, to improve the nutritional status of the elderly.⁶¹ Now, the application of semi-solid enteral nutrition is widely carried out in Japan, while in China, a liquid homogenized diet or nutrient solution is mainly used, and there are few research studies and practices on semi-solid enteral nutrition. Moreover, the amount of pectin used, feeding speed, and time are inconsistent. In addition, some scholars have applied semi-solid enteral nutrition to post-pyloric feeding and proposed that such formulas can reduce diarrhea and constipation caused by post-pyloric feeding, improve nutritional indicators, and reduce inflammatory response. Still, no high-quality research has been conducted.⁶² Therefore, large-scale samples and high-quality randomized controlled trials are still needed to further explore the application and safety of semi-solid enteral nutrition.³¹

Limitations

The literature included in this study was only in Chinese and English, and literature in other languages was not included. And the quality of the included quasi-experimental studies needs to be improved.

Future Perspectives

1. Development of Specific Assessment Tools:

Future research should focus on developing and validating specific assessment tools tailored for elderly patients with HETF. These tools should address various aspects of care, including nutritional status, tube feeding-related complications and quality of life.

2. Standardization of Care Practices:

Studies are needed to establish standardized care protocols and guidelines for HETF in the elderly. This includes the formulation of personalized HETF plans based on individual patient characteristics, regular monitoring and evaluation of nutritional status, and prevention and management of complications.

3. Enhancement of Caregiver Education and Training:

Future studies should evaluate various education and training programs aimed at improving caregivers' knowledge, skills, and compliance with HETF care protocols. The effectiveness of different teaching methods, such as face-to-face training, online courses, and mobile health applications, should be explored.

4. Exploration of New Technologies and Interventions:

Research should investigate the potential of new technologies and interventions to improve HETF care management in the elderly. This includes the use of telemedicine, remote monitoring, and artificial intelligence to support caregivers and patients in real-time.

Conclusion

This study summarizes the best evidence of HETF care management in the elderly, involving three aspects: NST administration, education of caregivers, and selection of enteral formulas. These aspects were subdivided into eight sections, which elaborate the necessity of developing a comprehensive care management system based on the trinity of hospital, community and home, aiming at providing evidence-based guidance for HETF care management of the elderly,

reducing the incidence of complications, improving the quality of life, and providing a practical reference for NST members and caregivers.

It is recommended that evidence users consider the specific background and environment in the process of evidence transformation, select evidence according to local conditions, experience of carers, allocation of medical staff, and demands of the elderly, to make appropriate modifications, and develop personalized care management plans for the elderly with HETF.

Strengths

This research has a small starting point and is close to the current situation of home care, which has important social significance. A rigorous, evidence-based approach was used to identify high-quality literature in the field from comprehensive data sources. The extracted evidence is close to the actual problems of home care settings, which provides a basis for improving the quality of HETF care, reducing complications of the elderly, and improving their quality of life.

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Disclosure

The authors report no conflicts of interest in this work.

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