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# Research Progress on Factors Influencing the Internal Capacity of Patients with Heart Failure and Rehabilitation Interventions

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## ABSTRACT

*Heart failure (HF) represents the terminal stage of various cardiac diseases, characterized pathologically by impaired cardiac pumping function and reduced cardiac output. In the assessment of treatment and rehabilitation outcomes for HF patients, intrinsic capacity serves as a core indicator, encompassing evaluations across multiple dimensions such as physical function, cognitive function, and psychological status, thereby reflecting patients' rehabilitation potential. Based on recent domestic and international research, this article identifies the influencing factors of intrinsic capacity in HF patients and summarizes current key rehabilitation intervention strategies, aiming to provide insights for optimizing individualized rehabilitation plans.*

## Keywords

Heart failure, Internal capacity, Influencing factors, Rehabilitation intervention.

Heart failure (HF) is a progressive and complex clinical syndrome with an increasing prevalence. According to the "China Cardiovascular Health and Disease Report 2022", there are approximately 8.9 million HF patients in China, with over 500,000 new cases annually. The treatment of HF has shifted from a traditional disease-centered approach to a patient-centered comprehensive management strategy, where maintaining and enhancing intrinsic capacity serves as a key objective [1]. Intrinsic capacity, as defined by the World Health Organization (WHO), refers to an individual's ability to integrate physical, cognitive, psychological, nutritional, and sensory functions without external assistance to cope with daily activities and health challenges [2]. Over the years, researchers worldwide have conducted extensive studies on the intrinsic capacity of HF patients, investigating influencing factors and targeted interventions, elucidating the regulatory roles of multidimensional factors, and exploring various rehabilitation intervention models. This article summarizes relevant research as follows.

## Factors Influencing the Intrinsic Capacity of Patients with Heart Failure

### Disease-related Factors

The primary symptoms of heart failure patients include dyspnea, restricted physical activity, and lower limb edema, which significantly impair both their physiological and mental health, thereby reducing quality of life [3]. Internal capacity assesses patients 'comprehensive coping abilities with the disease across multiple dimensions, including physical function, cognitive level, and psychological state, with disease being the central factor influencing these capacities. Heart failure patients exhibit varying degrees of cardiac function decline; studies by Wang Sipei et al. [4] demonstrate that cardiac function classification serves as an independent determinant of patients' physical, cognitive, and social impairment. The progression of heart failure is characterized by irreversible loss of myocardial cells and impaired myocardial regenerative capacity, leading to persistent decline in cardiac pumping function, resulting in symptoms such as reduced exercise tolerance and dyspnea, which exacerbate internal capacity impairments in the physical function dimension. Additionally, regarding disease management, some patients discontinue medications prematurely due to concerns about adverse effects, compromising treatment adherence and causing

disease recurrence—a vicious cycle that increases cognitive and physical burdens. In recent years, research on biomarkers for cardiovascular diseases has advanced significantly, with the clinical utility of these indicators becoming increasingly evident. These biological signals not only provide objective criteria for assessing heart failure severity but also hold promise for dynamic monitoring of physiological status and predicting rehabilitation outcomes. Myocardial injury markers, neurohormonal markers, inflammatory markers, and fibrosis markers objectively reflect the extent of myocardial damage, cardiac function status, systemic inflammatory responses, and myocardial remodeling processes. Abnormal levels of these markers are closely associated with declines in physical function, reduced exercise tolerance, cognitive impairment, and deterioration of psychological well-being. In the evaluation of heart failure, N-terminal B-type natriuretic peptide precursor (NT-proBNP) and high-sensitivity cardiac troponin I/T (hs-cTnI/T) are recognized as critical biological markers reflecting disease severity. Elevated levels of these biomarkers often indicate further impairment of cardiac function and are associated with an increased risk of multiple intrinsic functional declines in patients, serving as independent prognostic factors. Inflammatory markers such as high-sensitivity C-reactive protein (hs-CRP) and interleukin-6 (IL-6) primarily exert adverse effects on the body through their involvement in persistent inflammatory responses, including promoting muscle mass loss, exacerbating depression, and impairing cognitive function, thereby compromising the patient's overall functional reserve. With the advancement of precision medicine, various novel biomarkers are increasingly being employed to assess intrinsic cardiac function in heart failure patients, facilitating early functional status determination, risk stratification, and quantitative analysis of rehabilitation outcomes, thereby providing objective guidance for personalized rehabilitation strategies. Biomarkers not only serve as critical indicators for monitoring heart failure progression but also represent significant factors influencing and predicting patient outcomes, demonstrating substantial clinical value in the comprehensive management and rehabilitation interventions for heart failure.

### Individual Factors

Age is a significant influencing factor on the intrinsic functional capacity of heart failure patients. Studies such as those by Bu Na [5] have demonstrated that elderly heart failure patients commonly exhibit manifestations of physical functional decline. With advancing age, myocardial function, muscle mass, cognitive function, and sensory function naturally deteriorate. Furthermore, the pathological damage caused by heart failure exacerbates this decline in intrinsic capacity. However, age itself is not an absolute risk factor; appropriate rehabilitation interventions can partially delay this decline [6]. Gender differences also play a role: female patients, due to relatively lower muscle mass and higher emotional sensitivity, typically score lower in intrinsic capacity assessments regarding both physical function and psychological state compared to males [7]. Notably, current research findings on gender effects remain inconclusive and warrant further investigation.

### Psychosocial Factors

Mao Yi [8] and colleagues analyzed the influencing factors of depressive disorders in patients with chronic heart failure, demonstrating that a high prevalence of depression is observed among these patients, influenced by factors such as hospitalization duration, atrial fibrillation, and age, with depression significantly impairing their quality of life. Psychological state and the social support system, as important external regulatory factors, markedly influence patients 'treatment adherence and life attitudes, thereby exerting indirect yet profound effects on their intrinsic capabilities. The regulatory role of these factors is crucial, with its importance rivaling that of the disease itself. Regarding social factors, both insufficient social support and excessive protection are detrimental to maintaining the psychological resilience of heart failure patients. For instance, excessive bed rest imposed by concerned family members may reduce patients' physical activity capacity and increase their psychological burden.

## Rehabilitation Intervention Measures Based on the Intrinsic Capacity of Heart Failure Patients

### Somatic Rehabilitation Intervention

Patients with heart failure commonly experience reduced physical activity capacity and decreased exercise endurance due to impaired cardiac function, necessitating enhanced cardiopulmonary rehabilitation interventions to improve cardiac and pulmonary function while preventing muscle atrophy. Physical rehabilitation primarily involves personalized exercise training, with feasible training plans tailored to the patient's functional capabilities. Research by Chen Chunmei et al. [9] demonstrates that comprehensive exercise rehabilitation improves frailty status and enhances balance function in elderly patients. Zhou Na et al. [10] found that combined resistance training and Baduanjin exercise effectively improves cardiac function in patients with chronic heart failure and reduces adverse cardiac events. Current studies focus predominantly on exercise-based rehabilitation interventions, including aerobic exercise, respiratory training, and resistance training. An integrated traditional Chinese and Western medicine rehabilitation approach has emerged as a trend; for instance, Baduanjin training provides full-body exercise benefits, offering significant advantages in improving cardiac function and enhancing exercise endurance, while its gentle training modalities make it particularly suitable for heart failure patients, especially the elderly.

### Cognitive and Psychological Collaborative Intervention

The research findings by Sun Shuhong [11] et al. demonstrate that psychological control sources significantly influence the mental health and quality of life in elderly patients with chronic heart failure, underscoring the necessity of implementing psychological rehabilitation interventions. Similarly, Wu Weili [12] et al. indicated that combining personalized rehabilitation nursing with psychological interventions can improve emotional states and sleep quality in heart failure patients. Cognitive and psychological interventions exhibit synergistic effects; for instance, enhanced cognitive interventions can correct patients' cognitive biases

regarding the disease and rehabilitation care, boost their confidence in recovery, and alleviate negative emotions. For patients with cognitive impairments, cognitive interventions involve targeted training to improve attention, memory, and executive function, thereby enhancing cognitive performance. In the psychological dimension, commonly employed methods include mindfulness-based stress reduction, cognitive behavioral therapy, and support from family and peers, with the core objectives of reducing psychological stress, alleviating negative emotional distress, and improving treatment adherence.

### Nutritional Support Intervention

Nutritional status possesses inherent protective capabilities that provide nutritional support for patients with heart failure. By improving the body's nutritional status and enhancing resistance, it lays the material foundation for the restoration of intrinsic functions [13]. This intervention is typically implemented through in-hospital education and outpatient continuous nursing health education, with a focus on adjusting dietary structures based on patients' nutritional status. For patients with nutritional deficiencies, supplementation with high-quality proteins (e.g., fish, eggs, dairy products), vitamins, and dietary fiber on top of standard nutrition can increase muscle mass and immune function. For patients with eating difficulties, methods such as nasogastric feeding or oral nutritional supplements may be employed as appropriate to ensure adequate nutrient intake, elevate prealbumin levels, and safeguard the body's intrinsic nutritional capacity.

### Multidimensional Collaborative Rehabilitation Model

One-dimensional rehabilitation interventions are insufficient to comprehensively enhance patients 'intrinsic capabilities; therefore, clinical practice in recent years has increasingly favored multidimensional collaborative rehabilitation models. In Wu Huan's study, internet-based continuous nursing interventions under the dual-heart medical model demonstrated significant efficacy in improving patients with heart failure, including enhanced quality of life, medication adherence, and cardiac function. This nursing approach incorporates cardiac function rehabilitation, psychological care, and online/offline health education, exerting multi-dimensional effects to collectively improve patients' psychological resilience. Regarding stakeholder collaboration, integrated interventions involving hospitals, families, and communities are currently standard rehabilitation protocols. Hospitals conduct patient assessments and develop treatment plans, while communities assist families in monitoring treatment adherence, thereby maximizing the successful implementation of rehabilitation programs.

### Existing Issues and Prospects

Through a series of studies on the intrinsic capabilities and rehabilitation interventions for heart failure patients, certain progress has been achieved, yet numerous shortcomings remain. These include insufficiently detailed research on the various dimensions of intrinsic capabilities, excessive overlap among rehabilitation intervention methods, and a lack of personalized rehabilitation training approaches. Additionally, research on multidimensional collaborative intervention mechanisms remains inadequate, with the interactions and synergistic effects among different dimensions yet to be fully elucidated. Future research should focus on addressing these issues, prioritizing studies on the application of patient-specific intrinsic capability assessment scales for heart failure patients, the interaction mechanisms among multidimensional influencing factors, and the optimization of multidimensional collaborative rehabilitation models. For instance, intelligent technologies should be actively integrated to develop convenient and accessible rehabilitation intervention tools, thereby reducing service costs, improving accessibility, and enhancing user compliance. In this process, strengthening community-based rehabilitation resource infrastructure at the primary level is crucial to breaking down service barriers between hospitals, households, and communities, ensuring continuous and integrated rehabilitation services. Furthermore, long-term follow-up studies of heart failure patients are essential to investigate the lasting impact of rehabilitation interventions on their intrinsic capabilities, enabling the refinement of intervention protocols and advancing the standardized and scientific development of rehabilitation practices for heart failure patients.

## Conclusion

The maintenance and enhancement of the intrinsic capacity of heart failure directly influence rehabilitation quality and long-term prognosis. This capacity is affected by factors such as the patient's disease condition, individual characteristics, and psychological factors, including cardiac function classification, nutritional status, and emotional disturbances. Guided by these factors, the development of personalized rehabilitation intervention plans has become a core approach to advancing patient recovery. Current rehabilitation interventions have evolved into a comprehensive model grounded in physical rehabilitation, integrated with psychological and cognitive interventions, nutritional support, and multidimensional collaborative approaches, effectively improving patients' cardiac function, mental health, cognitive abilities, and exercise endurance.

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