Scientific Research Publishing

Open Journal of Applied Sciences, 2026, 16(11), 4492-4502
https://www.scirp.org/journal/ojapps
ISSN Online: 2165-3925
ISSN Print: 2165-3917

Impact of Nutrition Management Led by Specialty Nurses on the Nutritional Status of Patients with Chronic Heart Failure

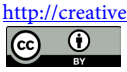
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How to cite this paper: Zhang, J., Liu, J., Li, L.X. and Liu, J.J. (2026) Impact of Nutrition Management Led by Specialty Nurses on the Nutritional Status of Patients with Chronic Heart Failure. *Open Journal of Applied Sciences*, **16**, 4492-4502.
https://doi.org/10.4236/ojapps.2026.1611245

Received: September 24, 2026
Accepted: November 16, 2026
Published: November 19, 2026

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Abstract

Objective: To analyze the efficacy of specialized nurses-led nutritional management in improving the nutritional status and reducing the incidence of malnutrition-related complications in patients with chronic heart failure (CHF). **Methods:** A total of 164 patients with chronic heart failure were randomly assigned to two groups; 156 patients who completed follow-up were included in the analysis (77 in the control group and 79 in the observation group). The control group received routine nursing care, while the observation group received specialized nurses-led multidisciplinary nutritional management. After three months of intervention, the subjective nutritional status, serum nutritional indicators, and the incidence of malnutrition-related complications were compared between the two groups. **Results**: Following the intervention, the observation group demonstrated significantly better MNA-HF scores, serum total protein levels, albumin levels, and hemoglobin levels compared to the control group ($P < 0.05$); furthermore, the incidence of malnutrition-related complications in the observation group was significantly lower than that in the control group ($P < 0.05$). **Conclusion:** Specialized nurses-led nutritional management can improve the nutritional status of CHF patients, reduce the incidence of malnutrition-related complications, and is suitable for clinical application.

Keywords

Chronic Heart Failure, Specialty Nurses, Nutritional Management, Malnutrition, Malnutrition-Related Complications

1. Introduction

Chronic heart failure (hereinafter referred to as "HF") is a clinical syndrome that develops in patients with various cardiac diseases in the terminal stage, characterized by high incidence, high mortality, high hospitalization rates, and a substantial economic burden [1] [2]. The situation regarding HF prevention and management in China is severe, with approximately 3 million new HF cases reported annually, and the number of HF patients reached about 14.3 million in 2023 [3]. The all-cause mortality rates at 1 year and 3 years after discharge in HF patients are as high as 13.7% and 28.2%, respectively, while the 1-year rehospitalization rate ranges from 13.4% to 20.0% [4]. HF has become a major public health issue in China, posing a serious threat to the health of its residents and consuming vast amounts of societal resources [5].

Malnutrition is a significant independent risk factor for poor prognosis in patients with heart failure [6] [7]. In these patients, gastrointestinal congestion can lead to decreased appetite and impaired nutrient absorption; inflammatory responses may induce a hypermetabolic state; while activation of the renin-angiotensin-aldosterone system and the sympathetic nervous system can disrupt the balance between synthesis, metabolism, and catabolism. These factors collectively predispose patients to a vicious cycle of "malnutrition → inflammatory response → cachexia" [7]. Therefore, early nutritional screening and assessment, coupled with the implementation of scientifically sound and effective nutritional interventions, constitute critical steps in improving clinical outcomes for patients with heart failure. Qualitative studies have revealed that cardiac nurses frequently exhibit inadequate knowledge of nutritional management, negative attitudes, and suboptimal practices; furthermore, nonstandardized protocols for nutritional screening and assessment, imprecise nutritional education and counseling, and the absence of effective organizational frameworks and mechanisms for nutritional management represent key obstacles to the effective implementation of nutritional care [8].

Against this backdrop, how to translate evidence-based findings into clinical practice—and who should lead such implementation—has emerged as a critical issue requiring urgent resolution. Specialty nurses, who possess profound professional knowledge and advanced practical skills, hold unique advantages in the comprehensive management of patients with heart failure [9]. Research has demonstrated that extended rehabilitation nursing care, led by specialty nurses and involving multidisciplinary teamwork, can improve cardiac function parameters, self-management capabilities, and quality of life in patients with chronic heart failure [10]; furthermore, extended interventions delivered by specialty nurses in combination with home-based care can significantly enhance the quality of life of these patients [11]. This study aims to investigate the effects of nutrition management practices led by specialty nurses on improving patients' nutritional status and reducing the incidence of malnutrition-related complications, thereby providing a reference for establishing standardized and sustainable nutrition management systems.

2. Materials and Methods

2.1. General Information

A total of 164 patients with chronic heart failure admitted to the Department of Cardiology at Jingzhou First People's Hospital between February 2025 and December 2025 were selected as the study subjects. Patients were randomly assigned in a 1:1 ratio to the observation group (specialist nurse-led multidisciplinary nutritional management) or the control group (routine nursing care) using a random number table. Allocation concealment was ensured by sequentially numbered, opaque, sealed envelopes: after written informed consent was obtained and baseline assessments were completed, the recruiting nurse opened the next envelope in sequence to reveal the group assignment. The trial was open-label, and neither the participants, the nurses delivering the intervention, nor the outcome assessors were blinded to group assignment. Serum nutritional indicators were measured by laboratory technicians who were unaware of the patients' group allocation. During the study, five patients in the control group (three lost to follow-up, two withdrawals) and three in the observation group (two lost to follow-up, one withdrawal) were excluded, leaving 77 and 79 patients, eight patients who dropped out were not included in the outcome indicator analysis. Baseline characteristics were comparable between the two groups (all $P > 0.05$; Table 1).

Table 1. Comparison of baseline characteristics between the two groups.

Characteristics	Control group (n = 82)	Trial group (n = 82)	Statistic ($t/Z/\chi^2$)	P value
Age [years, $\bar{x} \pm s$]	61.09 ± 8.21	62.24 ± 6.22	1.011	0.312
Male sex [n (%)]	38 (46.3)	42 (51.2)	0.39	0.53
LVEF [%, $\bar{x} \pm s$]	46.46 ± 7.35	46.77 ± 7.31	0.27	0.79
Functional class (NYHA) [n (%)]			0.14	0.99
Class I	5 (6.3)	5 (6.2)		
Class II	22 (26.3)	20 (24.8)		
Class III	40(49.0)	41 (50.3)		
Class IV	15 (18.5)	16 (18.7)		
Diuretic use [n (%)]	37 (45.12)	39 (47.56)	0.098	0.754
eGFR [mL/(min·1.73m^2), $\bar{x} \pm s$]	39.55 ± 6.6	40.05 ± 6.35	0.49	0.62
NT-proBNP, [ng/L, $M(P_{25}, P_{75})$]	85.0 (45.2, 198.5)	78.5 (42.3, 185.1)	0.279	0.78
NRS-2002 score ≥ 3 [n (%)]	46 (56.1)	47 (57.3)	0.03	0.88

Note: Baseline characteristics were analyzed using data from 164 patients (82/82) at the time of enrollment; outcome measures were analyzed using the valid sample after dropout (77 patients in the control group and 79 patients in the observation group).

Inclusion criteria: 1) Meeting the diagnostic criteria for chronic heart failure as specified in the "Chinese Guidelines for the Diagnosis and Treatment of Heart

Failure"; 2) Age ≥ 18 years; 3) Provide informed consent and voluntarily participate in the study. Exclusion criteria: 1) Presence of severe hepatic or renal insufficiency; 2) Presence of malignant tumors or other debilitating diseases; 3) Inability to eat orally. Discontinuation criteria: 1) Transfer to the ICU or death due to rapid clinical deterioration during the study period; 2) Patient's voluntary decision to withdraw from the study; 3) Loss to follow-up (failure to complete follow-up visits for two consecutive times). This study was approved by the institutional medical ethics committee, and all patients provided written informed consent.

2.2. Methods

2.2.1. The Control Group Received Routine Care

Maintain a clean and safe environment in the patient room; guide patients in rest and activity based on their cardiac function classification—during the acute phase, place patients in a semi-recumbent position to reduce venous return; closely monitor vital signs, 24-hour fluid intake and output, and daily weight changes; the attending physician prescribes conventional medications (e.g., cardiotonics, diuretics, vasodilators) based on examination results, and nurses strictly adhere to medication monitoring protocols; the assigned nurse provides guidance on a low-salt, low-fat diet and regular daily routines, utilizing verbal education and distribution of patient education handbooks to convey fundamental knowledge about the disease, common triggering factors, and precautions; concurrently, monitor the patient's psychological status, engage in proactive communication and counseling, and, when necessary, coordinate with the physician for collaborative management. At baseline and 3 months after intervention, the control group underwent the same MNA-HF assessment and serum biomarker testing as the observation group, but did not receive nutritional intervention.

2.2.2. In Addition to the Nursing Care Provided in the Control Group, the Observation Group Received Specialized Nutrition Management Led by Specialist Nurses, with the Specific Details as Follows

Establish a multidisciplinary nutrition management team: Form a nutrition management team led by a cardiovascular specialist nurse, comprising: two cardiovascular specialist nurses (one of whom holds specialized nutrition nursing qualifications), one cardiovascular physician, one clinical nutritionist, one pharmacist, one nursing manager, and 2 - 3 designated nurses. The roles of team members are clearly defined as follows: the cardiovascular physician is responsible for developing clinical treatment plans and issuing medical orders; the clinical nutritionist participates in the development of individualized dietary plans; the pharmacist provides information on drug-nutrient compatibility and medication guidance; the nursing manager oversees quality control of plan implementation and facilitates personnel coordination; the specialist nurses, serving as core coordinators, lead the development of standardized nutrition management protocols, organize multidisciplinary discussions, and coordinate and supervise the full implementa-

tion of nutrition plans; the designated nurses are responsible for executing specific nutrition interventions and collecting follow-up data.

Nutritional Screening and Assessment: Within 24 hours of admission, the assigned nurse conducts a preliminary screening using the NRS-2002 Nutritional Risk Screening Scale. For patients who test positive (NRS-2002 score ≥ 3), a specialized nutrition nurse performs a systematic nutritional assessment using the MNA-HF Mini Nutritional Assessment within 48 hours of admission. The assessment includes the following components: 1) MNA-HF score; 2) anthropometric measurements (body mass index, upper arm circumference, lower leg circumference); 3) laboratory parameters (serum total protein, albumin, hemoglobin, etc.); 4) dietary intake history and recent history of involuntary weight loss; 5) assessment of edema severity and volume status. Based on the assessment results, patients' nutritional status is classified as good nutrition, mild malnutrition, moderate malnutrition, or severe malnutrition, serving as the basis for subsequent interventions. Meanwhile, as a shared outcome measure for both groups, the MNA-HF was assessed uniformly for all participants at baseline and at 3 months after intervention, regardless of screening results.

Development of Individualized Nutritional Plans: Based on nutritional assessment results, specialized nutrition nurses, in collaboration with clinical nutritionists, develop individualized nutritional plans for patients in accordance with the five-step treatment protocol for malnutrition, and make dynamic adjustments based on the patient's clinical condition. The core nutritional objectives are as follows:

1) Energy target: Based on ideal body weight, the target energy intake is 104.5 - 125.4 kJ/(kg·d) [equivalent to 25 - 30 kcal/(kg·d)]; 2) Protein target: The target protein intake is 1.2 - 1.5 g/(kg·d); in patients with renal insufficiency, this should be adjusted to 0.6 - 0.8 g/(kg·d); 3) Sodium management: For patients with stable heart failure, daily salt intake should be <6 g; during acute exacerbation or when volume overload is present, this should be restricted to <2 g/d; 4) Fluid management: For patients with severe hyponatremia (serum sodium <130 mmol/L), fluid restriction should be <2 L/d; for patients with severe heart failure, fluid restriction should be 1.5 - 2.0 L/d; 5) Micronutrient supplementation: Assess for deficiencies in vitamin B1, vitamin D, iron, etc., and provide targeted oral supplements accordingly. The route of nutritional support should be selected based on the patient's digestive and absorptive function and the severity of the condition, prioritizing oral intake; if oral intake is insufficient, oral nutritional supplements (ONS) should be supplemented; when necessary, enteral or parenteral nutritional support should be administered according to medical advice.

Patient and Family Empowerment Education: Specialty nurses employ an "integrated patient-family" empowerment education model, with the following specific measures: 1) Conduct one-on-one structured education sessions to help patients understand the causal relationship between nutritional management and improvement of cardiac function, thereby enhancing their motivation for self-management; 2) Teach patients to identify high-sodium foods, read nutrition la-

bels, and master calculation methods for daily sodium and fluid intake; 3) Guide family members in using auxiliary tools such as salt-limiting spoons and measuring cups, as well as in preparing low-sodium diets; 4) Distribute nutrition management education handbooks to patients with heart failure, and establish WeChat groups to regularly share relevant nutritional knowledge and address home-based nutritional concerns; 5) Host weekly specialized lectures on nutrition—either online or offline—covering principles of food selection and healthy cooking techniques.

Continued nutritional management after discharge: Specialty nurses shall establish a standardized post-discharge follow-up protocol, including the following steps: 1) Conduct the first telephone follow-up within one week after discharge, focusing on assessing the patient's adherence to home dietary regimens, changes in body weight, symptom control, and compliance with the treatment plan; 2) Schedule outpatient follow-up visits at 1 and 3 months after discharge; during these visits, complete the MNA-HF scale assessment, collect fasting venous blood samples to measure serum nutritional markers, and have the specialty nurse re-evaluate the patient's nutritional status (including anthropometric measurements and laboratory parameters); based on these evaluations, collaborate with a dietitian to adjust the nutritional intervention plan accordingly; 3) For each follow-up visit, document a 24-hour dietary recall, body weight measurements, changes in heart failure-related symptoms, and updated nutritional marker results, thereby dynamically tracking the efficacy of the nutritional interventions.

2.3. Observation Indicators

1) Subjective nutritional status: The Mini-Nutrition Assessment Special for Heart Failure (MNA-HF) consists of four components—anthropometric assessment, dietary assessment, overall assessment, and subjective assessment—comprising 15 items with a total score ranging from 0 to 29. It evaluates four dimensions: overall assessment (5 items, 0 - 9 points), general assessment (3 items, 0 - 6 points), dietary assessment (5 items, 0 - 9 points), and self-assessment (2 items, 0 - 5 points). Lower scores indicate poorer nutritional status. The cutoff values for nutritional status are defined as follows: a score ≥ 22 indicates normal nutritional status; a score < 16 indicates malnutrition; and a score between 16 and <22 indicates risk of malnutrition.

2) Serum nutritional parameters: Collect fasting venous blood samples from patients and measure serum total protein, albumin, and hemoglobin levels.

3) Incidence rate of malnutrition-related complications: refers to newly occurring complications directly related to nutritional status during the follow-up period, including hypoalbuminemic edema, recurrent infections, and delayed wound healing. These complications were jointly assessed by two investigators based on medical records and follow-up data; in cases of disagreement, a consensus was reached through discussion. The incidence rate was calculated as follows: (number of cases with complications/total number of cases in the cohort) × 100%.

2.4. Statistical Methods

Statistical analysis was performed using SPSS 26.0 software. Measurement $\bar{x}$data are expressed as mean ± standard deviation ($\overline{x} \pm s$); comparisons within each group before and after intervention were conducted using paired t-tests, while inter-group comparisons were performed using independent samples t-tests; enumeration data are expressed as number of cases and rate (%), with inter-group comparisons conducted using the χ^2 test, Non-normally distributed measurement data are expressed as median (P_{25}, P_{75}); intergroup comparisons were performed using the Mann-Whitney U test. The primary analyses included the 156 participants who completed the three-month follow-up: 77 in the control group and 79 in the observation group. To assess the impact of the eight dropouts, sensitivity analyses re-analyzed continuous outcomes using baseline-observation-carried-forward imputation and re-compared complication rates under best- and worst-case scenarios in which all dropouts were assumed to have or not have the event. A P-value < 0.05 was considered statistically significant.

3. Results

Comparison of baseline characteristics between the two groups (age, sex, NYHA class, LVEF, NT-proBNP, NRS-2002 score, eGFR, and diuretic use) showed no statistically significant differences (P > 0.05); the groups were thus balanced and comparable at baseline, as shown in Table 1.

3.1. Comparison of MNA-HF Scores between the Two Groups before and after Intervention

Prior to the intervention, there was no statistically significant difference in MNA-HF scores between the two groups (P > 0.05); after 3 months of intervention, the MNA-HF scores in both groups increased compared to pre-intervention levels, with the observation group showing significantly higher scores than the control group (P < 0.05), as shown in Table 2.

Table 2. Comparison of MNA-HF scores between the two groups before and after intervention (points, $\overline{x} \pm s$).

Group	Number of cases	Before intervention	At 3 months after intervention
Control group	77	17.12 ± 3.46	20.35 ± 3.71[a]
Observation group	79	16.87 ± 3.29	23.84 ± 3.53[ab]

Note: [a] P < 0.05 compared with the same group before intervention; [b] P < 0.05 compared with the control group at the same time point.

3.2. Comparison of Serum Nutritional Indicators between the Two Groups before and after Intervention

Prior to intervention, there were no statistically significant differences between the two groups in serum total protein, albumin, and hemoglobin levels (P > 0.05); after three months of intervention, all of these indicators in both groups increased

compared to pre-intervention levels, with the observation group showing higher values than the control group, and this difference being statistically significant (P < 0.05); see Table 3.

Table 3. Comparison of serum nutritional indicators between the two groups before and after intervention (points, $\bar{x} \pm s$).

Group	Number of cases	time	total protein(g/L)	albumin(g/L)	Hemoglobin (g/L)
Control group	77	Before intervention	60.24 ± 4.73	33.41 ± 3.26	108.36 ± 9.42
		After intervention	63.17 ± 4.25[a]	35.62 ± 3.18[a]	112.51 ± 8.74[a]
Observation group	79	Before intervention	59.86 ± 4.58	33.08 ± 3.42	107.82 ± 9.15
		After intervention	67.43 ± 4.41[ab]	38.75 ± 3.34[ab]	118.63 ± 8.27[ab]

Note: [a] P < 0.05 compared with the same group before intervention; [b] P < 0.05 compared with the control group at the same time point.

3.3. Comparison of the Incidence of Malnutrition-Related Complications at 3 Months between the Two Groups

At the 3-month follow-up, 12 cases of malnutrition-related complications occurred in the control group, with a complication rate of 15.58%; in the observation group, 8 cases of malnutrition-related complications occurred, with a complication rate of 10.13%. The incidence of malnutrition-related complications did not differ significantly between the two groups ($\chi^2 = 1.04$, P = 0.031 < 0.05); The incidence of malnutrition-related complications in the observation group was approximately 5.5% lower than that in the control group. See Table 4.

Table 4. Comparison of the incidence of malnutrition-related complications at 3 months between the two groups [n (%)].

Group	Number of cases	Number of cases of complications	Complication rate
Control group	77	12	15.58%
Observation group	79	8	10.13%

3.4. Sensitivity Analyses

Sensitivity analyses yielded results consistent with the primary analysis. After BOCF imputation, the between-group differences in MNA-HF score and serum nutritional indicators remained essentially unchanged in direction and significance. For the complication rate, under the worst-case scenario (all dropouts assigned as having complications) the rates were 20.7% (17/82) versus 13.4% (11/82; $\chi^2 = 1.55$, P = 0.21), and under the best-case scenario (all dropouts assigned as having no complications) 14.6% (12/82) versus 9.8% (8/82; $\chi^2 = 0.91$, P = 0.34); the comparison remained non-significant in both scenarios.

4. Discussion

Patients with chronic heart failure (CHF) exhibit a high incidence of malnutrition.

Malnutrition can exacerbate myocardial injury, aggravate systemic inflammatory and catabolic processes, further deteriorate cardiac function, increase the risk of complications, and thus serves as an independent risk factor for poor prognosis in CHF [6] [7]. Malnutrition may induce various complications—including hypoalbuminemic edema, reduced host resistance, and infections—thereby complicating clinical management. In previous clinical practice, the primary focus has often been on pharmacotherapy and volume management, while nutritional screening, assessment, and individualized intervention have frequently been overlooked. In conventional nursing care models, nurses often lack systematic knowledge of nutrition, multidisciplinary collaboration mechanisms are absent, nutritional education is limited to verbal instruction, follow-up nutrition care after discharge is lacking, intervention effects are difficult to sustain, and complication prevention and control remain inadequate [8].

This study established a multidisciplinary nutrition management model led by cardiovascular specialty nurses, with these nurses serving as the central coordinator. In collaboration with physicians, dietitians, pharmacists, and charge nurses, the model implemented a comprehensive closed-loop management process encompassing admission screening, assessment, individualized treatment planning, health education, and post-discharge follow-up. The results demonstrated that, following the intervention, the observation group exhibited superior MNA-HF nutrition scores, serum albumin levels, total protein levels, and hemoglobin levels compared to the control group; furthermore. Although the difference in the incidence of malnutrition-related complications between the two groups was not statistically significant, the incidence in the observation group was 5.5 percentage points lower than that in the control group (10.1% vs 15.6%), suggesting a possible benefit that warrants confirmation in adequately powered studies. The rationale for these findings includes: 1) standardized implementation of the NRS-2002 initial screening and the MNA-HF systematic assessment during the admission phase to accurately identify nutritional risk; 2) formulation of individualized targets for energy, protein, sodium intake, and fluid volume based on the five-step treatment protocol, balancing volume management in heart failure with adequate nutritional supply; and 3) provision of integrated patient-family empowerment education to equip families with skills in salt restriction, dietary preparation, and interpretation of nutrition labels, thereby enhancing adherence to home dietary guidelines. Post-discharge, continuous dynamic adjustments to the nutrition regimen were conducted via telephone follow-ups and outpatient visits, ensuring uninterrupted nutritional care after discharge. This approach improved the body's protein reserves and immune status, consequently reducing the incidence of various complications mediated by malnutrition, and breaking the vicious cycle of "malnutrition → inflammation → complication development." The improvement in hemoglobin levels may be attributed to more adequate supply of hematopoietic raw materials, such as protein and iron. In this study, 8 cases (4.9%) were lost to follow-up or dropped out; furthermore, the sensitivity analysis yielded results

consistent with those of the primary analysis, indicating that missing data had a limited impact on the study conclusions.

This study has several limitations: First, it is a single-center study with a homogeneous sample source, which limits the generalizability of its findings; second, the follow-up period was limited to three months, and thus the effects of long-term nutritional status maintenance as well as long-term complications—other endpoint indicators—were not assessed; third, this study focused exclusively on nutrition-related outcome measures and did not incorporate cardiac function parameters or quality-of-life indicators, thereby failing to explore the mediating effects of nutritional intervention on cardiac function or its impact on patients' subjective experiences. Future research could incorporate these additional indicators to strengthen the evidence base. Subsequent studies could adopt a multi-center, large-sample design with extended follow-up periods, while also exploring digital tools—such as mini-programs or mobile-based nutritional assessment instruments—to optimize nutritional management pathways for patients with heart failure, thereby facilitating broader implementation in primary care settings.

5. Conclusion

Multidisciplinary standardized nutrition management led by specialized nurses can effectively improve the subjective nutritional status and serum nutritional biomarkers in patients with chronic heart failure, reducing the incidence of malnutrition-related complications by approximately 5.5%. This model demonstrates good clinical feasibility, can be integrated into the nursing pathway for chronic heart failure patients, and can facilitate the standardized implementation of nutrition management in heart failure care.

Author Contributions

Zhang Jing contributed to the study conceptualization, methodology design, original draft writing, and overall project administration. Liu Jing participated in the trial implementation and data collection. Li Lixin was responsible for data curation and statistical analysis. Liu Junjun, as the corresponding author, supervised the study design, critically reviewed and revised the manuscript, and acquired the research funding. All authors have read and approved the final manuscript.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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