



Factors Related to Dietary Adherence Among End-Stage Renal Disease Persons
Receiving Hemodialysis in Sichuan Province,
the People's Republic of China*

ปัจจัยที่เกี่ยวข้องกับความร่วมมือในการรับประทานอาหารในผู้ที่เป็นโรคไตเรื้อรังระยะสุดท้าย
ที่ได้รับการฟอกเลือดด้วยเครื่องไตเทียม ในมณฑลเสฉวน สาธารณรัฐประชาชนจีน*

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Abstract

Dietary adherence is critical for hemodialysis patients to manage fluid balance; regulate electrolytes and blood pressure; and reduce complication rates. This descriptive correlational study aimed to examine the relationship between the core constructs of dietary adherence and dietary adherence behaviors, guided by the Health Belief Model (HBM). This study was conducted with 193 end-stage renal disease patients undergoing hemodialysis. The research instruments included the Renal Adherence Behavior Questionnaire (RABQ) and the Dietary Health Belief Questionnaire (DHBQ). Data were analyzed using descriptive statistics and Spearman correlation.

Results demonstrated suboptimal dietary adherence ($M = 57.70$, $SD = 6.85$), with moderate levels across all health belief domains: perceived susceptibility ($M = 12.28$, $SD = 3.97$), perceived severity ($M = 15.78$, $SD = 2.83$), perceived benefits ($M = 13.13$, $SD = 3.78$), and perceived barriers ($M = 21.71$, $SD = 6.74$). Moreover, correlation analyses revealed significant associations: perceived severity ($r = .910$, $p < .001$) and perceived benefits ($r = .877$, $p < .001$) showed strong positive correlations with adherence; perceived susceptibility demonstrated a moderate positive correlation ($r = .429$, $p < .001$); and perceived barriers exhibited a strong negative correlation ($r = -.820$, $p < .001$).

These findings suggest that the Health Belief Model can be used to explore factors significantly influencing dietary adherence in end-stage renal disease patients undergoing hemodialysis. Clinical interventions targeting these cognitive factors may enhance adherence behaviors in this population.

Keywords: Dietary adherence; End-stage renal disease; Health Belief Model; Hemodialysis

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บทคัดย่อ

ความร่วมมือในการรับประทานอาหาร มีความสำคัญอย่างยิ่งสำหรับผู้ป่วยที่ได้รับการฟอกเลือดด้วยเครื่องไตเทียมในการควบคุมสมดุลของสารน้ำ ระดับอิเล็กโทรไลต์ ความดันโลหิต และลดอัตราการเกิดภาวะแทรกซ้อน การศึกษาความสัมพันธ์เชิงพรรณานี้ มีวัตถุประสงค์เพื่อศึกษาความสัมพันธ์ระหว่างองค์ประกอบหลักของแบบแผนความเชื่อด้านสุขภาพกับความร่วมมือในการรับประทานอาหาร โดยอิงจากกรอบแนวคิดแบบแผนความเชื่อด้านสุขภาพ การศึกษานี้ทำในผู้ป่วยที่เป็นโรคไตเรื้อรังระยะสุดท้ายที่ได้รับการฟอกเลือดด้วยเครื่องไตเทียมจำนวน 193 ราย เครื่องมือวิจัย ได้แก่ แบบสอบถามพฤติกรรมความร่วมมือของผู้ป่วยโรคไต และแบบสอบถามความเชื่อด้านสุขภาพเกี่ยวกับอาหาร วิเคราะห์ข้อมูลโดยใช้สถิติเชิงพรรณนา และสถิติ Spearman correlation

ผลการวิจัยแสดงให้เห็นว่า ระดับความร่วมมือในการรับประทานอาหารอยู่ในระดับต่ำ ($M = 57.70$, $SD = 6.85$) โดยมีความเชื่อด้านสุขภาพทุกองค์ประกอบอยู่ในระดับปานกลาง ได้แก่ การรับรู้ต่อโอกาสเสี่ยงของการเป็นโรค ($M = 12.28$, $SD = 3.97$) การรับรู้ความรุนแรงของโรค ($M = 15.78$, $SD = 2.83$) การรับรู้ถึงประโยชน์ ($M = 13.13$, $SD = 3.78$) และการรับรู้ต่ออุปสรรค ($M = 21.71$, $SD = 6.74$) นอกจากนี้ การวิเคราะห์ความสัมพันธ์แสดงให้เห็นว่า การรับรู้ความรุนแรงของโรค ($r = .910$, $p < 0.001$) และการรับรู้ถึงประโยชน์ ($r = .877$, $p < 0.001$) มีความสัมพันธ์เชิงบวกระดับสูงกับความร่วมมือในการรับประทานอาหาร การรับรู้ต่อโอกาสเสี่ยงของการเป็นโรคมีความสัมพันธ์เชิงบวกในระดับปานกลาง ($r = .429$, $p < 0.001$) และการรับรู้ต่ออุปสรรคมีความสัมพันธ์เชิงลบสูง ($r = -.820$, $p < 0.001$)

ผลการศึกษาชี้ให้เห็นว่า แบบแผนความเชื่อด้านสุขภาพ สามารถนำมาใช้เพื่อสำรวจองค์ประกอบของปัจจัยต่าง ๆ ที่มีอิทธิพลอย่างมีนัยสำคัญต่อการปฏิบัติตามคำแนะนำด้านอาหารในผู้ป่วยโรคไตระยะสุดท้ายที่ได้รับการฟอกเลือดด้วยเครื่องไตเทียม การปฏิบัติทางคลินิกที่มุ่งเน้นปัจจัยด้านการรับรู้เหล่านี้ อาจช่วยส่งเสริมพฤติกรรมการปฏิบัติตามคำแนะนำด้านอาหารของผู้ป่วยกลุ่มนี้ได้

คำสำคัญ: ความร่วมมือในการรับประทานอาหาร โรคไตเรื้อรังระยะสุดท้าย แบบแผนความเชื่อด้านสุขภาพ การฟอกเลือดด้วยเครื่องไตเทียม

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Background and Significance

End-stage renal disease (ESRD) is the final stage of chronic kidney disease (CKD), defined by a glomerular filtration rate (GFR) of less than 15 mL/min/1.73 m², leading to irreversible kidney function loss (Lok et al., 2020). The global prevalence of ESRD continues to rise. In the United States, the prevalent ESRD population is projected to increase from 687,093 in 2015 to between 971,000 and 1,259,000 by 2030 (McCullough et al., 2019), while in China, there were over 800,000 ESRD patients in 2020, increasing at a rate of 120,000 to 150,000 per year (Yang et al., 2020).

Renal Replacement Therapy (RRT) options include kidney transplantation, peritoneal dialysis (PD), and hemodialysis (HD). Hemodialysis (HD) is utilized by approximately 94% of patients, compared to fewer than 5% receiving peritoneal dialysis or kidney transplantation (Pajimna et al., 2023). This preference is often due to HD's association with lower morbidity, reduced hospitalization, and greater cost-effectiveness (Crawford & Lerma, 2008). The global HD population is expected to grow from 3 million in 2017 to 5.4 million by 2030 (Dou et al., 2023). In China, the number of HD patients grew from 234,632 in 2011 to 632,653 in 2019 (Tao et al., 2023).

ESRD patients on HD frequently experience significant clinical complications resulting from the disease and its treatment. Fluid overload occurs due to impaired urinary excretion, leading to interdialytic weight gain and edema (Loutradis et al., 2021). Electrolyte disturbances particularly hyperkalemia, hyponatremia, and disordered calcium-phosphate metabolism arise from loss of renal regulatory function (Özkan & Ulusoy, 2011). Additionally, decreased glomerular filtration rates contribute to hypoalbuminemia and protein energy wasting (Kaysen, 2003). These complications collectively elevate cardiovascular risk and mortality, underscoring the critical need for diligent management of metabolic and nutritional parameters in this population.

The National Kidney Foundation Disease Outcomes Quality Initiative (KDOQI) recommends an energy intake of 25–35 kcal/kg/day, protein intake of 1.0–1.2 g/kg/day, sodium intake below 2.3 g/day, phosphorus intake between 800–1,000 mg/day, potassium intake restrictions, and fluid intake limited to 1,000 mL/day (Ikizler et al., 2020). Similarly, Chinese dietary guidelines recommend 30–35 kcal/kg/day of energy, 1.0–1.2 g/kg/day of protein, sodium intake below 2.3 g/day, phosphate intake of 800–1,000 mg/day, potassium intake of 2–3 g/day, and fluid intake of 500 mL plus the previous day's urine output (National Health Commission of the People's Republic of China, 2024).

Proper adherence involves consuming low-phosphorus foods such as refined grains and certain fresh fruits rather than nuts or dairy; low-potassium choices like apples and cabbage instead of bananas or tomatoes; low-sodium options including fresh vegetables and homemade meals over pickled or processed foods; and high-quality protein sources such as egg whites and lean meat, while carefully restricting fluid intake. These specific dietary adjustments are essential



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for managing biochemical parameters and improving clinical outcomes in ESRD patients receiving hemodialysis.

Dietary adherence is critical for hemodialysis (HD) patients to prevent complications and improve clinical outcomes (Chen et al., 2023). Evidence shows that appropriate dietary compliance helps regulate blood pressure, fluid balance, and electrolyte levels, thereby reducing hospitalization frequency and enhancing quality of life (Kopple & Fouque, 2018). Furthermore, it slows the progression of kidney function decline, extends life expectancy, and significantly decreases healthcare expenditures (Ikizler et al., 2020). Conversely, poor dietary adherence leads to serious clinical consequences, including hyperkalemia, hyperphosphatemia, pulmonary edema, malnutrition, and accelerated bone demineralization (Lambert, 2018). These complications increase risks of cardiac events and neuromuscular disorders, elevate healthcare costs, and impose additional burdens on medical systems and providers (Burrowes, 2020). Ultimately, non-adherence is associated with increased morbidity and mortality, underscoring the need for effective nutritional management in this vulnerable population.

Despite its significance, dietary adherence remains low among HD patients. Studies indicate that 77% of patients deviate from prescribed dietary restrictions, increasing their risk of complications (Benjamin et al., 2021). In China, only 35.5% of patients followed dietary recommendations, while 40.3% complied with fluid restrictions (Lee & Molassiotis, 2002). To improve the translatability of clinical recommendations into daily practice, Chinese hospitals are implementing multidimensional strategies including technology-driven personalization through smart meal ordering systems integrated with electronic health records; tailored food preparation (Wang et al., 2023) such as texture-modified and electrolyte-controlled meals; and simplified patient education using portion tools and WeChat-based support groups for continuous guidance (Chen et al., 2019). These integrated approaches aim to overcome practical barriers and make complex nutritional management more sustainable and effective for HD patients.

Efforts to improve dietary adherence have increasingly focused on health beliefs. The Health Belief Model (HBM) is widely used to understand health-related behaviors and consists of six components: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action (Becker, 1974). This model suggests that individuals are more likely to engage in health-promoting behaviors if they recognize their susceptibility to a condition, understand its severity, perceive benefits in taking action, and do not face significant barriers (Nooriani et al., 2019). Some other studies incorporate all variables including self-efficacy and cues to action, making it unclear which specific HBM constructs are the most influential in dietary behaviors (Keshani et al., 2018; Glick et al., 2024; Li et al., 2021).

Since this study prioritizes internal perceptions rather than external motivators, focusing exclusively on perceived susceptibility, perceived severity, perceived benefits, and perceived barriers enables a clearer analysis of the psychological mechanisms underlying dietary adherence. Perceived susceptibility refers to an individual's belief that they are at risk of



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complications due to dietary non-adherence (Yuan et al., 2022). Studies have found a positive relationship between perceived susceptibility and dietary adherence among HD patients (Cuicui et al., 2021; Gao et al., 2025). Perceived severity relates to the extent to which individuals believe non-adherence will negatively affect their health. Increased awareness of complications such as hyperkalemia and cardiovascular risks has been linked to better adherence.

Perceived benefits refer to a patient's belief in the positive outcomes of dietary adherence, including reduced dialysis frequency, improved quality of life, and lower healthcare costs (Sabzmakan et al., 2021). Research has reported a positive correlation between perceived benefits and dietary adherence. Perceived barriers represent obstacles that make adherence difficult, such as high food costs, lack of social support, and emotional stress (Becker, 1974). Studies in Hong Kong and Malaysia found a moderate negative relationship between perceived barriers and dietary adherence (Fung et al., 2017; Lim et al., 2019).

While previous studies have explored dietary adherence using the HBM in various countries, findings may not be generalizable to China due to profound cultural and dietary differences. Traditional Chinese diets are notably high in salt and frequently include preserved and pickled foods, which pose significant challenges to renal dietary guidelines. Furthermore, deep-rooted cultural beliefs such as “yi xing bu xing”, the practice of consuming animal organs to strengthen corresponding human organs directly influence food choices and adherence behaviors (Clark-Cutaia et al., 2014). In addition, Chinese collectivist culture prioritizes family involvement in health decisions, meaning dietary practices are often shaped by familial preferences and collective decision-making rather than individual autonomy, contrasting sharply with Western individualistic approaches (Song et al., 2022). These distinctive socio-cultural factors underscore the need for context-specific research when examining dietary adherence using the HBM in Chinese populations.

To date, only one study in China has investigated the relationship between Health Belief Model (HBM) constructs and dietary adherence in hemodialysis (HD) patients, with a narrow focus on low-phosphorus intake (Cuicui et al., 2021). This limited scope overlooks the comprehensive dietary modifications required in renal management, particularly within the context of traditional Chinese cuisine. Common foods such as pickled vegetables, soy sauce, processed meats, and fermented products are high in sodium (Lin et al., 2021); nuts, dairy, legumes, and organ meats are rich in phosphorus; while fruits like bananas and oranges, as well as leafy green vegetables, contain high levels of potassium.

Adhering to renal dietary guidelines necessitates significant alterations in meal preparation often requiring separate cooking, prolonged soaking, and specialized boiling techniques which are time-consuming and impractical for many families (Chen et al., 2023). Moreover, the cost of purchasing fresh, low-electrolyte ingredients, and specialty renal formulas is substantially higher than that of a conventional Chinese diet, creating economic barriers to compliance. Therefore, further research is essential to examine how perceived susceptibility, severity, benefits, and



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barriers influence overall dietary adherence among Chinese ESRD patients undergoing HD, taking into account these socio-cultural and economic constraints.

Understanding the factors influencing dietary adherence in HD patients is essential for improving patient outcomes. This study aims to examine the levels of perceived susceptibility, perceived severity, perceived benefits, and perceived barriers in relation to dietary adherence based on the HBM. The findings might provide insights for healthcare teams to develop targeted interventions to improve dietary adherence in ESRD patients undergoing HD in China.

Research objectives

1. To examine the level of dietary adherence, perceived susceptibility, perceived severity, perceived benefit, and perceived barriers among end-stage renal disease persons receiving hemodialysis.
2. To examine the relationship between perceived susceptibility, perceived severity, perceived benefit, and perceived barriers and dietary adherence among end-stage renal disease persons receiving hemodialysis.

Conceptual framework

This study employs the Health Belief Model (HBM) (Becker, 1974) as its theoretical framework to examine dietary adherence among end-stage renal disease (ESRD) patients receiving hemodialysis in China. The HBM posits that health behavior is determined by four core constructs: perceived susceptibility (belief in personal risk of complications), perceived severity (belief in the seriousness of these complications), perceived benefits (belief in the efficacy of dietary management), and perceived barriers (obstacles to adherence). Within the Chinese context, traditional diets high in sodium, phosphorus, and potassium present unique challenges to compliance (Lin et al., 2021). By analyzing these cognitive factors, the HBM provides a structured approach to understanding dietary adherence in ESRD patients. Perceived susceptibility and severity encourage adherence by emphasizing health risks such as hyperkalemia or fluid overload, while perceived benefits reinforce positive behavior. Conversely, perceived barriers hinder adherence. Interventions targeting these factors such as patient education, barrier mitigation, and reinforcement of health benefits can improve adherence and clinical outcomes. This framework highlights the model's utility in promoting patient health and optimizing healthcare delivery.

Methodology

Population and sample

The target population is end-stage renal disease persons receiving hemodialysis in Sichuan province, the People's Republic of China.

The sample consisted of 193 end-stage renal disease persons receiving hemodialysis at Xi Chang City People's Hospital in Sichuan province, the People's Republic of China. The inclusion



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criteria were as follows: (1) being above 30 years old (in China, patients over 30 years old account for 93.7% of the hemodialysis population) (Zhang & Huang, 2013), (2) receiving hemodialysis more than 3 months, (3) being able to read and write Chinese language, and (4) voluntarily taking part in the research. The exclusion criterion was as follows: having a history of mental illness, cognitive impairment, or Alzheimer's disease as indicated in medical records. The withdrawal criterion was as follows: (1) voluntary withdrawal: the participant explicitly communicates their desire to stop; (2) failure to complete the questionnaire within 20 minutes; or (3) a participant indicates, either through questionnaire responses or direct communication, significant emotional or psychological distress as a result of the questionnaire's content.

The sample size was calculated based on G*Power analysis at an alpha level of .05 and power of 0.80. According to a previous study which studied the correlation between the perceived susceptibility, perceived severity, perceived benefit, perceived barriers, self-efficacy, and dietary adherence among end-stage renal disease persons receiving hemodialysis, the correlation coefficient ranged from 0.246 to 0.979. Since a lower effect size yields a larger sample, the lowest effect size, 0.246, was chosen. However, a correlation coefficient of 0.246 was not calculated; therefore, the closest correlation coefficient which could be used was 0.2 (Bujang & Baharum, 2016), resulting in a sample size of 193.

Research instruments

1. The demographic data record form was developed by the researcher based on the literature review.

2. The Renal Adherence Behavior Questionnaire (RABQ) was developed by Rushe and McGee (1998) and translated by Huichen Chen and colleagues (Chen et al., 2023) It has 25 items: 11 items for adherence to fluid restrictions; 5 items for adherence potassium/phosphate restriction; 2 items for self-care; 2 items for sodium restriction; and 5 items for adherence in times of particular difficulty, for example, when eating out, in summer. A 5-point scale was used to measure the level of adherence, as follows: 1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, and 5 = Always (Rushe & McGee, 1998). The scores for dietary adherence range from 25 to 125 (total score). Dietary adherence can be divided into two levels: ≤ 75 score low dietary adherence; >75 score = high dietary adherence (Chen et al., 2023).

3. The Dietary Health Belief Questionnaire for Hemodialysis Patients (DHBQ) was developed by Zhang Yuan and colleagues (Yuan et al., 2022). It is a self-reported questionnaire with 19 items, which include 4 dimensions: perceived susceptibility - 4 items; perceived severity - 5 items; perceived benefit - 4 items; perceived barriers - 6 items (Yuan et al., 2022). It uses a 5-point scale to measure dietary health beliefs (1 = Strongly disagree, 2 = Disagree, 3 = Not sure, 4 = Agree, and 5 = Strongly agree).

Validity and reliability of research instruments

The validity of the Renal Adherence Behavior Questionnaire (RABQ) was confirmed by Huichen Chen and colleagues (2023) while that of the Dietary Health Belief Questionnaire for



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Hemodialysis Patients (DHBQ) was confirmed by Zhang and colleagues (2022). Both instruments were used without any modification, thus their validities were not tested in this study.

The reliability of the RABQ and DHBQ was tested with 10 subjects who met the inclusion and exclusion criteria, but were not included in the sample. The Cronbach's alpha value for the RABQ was 0.82. The Cronbach's alpha value of the DHBQ was as follows: overall Cronbach's α = 0.90, which measured the HBM constructs of perceived susceptibility (α = 0.82), perceived severity (α = 0.91), perceived benefits (α = 0.82), and perceived barriers (α = 0.93).

Ethical considerations

The study was approved by the Institutional Review Board of the Faculty of Nursing, Chiang Mai University (COA No. 119/2024; Date of approval: September 11, 2024). Permission for data collection was also obtained from the administrator of Xi Chang City People's Hospital. All the participants were provided with written and verbal information about the study objectives and processes, protection of confidentiality and anonymity, and the right to refuse or withdraw from the study at any time. Informed consent was obtained from each participant before data collection.

Data collection

Following approval from the institutional review boards of both the academic institution and Xi Chang City People's Hospital, data collection was initiated. A study poster was placed in the hemodialysis unit, and interested patients contacted the unit nurse for preliminary enrollment. The researcher, wearing polite attire and a master's student name tag, approached potential participants before their dialysis sessions. After explaining the study purpose, written informed consent was obtained, including permission to review medical records for eligibility screening.

Eligible participants were escorted to a private education room within the unit to ensure confidentiality and minimize distractions. Data were collected prior to hemodialysis treatment to avoid fatigue or treatment related bias. Participants independently completed the three study questionnaires within 20 minutes, a duration determined through pilot testing to be sufficient without causing respondent fatigue. The researcher did not provide interpretation or guidance during completion to avoid influencing responses. Incomplete questionnaires were excluded, and recruitment continued until the target sample size of 193 was reached.

Data analysis

Data were analyzed using IBM SPSS Statistics for Windows, Version 29.0.1.0. Mean and standard deviation were used to describe the RABQ and the 4 HBM constructs (perceived susceptibility, perceived severity, perceived benefits, and perceived barriers of dietary adherence). Normality of the RABQ and the HBM constructs were checked by Kolmogorov-Smirnov tests and p-values, and all were not normally distributed. Therefore, Spearman's correlation was chosen to find the associations among them.



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Results

The participants in this study consisted of 193 individuals with end stage renal disease receiving hemodialysis in Sichuan Province, the People's Republic of China. Their average age was 57.95 years (SD = 12.36), with a range of 30 to 88 years. The majority were male (73.05%). In terms of education level, 40.41% had completed middle school, 31.60% had completed primary school or below, and only 1.57% had attained a university level education or higher (Table 1).

Table 1 Frequency and percentage of demographic characteristics of the participants (n = 193)

Demographic characteristics	Frequency	Percentage (%)
Gender		
Male	141	73.05
Female	52	26.95
Age (years old) (M = 57.95, SD = 12.36, range 30-88)		
30-59 years old	108	55.95
≥ 60 years old	85	44.05
Education level		
Primary school and below	61	31.60
Middle school	78	40.41
High school or technical secondary school	51	26.42
University and above	3	1.57
Time for hemodialysis		
3-12 months	42	21.76
12-60 months	113	58.55
61-120 months	32	16.58
≥120 months	6	3.11
Employment status		
Employed	32	16.58
Unemployed	161	83.42

The results indicate that dietary adherence among participants was at a low level, with a mean total score of 57.70 (SD = 6.85), ranging from 43 to 70. When comparing subscale scores based on mean item scores, the highest adherence was observed in the Self-care domain (M = 3.21, SD = 0.77), while the lowest was found in the Fluid Restrictions domain (M = 2.09, SD = 0.36) (Table 2).



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Table 2 Descriptive statistics of renal adherence behavior scores of participants (n = 193)

Renal Adherence Behavior Score of Participants by Range and Mean (n = 193) RABQ	Possible score	Total score			Mean item score		
		Range	M	SD	Range	M	SD
Overall	25-125	43-70	57.70	6.85	1.72-2.80	2.31	0.27
Fluid restrictions	11-55	16-30	22.99	4.01	1.45-2.73	2.09	0.36
Potassium/Phosphate Restriction	5-25	7-16	11.80	1.58	1.40-3.20	2.36	0.32
Self-care	2-10	3-8	6.44	1.55	1.50-4.00	3.21	0.77
Sodium intake	2-10	2-8	6.62	1.37	1.00-4.00	2.81	0.69
Times of difficulty	5-25	6-18	10.86	2.60	1.20-3.60	2.17	0.52

Regarding participants' levels of health belief components related to dietary adherence, the mean score for perceived susceptibility was 12.28 (SD = 3.97), indicating a moderate level, with more than half of participants (55.45%) falling into this category. Perceived severity also showed a moderate level overall (M = 15.78, SD = 2.83), with the majority of participants (85.00%) scoring in the moderate range. For perceived benefit, the mean score was 13.13 (SD = 3.78), with nearly equal proportions at moderate (43.52%) and high (44.56%) levels, suggesting a relatively positive belief toward dietary adherence. The mean score for perceived barriers was 21.71 (SD = 6.74), which also fell within the moderate range, though a considerable number of participants (40.93%) perceived high levels of barriers, which may impact adherence behaviors (Table 3).

Table 3 Perceived susceptibility, perceived severity, perceived benefit, and perceived barriers score of participants (n = 193)

	Range	M	SD	Levels	Possible score	Frequency (%)
Perceived susceptibility	4-16	12.28	3.97	Low	4-7	29 (15.02%)
				Moderate	8-15	107 (55.45%)
				High	16-20	57 (29.53%)
Perceived severity	10-20	15.78	2.83	Low	5-9	0 (0%)
				Moderate	10-19	166 (85.00%)
				High	20-25	27 (15.00%)
Perceived benefit	5-16	13.13	3.78	Low	4-7	23 (11.91%)
				Moderate	8-15	84 (43.53%)
				High	16-20	86 (44.56%)
Perceived barriers	6-30	21.71	6.74	Low	6-11	24 (12.43%)
				Moderate	12-23	90 (46.63%)
				High	24-30	79 (40.94%)



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There was a moderate positive correlation between perceived susceptibility and dietary adherence (Spearman's $r = .429$, $p < .001$). A very strong positive correlation was found between perceived severity and dietary adherence ($r = .910$, $p < .001$), and a strong positive correlation was observed between perceived benefit and dietary adherence ($r = .877$, $p < .001$). Conversely, perceived barriers were strongly and negatively correlated with dietary adherence ($r = -.820$, $p < .001$), suggesting that higher perceived barriers are associated with lower adherence (Table 4).

Table 4 Correlation analysis between perceived susceptibility, perceived severity, perceived benefit, and perceived barriers and dietary adherence

Health Belief	Dietary Adherence	
	Spearman's r	p-value
Perceived susceptibility	0.429**	< .001
Perceived severity	0.910**	< .001
Perceived benefit	0.877**	< .001
Perceived barriers	-0.820**	< .001

Note. **Spearman's rank order correlation test, $p < .001$

Discussion

This study presents a multifaceted examination of dietary adherence patterns among end-stage renal disease (ESRD) patients undergoing hemodialysis in Sichuan Province, China. The investigation reveals alarmingly low adherence rates, with no participants achieving high compliance levels, highlighting significant gaps in current management approaches for this vulnerable population.

Demographic characteristics of the cohort reveal several risk factors for non-adherence. The predominantly male population (73.5%) with limited educational attainment (31.6% with only primary education) and high unemployment rates (83.4%) reflects substantial socioeconomic barriers to optimal disease management. These structural disadvantages are compounded by cultural dietary practices favoring high-sodium, spicy Sichuan cuisine, creating a perfect storm of adherence challenges that are particularly acute in this region compared to Western healthcare settings.

Application of the Health Belief Model (HBM) framework yields important insights into cognitive factors influencing adherence behaviors. The study documents moderate levels of perceived susceptibility and disease severity (15.78 ± 2.830), with 85% of participants demonstrating moderate severity perception. This likely reflects both the chronic disease paradox (where patients normalize progressive symptoms) and cultural perspectives rooted in traditional Chinese health beliefs, which often emphasize holistic balance and gradual “tiao yang” recuperation rather than acute threat perception. Notably, the research identifies a robust positive correlation between perceived severity and adherence (Spearman's $r = .910$, $p < 0.001$), consistent with previous findings in Chinese populations (Cuicui et al., 2021). These results underscore the importance of integrating cultural illness representations into dietary intervention strategies.



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The psychological dimensions of adherence emerge as particularly significant in this population. Perceived benefits demonstrated a strong positive correlation with dietary adherence ($r = .877$, $p < 0.001$), potentially reflecting cultural values prevalent in Chinese society that emphasize practical outcomes and tangible health improvements such as maintaining family responsibilities and functional capacity as key motivators for adherence (Lu et al., 2020). Conversely, perceived barriers showed a substantial negative correlation ($r = -.820$, $p < 0.001$). These barriers particularly include the high cost of renal-specific foods, limited access to dietitian services, and difficulties adapting traditional high-salt diets to renal requirements, which represent significant socioeconomic and systemic challenges within the Chinese healthcare context. These specific barriers highlight critical areas for intervention, such as implementing financial support programs for special foods and enhancing nutritional counseling services. These findings collectively suggest that while patients generally acknowledge the seriousness of ESRD and recognize the advantages of dietary compliance, they face overwhelming practical obstacles rooted in economic hardship, food insecurity, and cultural dietary norms. The complexity of renal diets – requiring simultaneous regulation of protein, phosphorus, potassium, sodium, and fluid intake – creates additional cognitive burdens that contribute to decision fatigue and eventual non-compliance.

Based on the findings of this study, clinical interventions aimed at improving dietary adherence among hemodialysis patients in this region should prioritize enhancing key health beliefs, particularly the perception of severity and benefits, which demonstrated very strong positive correlations with adherence, while concurrently developing targeted strategies to mitigate perceived barriers, which showed a strong negative correlation. Given the participants' predominantly low educational attainment, all educational materials must be communicated in clear, simple language and should specifically address the domain of fluid restrictions, where adherence was lowest.

Applications of research findings

Psychosocial beliefs, particularly perceptions of risk, severity, and barriers, significantly influence dietary adherence in ESRD patients, as outlined by the Health Belief Model (HBM). To improve compliance, providers should deliver education and culturally sensitive counseling that amplifies perceived severity and benefits, while introducing practical tools to reduce barriers. Integrating structured communication training based on the HBM into nursing curricula can enhance patient interactions and support better long-term ESRD outcomes. Future studies should further develop technology-assisted interventions to modify these critical beliefs.

Suggestions for further research

Future research should employ longitudinal and predictive study designs to explore causal relationships between psychosocial factors and dietary adherence among ESRD patients. Incorporating real-time monitoring technologies and personalized behavioral interventions may offer promising avenues to improve adherence and clinical outcomes over time.



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