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ORIGINAL RESEARCH

Exploring Factors Influencing Dietary Management in Chinese Chronic Kidney Disease Patients Based on the COM-B Model: A Qualitative Study

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Background: Dietary management plays an important role in slowing the progression of chronic kidney disease, however, adherence to dietary management remains a significant challenge, particularly in culturally diverse settings like China. Currently, there is limited research on the factors influencing dietary management in Chinese patients with chronic kidney disease. Given this knowledge gap, we aimed to explore the factors influencing dietary management in patients with chronic kidney disease based on the capability, opportunity, motivation, and behavior (COM-B) model and provide culturally suitable insights for the creation of focused interventions.

Methods: Semi-structured interviews were conducted between September and November 2024 at the Department of Nephrology, Affiliated Central Hospital of Jiangnan University, with 45 participants, including 19 patients with chronic kidney disease, 10 caregivers, and 16 healthcare professionals. Interview guide themes were informed by the COM-B model. Adoption of a thematic analysis approach and mapping onto the COM-B model. The study was reported following the COREQ Checklist.

Results: Fifteen factors influencing dietary management in chronic kidney disease were categorized according to the COM-B model's three domains: (1) Capability: physical dysfunction, difficulty in controlling physiological needs, knowledge mastery, willpower and self-control, low self-efficacy; (2) Opportunity: patient-to-patient influence, social support, social culture, limitations in food and advocacy resources, lack of meals for chronic kidney disease patients in hospital canteens; (3) Motivation: value orientation, dietary expectations, experience-driven (a: perceived benefits, b: perceived burden, c: stigma), nervousness, food desires.

Conclusion: This study provides a novel perspective on factors influencing dietary management in chronic kidney disease, highlights the profound impact of Chinese culture on dietary management, and provides a basis for the development of targeted, culturally appropriate intervention programs based on the dimensions of competence, opportunity, and motivation.

Keywords: renal insufficiency, chronic, COM-B model, diet therapy, dietary adherence, qualitative research

Introduction

Chronic Kidney Disease (CKD) is a significant public health problem, characterized by structural or functional kidney abnormalities persisting for over three months.[1] It impacts almost 850 million individuals globally,[2] with a prevalence of 8.2% in China.[3] By 2040, CKD is projected to become the fifth leading cause of death globally.[4] Beyond its direct health impacts, CKD contributes to cardiovascular complications and puts a heavy strain on the global healthcare system.[5] While genetic factors contribute to CKD onset, modifiable environmental factors, such as diet, play a crucial role in disease progression.[6] Evidence suggests that rational dietary management can effectively control the progression of CKD and improve health outcomes.[7]

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Despite the acknowledged importance of dietary management for patients with CKD, adherence to dietary guidelines remains a significant challenge, particularly within China's complex multicultural environment.[8] Recent surveys have indicated poor dietary adherence among Chinese CKD patients,[9] which is closely associated with the population's generally low food literacy.[10] Moreover, although some patients exhibit favorable attitudes toward dietary management, the actual execution is frequently obstructed by a deficiency in knowledge and inadequate practice.[11] The situation is further complicated by China's unique sociocultural norms and the constraints of its healthcare system.[12,13] While previous research has underscored the influence of sociocultural factors on dietary management in CKD patients,[14] the existing literature is still deficient in a comprehensive and in-depth exploration of dietary management of CKD patients within the Chinese cultural framework. This knowledge gap not only constrains our understanding of the complexities surrounding dietary management for CKD patients in China but also impedes the development of targeted interventions. Consequently, there is an urgent need for in-depth research to explore the factors influencing dietary management among Chinese CKD patients, providing a scientific foundation for the creation of effective, culturally sensitive intervention strategies.

The use of theoretical frameworks is pivotal in understanding behavior and designing interventions.[15] To address these challenges, this study employs the Capability, Opportunity, Motivation-Behaviour (COM-B) model, a theoretical framework that systematically identifies barriers and enablers of behavior change.[16] The COM-B model is at the heart of the Behavior Change Wheel (BCW) and emphasizes the three core components - Capability, Opportunity, and Motivation. Capability encompasses physical capability (eg, physical skills, strength) and psychological capability (eg, knowledge, comprehension); Opportunity is categorized into social opportunity (eg, interpersonal influences, cultural background, social support) and physical opportunity (eg, time, resources, location); and Motivations are divided into reflective motivation (eg, self-awareness, planning and assessment, beliefs about good and bad) and automatic motivation (eg, desires, impulses, emotions), providing a comprehensive understanding of behaviors.

The strengths of the COM-B Model reside in its inclusion of nearly all essential components from various theoretical models of health behavior, offering a systematic and comprehensive framework for analyzing influencing factors and behavioral mechanisms. In addition, the BCW system and COM-B model elements are mapped to each other, prompting interventions to be associated with behavioral mechanisms, providing a clear and specific framework and process for designing health behavior interventions, and helping to promote the development of implementation science and evidence-based practice.[16] Currently, the model has been applied to explore the factors influencing clinical problems such as eating behavior and health-seeking behavior.[17,18] Nevertheless, its application to dietary management in CKD patients remains unexplored, particularly within the cultural context of China.

Therefore, this study aims to thoroughly explore the factors affecting dietary management in patients with CKD based on the COM-B model, incorporating the viewpoints of patients (P), caregivers (C), and healthcare professionals (HCP) to offer a comprehensive knowledge of these issues. This establishes a foundation for the subsequent creation of culturally appropriate interventions and offers valuable evidence for the worldwide comprehension of dietary management in chronic diseases.

Methods

Study Design

Semi-structured in-depth interviews with CKD patients, caregivers, and healthcare professionals were conducted using descriptive qualitative research,[19] a research method based on the philosophical underpinnings of naturalistic questioning, which allows for an in-depth exploration of a relatively under-researched topic and providing a rich, comprehensive understanding of the subject matter,[19] making it suitable for this study. Data collection and analysis were guided by the COM-B model. The reporting of this study followed the Consolidated Standards for Reporting Qualitative Research (COREQ) checklist (Appendix 1).[20]

Participant and Setting

The study was performed at the Department of Nephrology, Affiliated Central Hospital of Jiangnan University, a tertiary general hospital situated in China, the Department of Nephrology is a prominent municipal specialty, providing care to approximately 2,500 patients with CKD annually.

Purposive sampling, in conjunction with the principle of maximal difference, was employed to choose patients with CKD, caregivers, and healthcare personnel within the nephrology department. The inclusion criteria for respondents were as follows: a. Patients: Diagnosed with CKD across stages G1-G5, who were relatively stable, exhibited clear mental clarity and normal cognitive function, could communicate effectively, and were aware of their condition; b. Caregivers: Undertake the primary care of the patient; not the caregivers of the enrolled patients; c: Healthcare Professionals: Personnel employed in the Department of Nephrology. All participants were at least 18 years old, voluntarily engaged in this study, and completed an informed consent document.

Participants were recruited through a poster displayed in the Department of Nephrology, detailing the study's purpose, significance, procedures, and contact information. We incorporated individuals of varying ages, genders, marital statuses, disease stages, and disease durations to encompass a broad spectrum of opinions.

Data Collection

An interview outline was constructed utilizing the COM-B model through a review of pertinent literature to align with the research objectives and topics. The development method encompassed group discussions and preliminary interviews: a. Group Discussions: The research team identified essential factors related to dietary management in CKD patients, ensuring comprehensive coverage of relevant themes; b. Preliminary Interviews: Preliminary interviews were conducted with two healthcare professionals, one patient, and one caregiver to evaluate the feasibility and validity of the interview outlines. Modifications were implemented following the feedback obtained. The final interview outline offers a detailed overview of the elements affecting dietary management in CKD patients. The interview outline is presented in Appendix 2.

The interviews were place from September 2024 to November 2024 in a separate lounge within the nephrology department to ensure a comfortable and confidential setting for participants. Before the commencement of the interviews, we elucidated the study's goal to the participants and informed them that the interviews would be audio-recorded. Simultaneously, we underscored that they could terminate or discontinue the interview at any moment should they experience discomfort. All participants were interviewed by a single researcher, who possessed training and expertise in qualitative research. Throughout the interviews, the interviewer actively prompted participants to articulate their thoughts and employed tactics such as "clarification" and "repetition" as needed.[21] Participants' non-verbal cues, including facial expressions and bodily movements, were observed and documented. After each interview, the interviewer composed a memorandum and completed a reflective journal. Following the interview, participants were requested to fill out a demographic survey. Concurrently, the interviewer examined the participant's electronic medical record for supplementary medical information.

In qualitative research, saturation is a common guideline for determining sample size,[22] hence, data collection and analysis were performed simultaneously to provide ongoing comparisons and assess the proximity to data saturation.[23] After 39 interviews, no new themes appeared to have emerged, the research team conducted and analyzed a further six interviews with the tripartite population to confirm that no new data or themes had emerged. Data collection ended after the 45th interview. The duration of the interviews varied from 21 to 85 minutes.

As all participants were Chinese, we conducted the interviews and recorded the content in Chinese. Translation from Chinese to English was primarily handled by the author, LFP, a nursing researcher and educator with a doctorate in Nursing and advanced English proficiency, ensuring accuracy and consistency.

Data Analysis

Within 24 hours following each interview, the interviewer (ZN) transcribed the text and collected the field notes. While another team member (FSY) checked the accuracy of the transcriptions. To maintain confidentiality, the transcripts were

anonymized, and participants were assigned pseudonyms. The coded transcribed text was subsequently entered into NVivo 12 separately. The data analysis comprised two phases: initially, a thematic analysis was conducted,[24] after which themes were deductively mapped onto the COM-B model.[16,25] In the first phase, coding members (ZN, FSY) repeatedly read the transcribed text to familiarize themselves with the data, looking for statements that were relevant and significant to the purpose of the study, creating initial codes; after coding all of the data, these codes were independently analyzed and collaboratively discussed to create categories and subcategories, which were classified into potential themes by consensus; through further development and review, themes were refined, defined and named, and content was clarified. In the second phase, two coding members reviewed the themes and representative quotes and mapped each theme to the COM-B model. This was then returned to multiple participants for validation. Any disagreements that arose throughout the process were resolved through discussion and consultation with other researchers until an agreement was reached.

Ethics

Ethical approval for this study was secured by the Ethics Review Committee of the Affiliated Central Hospital of Jiangnan University. Ethics Approval Number: (2024) Ethics Review No (Y-245). All participants signed written informed consent and orally affirmed it before the interview. The researchers were dedicated to maintaining the confidentiality of participant information. Moreover, the researchers who performed the interviews were not engaged in the clinical affairs of the unit, so the participants' decisions and statements would not influence them.

Rigor

To ensure rigor, the research team underwent standardized training in qualitative research methodologies and received ongoing guidance from qualitative research professionals throughout the study. The research employed purposive sampling alongside maximum differentiation sampling and conducted interviews with a tripartite population (CKD patients, caregivers, and healthcare professionals) to yield more comprehensive and dependable data. Interviews were transcribed promptly following each session, and the transcripts were examined verbatim. At the data coding stage, two researchers coded independently to ensure consistency, and in case of disagreement, the final coding was determined by a third researcher. Audit trails were employed to record all phases of the data gathering and analysis processes, and were archived in NVivo to augment the confirmability of the research study. Triangulation was also achieved through participant categories and multiple data collection methods,[26] along with the prompt return of interview transcripts to participants for validation, leading to increased credibility and reliability of the study.[27] Additionally, a comprehensive description of the study context, participant selection criteria, participant characteristics, and data collection and analysis procedures were provided to facilitate the transferability of findings. To reduce bias, the interviewer had no prior relationship with the participants and maintained a reflective diary throughout the interview and data analysis process.[28]

Results

A total of 45 individuals were engaged in the interviews, comprising 19 patients, 10 caregivers, and 16 healthcare professionals. Participant details are in Table 1. The study revealed 15 sub-themes across three primary categories that aligned with the COM-B model, elucidating factors that affect dietary management in patients with CKD (Table 2).

Theme 1: Capability

Physical Dysfunction

Interviewees noted that physical dysfunctions such as fatigue and loss of appetite brought on by the disease led to a reduction in the patient's physical strength, in addition, some patients with diabetic nephropathy had vision problems such as diabetic retinopathy, which made it impossible for patients to utilize online resources, and all of these reduced the ability of patients to follow dietary guidelines.

> "After having kidney disease, I don't even have the strength to cook, and even if I wanted to follow the dietary guidelines, my body wouldn't be able to support me to do so (sigh)." *(P1)*

Table 1 Basic Information About Participants

Characteristics	Participants		
	CKD Patients (n=19)	**Caregivers (n=10)**	**Healthcare Professionals (n=16)**
Age (years)			
Mean ± standard deviation	52.89±8.81	54.3±14.83	39.19±6.13
Range	41–78	28–76	28–54
Sex, n (%)			
Female	8(42.11)	5(50.00)	12(75.00)
Male	11(57.89)	5(50.00)	4(25.00)
Marital status, n (%)			
Married	12(63.16)	8(80.00)	16(100.00)
Single	7(36.84)	2(20.00)	
Educational level, n (%)			
Primary and below	2(10.53)	2(20.00)	
Middle school	13(68.42)	5(50.00)	
University and above	4(21.05)	3(30.00)	16(100.00)
Employment status, n (%)			
Employed	6(31.58)	4(40.00)	16(100.00)
Not employed	13(68.42)	6(60.00)	
Occupation of healthcare personnel, n (%)	NA	NA	
Nurse			12(75.00)
Doctor			4(25.00)
Years of work (years), n (%)	NA	NA	
5–10			2(12.50)
>10			14(87.50)
Disease stage, n (%)		NA	NA
G1-G3	5(26.32)		
G4-G5	14(73.68)		
* hemodialysis	*5(26.32)		
* peritoneal dialysis	*3(15.79)		
Duration of disease (years), n (%)		NA	NA
<1	6(31.58)		
1–5	7(36.84)		
>5	6(31.58)		
Relationship with patients, n (%)	NA		NA
Couple		3(30.00)	
Children		4(40.00)	
Parent		3(30.00)	

Notes: "n" represents the number of participants; "%" indicates the proportion of participants in the corresponding group, for example, 42.11% of CKD patients were female, meaning that the proportion of female patients among all CKD patients participating in the study was 42.11%; "*" represents the inclusion relationship, for example, the patients with stage G4-G5 included hemodialysis and peritoneal dialysis patients, among which there were 5 hemodialysis patients, accounting for 26.32% of all CKD patients participating in the study.
Abbreviation: "NA", not applicable.

Table 2 Factors Influencing Dietary Management in Patients with CKD

Themes	Sub-Themes
Capability	Physical dysfunction (B)
	Difficulty in controlling physiological needs (B)
	Knowledge mastery (M)
	Willpower and self-control (M)
	Low self-efficacy (B)
Opportunity	Patient-to-patient influence (M)
	Social support (M)
	Social culture (B)
	Limitations in food and advocacy resources (B)
	Lack of meals for CKD patients in hospital canteens (B)
Motivation	Value orientation (M)
	Dietary expectations (M)
	Driven by experience (M)
	Nervousness (B)
	Food desires (B)

Abbreviations: CKD, Chronic Kidney Disease; B, Barrier factor; M, Mix factor.

"My doctor suggested I go online to learn about diets, but I can't see well enough to use my smartphone to go online, I can't cope with dietary management." *(P7)*

Difficulty in Controlling Physiological Needs

Several interviewees noted that patients often found it challenging to meet basic physiological needs while adhering to dietary management guidelines. Persistent thirst and hunger were common issues, and the resulting severe physiological discomfort often made it difficult for patients to comply with medically recommended diets.

"I have a big appetite, and when I eat less, I get hungry and even hypoglycemic, making adherence to dietary management difficult." *(P4)*

Knowledge Mastery

The effectiveness of dietary management in patients with CKD is influenced by the knowledge mastery of healthcare professionals, patients, and caregivers regarding dietary requirements.

Healthcare professionals are the principal providers of dietary information for patients; nevertheless, interviews revealed that some healthcare professionals possess insufficient knowledge of dietary management. Moreover, some healthcare professionals had difficulty in effectively and concisely communicating dietary knowledge to patients during the process of dietary management knowledge dissemination, and these deficiencies in knowledge mastery hindered patients' dietary management.

"Not every healthcare professional is aware of the dietary management requirements for CKD. Even if I am, I find it difficult to convey these requirements to patients when it comes to particular quantitative approaches (sigh)." *(HCP1)*

In terms of patient knowledge mastery, interviewees reported that many patients had limited understanding of the precise dietary management requirements and could only make generalized attempts to regulate their food intake. Misconceptions were also common, with some diabetic nephropathy patients believing that glycemic control was their sole concern, leading to poor adherence to dietary management of nephropathy.

"Most patients have limited knowledge of dietary management and they manage their diets in a cursory manner, only a few patients have good knowledge of dietary management and they use food scales to be precise to specific grams." *(HCP2)*

"I'm also not sure of the specific requirements in terms of dietary management...many patients eat all foods, but less of them, or what else?" *(P3)*

"This kidney disease is mainly due to diabetes, just control your blood sugar, don't worry about the diet for kidney disease." *(P5)*

Caregivers, who play a critical role in home care, were also interviewed to have insufficient knowledge about dietary management for CKD patients. Many caregivers relied on everyday experiences or informal information to provide dietary care for their patients. As one caregiver shared:

"Nobody has given us in detail how he (the patient) should eat...Last time I heard a doctor telling other patients that blanching greens would have less phosphorus, I started doing the same." *(C8)*

Willpower and Self-Control

Willpower and self-control play an important role in patients' dietary management. Stronger willpower and self-control can effectively encourage patients to follow dietary management.

"Diet management needs to be self-controlled, don't eat foods that you can't eat, and discipline yourself." *(P14)*

Similarly, a caregiver emphasized the positive impact of willpower and self-discipline:

"He (the patient) was very self-disciplined, it was all under his control, his diet was well managed and all indicators were normal." *(C10)*

Conversely, a lack of willpower and self-control can hinder dietary compliance. Healthcare professionals observed that patients with a more casual personality, weak will, and poor self-control were less likely to adhere to dietary management.

"I have found in my clinical practice that some patients have poor willpower, and when they see the food that they want to eat, they forget that they are patients and eat whatever they want." *(HCP5)*

Low Self-Efficacy

Some patients expressed significant doubt about their ability to alter long-standing dietary habits, believing that ingrained behaviors were too challenging to change. This lack of confidence undermined their efforts at dietary management. As one patient reflected:

"I've been eating like this for half my life and now I'm being asked to change my diet, which I find exceedingly challenging... My physician advised me to weigh my food, but I mistrust my ability to accomplish it." *(P10)*

Theme 2: Opportunity

Patient-to-Patient Influence

The dietary management of CKD patients was influenced by interactions with other patients. Some patients indicated that engaging with seasoned patients facilitated their acquisition of good dietary control strategies that improved their dietary management. A patient shared:

"After diagnosis, I wanted to talk to other patients and their experience helped me a lot...I learned the small measuring cups I use now from them and it helps." *(P17)*

However, patient-to-patient communication could also have negative consequences. Healthcare professionals and caregivers have observed that certain patients with inadequate dietary adherence may misguide newly diagnosed individuals, leading them to adopt harmful eating practices.

"Some patients with a long course of the disease have poor dietary control and they publicize their incorrect eating behaviors... new patients hear about it and follow suit, which is bad." *(HCP9)*

Social Support

Social support, including familial, hospital, and governmental dimensions, is crucial in the dietary management of CKD patients.

The family constitutes the principal environment for the patient. Family members are essential in providing education, demonstration, and supervision in dietary management. Effective collaboration within families greatly aids adherence to dietary guidelines.

> "As family members, we must closely monitor the patient's diet...correct unsuitable diets, explain, and support the patient in changing their eating habits, such as avoiding soup...With one of us in charge of managing the diet and the other taking care of the emotions, we have a clear division of labor...The last time I talked to a patient's family member, she said she could not control the patient, but I think it is completely possible to participate and control the patient's diet through appropriate methods." *(C4)*

Hospitals have a profound impact on the dietary management of patients. A lot of interviewees point out serious shortcomings in the dietary management of hospitals. The lack of clarity of procedures concerning diet management and the lack of a full-time administrator makes it challenging for healthcare professionals to effectively guide and supervise patients and caregivers.

> "We currently do not have a full-time dietitian in our hospital, and the lack of a clear process for dietary management limits the role we can play." *(HCP10)*

> "Our dietary education is devoid of a systematic framework, lacking a standardized process within the hospital. We ought to assume a more significant role, however, in practice, we are often limited to providing patients with only brief information upon their admission." *(HCP11)*

Moreover, healthcare professionals generally indicated that hospitals inadequately prioritized dietary management and that dietary recommendations were vague and lacked individualized assistance. This made it difficult for patients to recognize the importance of dietary management.

> "Dietary advice is uniform and lacks accuracy, patients see other people's diet cards are the same as theirs and think that diet is an unimportant thing, this situation seriously affects the patients' attention to dietary management." *(HCP7)*

Government involvement is crucial but was reported to be insufficient in supporting dietary management for CKD patients. Although CKD is included in the national chronic disease management system, interviewees criticized the lack of follow-up and comprehensive management.

> "After CKD was uploaded to the Chronic Disease Management System, there was no one to follow up and manage it. Dietary management of CKD is not given enough attention in the entire environment." *(HCP12)*

Social Culture

Many interviewees highlighted the impact of social etiquette and cultural customs on dietary management, noting the pressure to conform to traditional norms in social settings. Such customs often challenged adherence to dietary guidelines. As one patient explained:

> "During festivals and friends' feasts, there will always be some heavy oil and salt dishes...men need to drink among themselves...It's impossible to follow dietary management on such occasion." *(P15)*

Limitations in Food and Advocacy Resources

Interviewees reported that patients' daily food choices were limited due to disease control. Additionally, hospitals lacked adequate nutritional education resources for CKD patients, and this scarcity of resources limited patient compliance with dietary management.

> "I usually eat potatoes and mushrooms, but I've been told I can't eat anything that grows in the ground due to high phosphorus. Now I feel like there's nothing left to eat." *(P7)*

"All we have is an outdated diet manual…We lack educational resources." *(HCP4)*

Lack of Meals for CKD Patients in Hospital Canteens

Interviewees widely reported that hospital canteens did not provide meals tailored to the dietary requirements of CKD patients. Concerns about high sodium levels and inappropriate meal formulations in canteen offerings negatively affected patients' dietary management.

"The meals in the hospital canteen are too salty, we can't eat that salty...I can't drink the carp soup at lunchtime, the soup will all go to waste...there are no meals specifically provided for CKD, which affects my dietary management a lot (voice intensifies)." *(P2)*

Theme 3: Motivation

Value Orientation

Patients' attitudes toward life and health affect their dietary management. Some patients valued longevity and consequently adhered to a stringent dietary regimen. A patient expressed:

"If you want to live longer, you need to control your diet." (P13)

Conversely, other patients prioritized enjoying life over dietary restrictions, dismissing the importance of dietary management. One patient stated:

"Life is about enjoying the moment and eating as much as you want...why live so tired?" *(P6)*

Dietary Expectations

Dietary expectations greatly impact the dietary management of patients. Most healthcare professionals indicated that upon initial diagnosis of CKD, patients experienced significant fear and regret regarding their condition, aspiring to postpone or remedy the disease through dietary management. As the disease advanced, patients exhibited a decline in adherence upon recognizing that dietary modifications could not substantially alter their prognosis. Furthermore, some patients appeared to rely on medical interventions, managing their condition through medication and dialysis, thereby enabling them to maintain a normal diet.

"We've noticed that many patients have high hopes for dietary management when they're first diagnosed, but when the illness progresses and they learn that food management won't make a big difference, they start to relax…In the latter stages of life, some patients even over-rely on medical interventions to replace dietary management; for example, they may ask for an increase in ultrafiltration only to get home and be able to eat more later." *(HCP10)*

Driven by Experience

Patients are driven by a variety of experiences, including perceived benefits, stigma, and perceived burden of illness, which might influence their dietary management.

The perceived benefit facilitates patient dietary management. Interviewees noted that after some patients developed serious problems such as edema and heart failure, patients began to make serious efforts to comply with dietary requirements. Adhering to these regulations resulted in patients experiencing improved physical comfort, thereby increasing their adherence to dietary management.

"He previously disregarded his diet but began to modify it following his heart failure better...now he feels significantly improved and his dietary management is enhancing." *(C6)*

Patients reported societal bias associating CKD with an uncontrolled lifestyle. Young, unmarried male patients, in particular, feared that dietary restrictions would make them appear weak, risking exposure to their condition and harming their marital prospects.

> "People always think that CKD is caused by indulgence in life...I had followed the diet for three months but was very weak every day and I didn't want anyone to know that I had CKD because I thought it would make it harder for me to get married. So, I gave it up." *(P9)*

The extensive dietary management required for CKD often involves family support, leading some patients to feel like a burden, particularly older single male patients. This guilt sometimes drove them to abandon dietary management.

> "When my elderly parents look after me, I am ashamed about it (sigh). I gave up diet control because I didn't want to put too much burden on them (voice low)." *(P16)*

Nervousness

Patients often experienced nervousness during their initial hospital admission, which negatively affected their ability to absorb dietary information. This nervousness led to insufficient awareness and understanding of dietary management requirements. One patient recounted:

> "I was so nervous when I was first admitted to the hospital that I could barely stand up...the nurse came to explain the dietary precautions to me, but I was so nervous that my mind went blank and I couldn't listen to her at all." *(P12)*

Food Desires

Numerous interviewees reported that patients often experienced the "forbidden fruit effect", where restricted foods became more desirable, complicating dietary management. A caregiver stated:

> "I observe that the more he is prohibited some of the foods, the greater his desire to eat becomes...After the doctor banned him from eating taro, I stopped buying it, but he kept asking me to buy some and return to consume it." *(C7)*

Discussion

This qualitative study is the first to explore the factors influencing dietary management in CKD patients from the multiple perspectives of CKD patients, caregivers, and healthcare professionals based on the COM-B model. Our study identified factors in three dimensions: capability, opportunity, and motivation, influencing the dietary management of CKD patients. The findings emphasize the impact of China-specific socio-cultural contexts on patients' dietary management, providing valuable insights for developing targeted and culturally adapted interventions.

We found that capability is a significant factor influencing dietary management in CKD patients. CKD patients frequently have diminished strength and endurance attributable to disease-related symptoms, including exhaustion, anorexia, and hypoglycemia, which hinder dietary management. This corresponds with previous research.[29] Moreover, we discovered that CKD patients with visual impairment, especially those suffering from diabetic retinopathy, faced challenges in independently accessing online dietary management resources. This conclusion has seldom been documented concerning dietary management for CKD patients. In China, 21.0% of CKD patients have diabetic retinopathy.[30] Given this, healthcare practitioners ought to contemplate alleviating symptomatology to mitigate the impact on dietary management, and develop various forms of educational resources, such as large-print brochures or offline educational activities, to meet the needs of patients with vision limitations. Simultaneously, community caregivers can assist patients in developing dietary management skills through direct training.

Our study revealed a phenomenon reported by many participants that unfulfilled fundamental physiological requirements, such as hunger and thirst, frequently hinder adherence to diets in patients. This is similar to previous findings that dietary management is as much a "fight against nature" as it is a "fight against oneself" and a fight against thirst or appetite.[8] To address this challenge, patients can be provided with individualized diet plans that help them meet their basic physiological needs while following the principles of dietary management. Additionally, educational sessions can teach patients about the importance of dietary management, providing pragmatic strategies for sustaining dietary compliance despite physiological cravings. Moreover, mobile health applications can be employed to dispatch reminders

and offer real-time assistance, aiding patients in managing their physiological challenges and reinforcing dietary objectives.

This study also found that patients' dietary management was influenced by knowledge mastery, willpower and self-control, and self-efficacy. Knowledge of dietary management among patients, caregivers, and healthcare professionals is critical to achieving effective dietary management.[31] Our study revealed that patients, caregivers, and healthcare professionals exhibited insufficient mastery of dietary management. Among them, healthcare professionals demonstrated limited knowledge and skills in this area, hindering their ability to effectively convey nutritional information to patients and caregivers, which is similar to findings on nutritional literacy among medical staff in tertiary hospitals in China.[32] Furthermore, participants in this survey recognized that the dietary management of CKD is intricate and that patients with low levels of confidence struggle to effectively manage their diets, whereas patients with higher self-efficacy showed greater confidence and motivation in managing their diets.[33] Consequently, it is imperative to augment the training of healthcare professionals. Training programs should include workshops on evidence-based nutritional guidelines specific to CKD, practical case studies, and simulation-based exercises focused on dietary planning. Training should emphasize the development of practical skills such as creating personalized dietary plans and addressing common dietary challenges in CKD, ensuring that professionals are equipped to deliver accurate and effective guidance. Simultaneously, conducting interactive workshops and employing digital health tools might improve information retention and application in patients. Additionally, cognitive-behavioral techniques can enhance self-efficacy by assisting patients in establishing attainable objectives and acknowledging little achievements, thus promoting ongoing dietary adherence.

This study elucidates the intricate impact of opportunity on the dietary management of CKD patients, including patient-to-patient influence, social support, social culture, limitations in food and advocacy resources, and lack of meals for CKD patients in hospital canteens. Among these, patient interactions have the dual role of motivating patients to follow dietary management or potentially hindering it. Similarly, studies in HIV patients have shown that peers impact patients' adherence to treatment,[34] perhaps due to the shared disease experience fostering trust and imitation of behaviors among patients. In order to positively leverage patient-to-patient influences, a structured peer support program could be established to train highly compliant patients as "diet management mentors" to encourage positive dietary behavioral mimicry. On the other hand, individualized dietary guidance and psychological support could be offered to patients to assist them in recognizing and managing negative social influences, thereby enhancing their self-efficacy and fostering more positive interactions among patients, ultimately promoting adherence to dietary management.

Social support is equally essential for patient dietary management, encompassing family, healthcare institutions, and governmental entities. Families play a central role by assisting with dietary modifications and providing education and supervision, while the level of assistance from hospitals and government influences the importance and implementation of dietary management. However, our study found that hospital dietary management processes were unclear, there was a lack of dedicated dietitians, dietary guidance provided by clinicians responsible for dietary management often lacked specificity, and dietary guidance from nurses was often superficial, which seriously hindered patients' dietary management. This issue may be attributed to China's scarcity of healthcare professionals and the uneven allocation of healthcare resources,[35] causing tertiary care hospitals to become overwhelmed, with staff focused primarily on essential treatments, leaving dietary management considerations neglected. This underscores the necessity for systemic reform: firstly, establishing a coherent dietary management framework and enhancing the hospital dietary management process; secondly, delineating the responsibilities of departments and personnel, and augmenting the allocation of full-time dietitians to guarantee that patients receive dietary support commensurate with their conditions; finally, alleviating the strain on tertiary care hospitals through policy support and resource redistribution will allow healthcare professionals to focus more on non-emergency but significant medical needs, such as dietary management.

Our study uniquely found that Chinese social etiquette and traditional culture have a significant impact on patients' dietary management. In traditional Chinese culture, occasions such as New Year's festivities and social gatherings emphasize hospitality and communal dining. Hosts demonstrate generosity by providing an abundance of food, while guests reciprocate with respect by partaking in the dishes and raising toasts. As a result, patients often feel compelled to conform to these customary dining practices, consuming substantial quantities of food and beverages high in salt, oil, and

alcohol, which adversely affect their adherence to dietary guidelines. This highlights the need for culturally sensitive strategies to address the challenges posed by traditional social norms in dietary management.

In addition, we found that the limitations of traditional Chinese food consumption, insufficient educational resources, and the lack of dietary offerings in hospital cafeterias tailored to the conditions of CKD patients uniquely affect the dietary management of CKD patients in China. In the traditional Chinese diet, soybean products, and mushrooms are popular,[36] however, due to their high protein and phosphorus content, these foods are restrictive for patients with CKD. At the same time, patients are challenged by a lack of specific dietary options that meet the needs of the disease throughout their hospitalization. The inability of hospital diets to accommodate patients with unique needs has been evidenced.[37] This is likely attributable to a lack of focus on CKD dietary management within hospitals, which have yet to establish comprehensive dietary management systems. Deficiencies in educational resources and tailored food provisions within hospital canteens exacerbate these challenges. Addressing these gaps requires the development of systematic dietary management frameworks, the allocation of resources for dietary education, and the inclusion of CKD-specific meals in hospital food services to better support patients' adherence to dietary regimens.

Our study also found that motivation plays an important role in the dietary management of CKD patients. Some individuals prioritize enjoying life without restraint, even at the potential cost of their health are reluctant to follow strict dietary management. This is similar to research on factors influencing healthy eating among nurses, where values influence their eating behaviors.[38] Values are characterized as desirable objectives of differing significance, serving as guiding principles for an individual's existence.[39] Therefore, values-based counseling combined with structured goal setting can align dietary recommendations with patients' core values and life goals. At the same time, educational programs incorporating motivational interviewing enhance adherence by clarifying how dietary choices align with patients' quality-of-life expectations.

Our study has uncovered a psychological phenomenon that deserves to be explored in depth. Numerous healthcare professionals indicate that certain patients' dietary management exhibits consistent alterations as the condition advances. During the initial diagnostic phase, patients are often motivated by emotions such as remorse, leading to strict compliance with dietary guidelines. However, if they do not see immediate physical benefits from adhering to dietary guidelines, skepticism may arise, leading to the abandonment of the regimen. As the disease advances, patients may experience burnout regarding dietary management, resulting in diminished expectations and a lack of active adherence to dietary protocols. In the advanced stages of the condition, patients increasingly depend on medical interventions, such as augmented dialysis ultrafiltration, to supplant dietary management, losing faith in its efficacy. Prior research indicates that patients who adhere to dietary management yet perceive little effectiveness experience frustration and subsequently abandon the regimen.[40] Currently, there is a lack of research on the impact of changes in the psychological experience of patients with CKD on dietary management. Future studies should investigate this progression in depth, to delineate each psychological phase more precisely. Such insights would enable the development of targeted interventions tailored to patients' psychological states at different stages of their condition, ultimately improving long-term adherence to dietary management.

This study also found a noteworthy phenomenon that patients' dietary management was influenced by their dietary experiences, such as perceived benefits, disease stigma, and perceived burdens. In particular, single male CKD patients had higher levels of disease stigma, which negatively affected their dietary management. Dietary management often led to weakness and fatigue, prompting some patients to adopt a normal diet to conceal their CKD status. This stigma is rooted not only in societal prejudice against the illness but also in traditional Chinese cultural beliefs. In Chinese medicine, the kidneys are associated with sexual function and kidney dysfunction is perceived as a decline in sexual capability. As a result, unmarried men with CKD often worry that their condition might compromise their fertility and marriage prospects, thereby intensifying their feelings of stigmatization.

Furthermore, the perceived burden can also affect patients' dietary management, with older, unmarried men in particular more likely to recognize the impact of the disease on their families. This likely relates to the old Chinese cultural principle of filial piety, which requires males to provide financial assistance and fulfill the material needs of their parents.[41] The Classic of Filial emphasizes that "the body's hair and skin are the recipients of one's parents' affection, and one does not dare to destroy or harm them, which is the beginning of filial piety".This implies that even minor bodily

harm can cause parental worry, which is deemed unfilial.[42] For CKD patients, their inability to fulfill their familial obligations of caring for their parents damages the body of parents, makes parents worried, and needs parents to take care of them, dragging down the family. To mitigate these implications for dietary management in patients with CKD, culturally sensitive education programs can be implemented to clarify misconceptions about kidney function and reduce stigmatization. Additionally, practical measures like culturally appropriate nutritional guidance and financial assistance can alleviate perceived burdens, aligning dietary management with patients' intrinsic motivation and long-term health goals.

In addition to the above factors, we have also uniquely found that spontaneous motives such as nervousness and cravings are also factors that influence patients' dietary management. Patients experience severe nervousness and anxiety after admission to the hospital,[43] while in China, dietary education is often carried out at the time of initial admission when patients' nervousness impedes their ability to successfully absorb dietary education. In addition, patients' desire often causes them to experience the "forbidden fruit effect", in which restricted foods become more desirable to patients. However, unlike the results of previous studies, in previous studies, although participants' desire for forbidden foods increased, consumption did not increase.[44] This may be due to the cessation of offering restricted food to study participants, which was subsequently substituted with alternative options. In our study, patients with CKD had access to forbidden food and were not offered alternate options, making it difficult for patients to resist rebound eating.

Finally, we found an unexpected superimposed effect. Lack of specificity of medical advice, inappropriate timing of admission education, and patients' nervousness upon hospital admission may interact to combine to lead to inadequate dietary management of patients. To address these issues, hospitals must enhance the workforce of healthcare professionals and ensure that physicians provide personalized and actionable dietary recommendations tailored to individual patient needs. Nurses should deliver education at appropriate moments, ensuring that patients are receptive and able to process the information effectively. Finally, dietary education and promotion must be dynamic and continuous, evolving with patients' needs and conditions, to improve the overall quality of dietary management for CKD patients.

Strengths and Limitations

The study's strength lies in its incorporation of diverse perspectives from CKD patients, caregivers, and healthcare professionals, providing a comprehensive and in-depth exploration of the factors influencing dietary management in CKD patients. Additionally, this is the first study to explore these factors using the COM-B model, enhancing the practical applicability of the findings for developing effective dietary management strategies. Another significant strength is the emphasis on cultural sensitivity, which is vital for designing interventions tailored to Chinese patients' unique cultural and social contexts.

Nonetheless, our study has certain drawbacks. Initially, we exclusively picked participants with access to hospital healthcare, other factors may affect patients without such access. Secondly, we recognize that the participants who engaged in the interviews may have been fervent about the subject, a common limitation that cannot be avoided in qualitative interviews.

Conclusion

This study, rooted in the COM-B model, explored the factors affecting the dietary management of CKD patients from the perspectives of patients, caregivers, and healthcare professionals. Factors identified as influencing dietary management in patients with CKD included: (1) Capability: physical dysfunction, difficulty in controlling physiological needs, knowledge mastery, willpower and self-control, low self-efficacy; (2) Opportunity: patient-to-patient influence, social support, social culture, limitations in food and advocacy resources, lack of meals for chronic kidney disease patients in hospital canteens; (3) Motivation: value orientation, dietary expectations, experience-driven (a: perceived benefits, b: perceived burden, c: stigma), nervousness, food desires. These findings enhance our understanding of the factors that influence dietary management for people with CKD, highlight the profound impact of culture in dietary management, and provide a basis for the development of targeted, culturally appropriate intervention programs based on the dimensions of competence, opportunity, and motivation.

Abbreviations

CKD, Chronic Kidney Disease; P, Patients; C, Caregivers; HCP, Healthcare professional.

Data Sharing Statement

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

Ethics Approval and Informed Consent

Before starting, researchers completed qualitative research training and received approval from the Ethics Committee of Affiliated Central Hospital of Jiangnan University. Ethics Approval Number: (2024) Ethics Review No (Y-245). The study followed the Helsinki Declaration. The research team members LFP and ZN were responsible for explaining the study details to the admitted patients and obtaining informed consent. Participants adhered to the voluntary principle throughout the study and had the option to withdraw at any time.

Consent for Publication

We agree that we can publish details of any images, videos, audio recordings, etc., and have shown those who agree to publish the content of the article to be published.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

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