



FACTORS INFLUENCING DIETARY BEHAVIORS OF ADULTS WITH
RECURRENT KIDNEY STONES IN WENZHOU, CHINA

HE TING LIANG

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR MASTER DEGREE OF NURSING SCIENCE
(INTERNATIONAL PROGRAM)
IN ADULT NURSING PATHWAY
FACULTY OF NURSING
BURAPHA UNIVERSITY

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HETING LIANG

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรพยาบาลศาสตรมหาบัณฑิต (หลักสูตร
นานาชาติ)

คณะพยาบาลศาสตร์ มหาวิทยาลัยบูรพา

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ลิขสิทธิ์เป็นของมหาวิทยาลัยบูรพา

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The Thesis of He Ting Liang has been approved by the examining committee to be partial fulfillment of the requirements for the Master Degree of Nursing Science (International Program) in Adult Nursing Pathway of Burapha University

Advisory Committee

Examining Committee

Principal advisor

.....
(Assistant Professor Dr. Khemaradee Masingboon)

Co-advisor

.....
(Associate Professor Dr. Niphawan Samartkit)

..... Principal examiner
(Associate Professor Dr. Noppawan Piaseu)

..... Member
(Assistant Professor Dr. Khemaradee Masingboon)

..... Member
(Associate Professor Dr. Niphawan Samartkit)

..... Member
(Assistant Professor Dr. Saifone Moungkum)

..... Dean of the Faculty of Nursing
(Associate Professor Dr. Pornchai Jullamate)

This Thesis has been approved by Graduate School Burapha University to be partial fulfillment of the requirements for the Master Degree of Nursing Science (International Program) in Adult Nursing Pathway of Burapha University

..... Dean of Graduate School
(Associate Professor Dr. Witawat Jangiam)

62910070: MAJOR: ADULT NURSING PATHWAY; M.N.S. (ADULT NURSING PATHWAY)

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The incidence of recurrent kidney stones is high worldwide, appropriate dietary behaviors is important to prevent recurrent kidney stones. The study was guided by the Health Belief Model, aimed to describe the dietary behaviors and to examine its influencing factors among adults with recurrent kidney stones. One-hundred and ten adults with recurrent kidney stones were recruited by a simple random sampling from the First Affiliated Hospital of Wenzhou Medical University in Wenzhou, Zhejiang Province, China. Instruments included the demographic information questionnaire, the Health Belief Scale and the Dietary Behaviors Scale. Data were analyzed using descriptive statistics and multivariate regression analysis.

Results showed that the mean score of dietary behaviors was 54.90 out of 95 (SD = 8.61). Five behaviors with the lowest mean scores were controlling weight through diet (2.53 ± 1.24), eating less coarse grains and fiber (2.54 ± 1.10), drinking more alcohol (2.62 ± 1.64), intaking high calcium milk or yoghurt, tofu, or small fish (2.65 ± 1.12), and drinking less water (2.69 ± 1.24). Perceived threat, perceived benefits, perceived barriers, perceived self-efficacy explained 20.4% in the variance of dietary behaviors among adults with recurrent kidney stones ($\text{Adj } R^2 = .204$, $F = 8.001$, $p < .001$). However, only perceived threat ($\beta = .287$, $p < .001$) and perceived barriers ($\beta = -.409$, $p < .001$) could significantly predict the dietary behaviors among the participants.

The findings indicated that improve perceived threat and reduce perceived barriers can help improve dietary behaviors among adults with recurrent kidney stones. Nurses and healthcare providers should provide more information to this population to help them understand more which can help reduce barriers and improve perceived threat in order to prevent the recurrent kidney stones.

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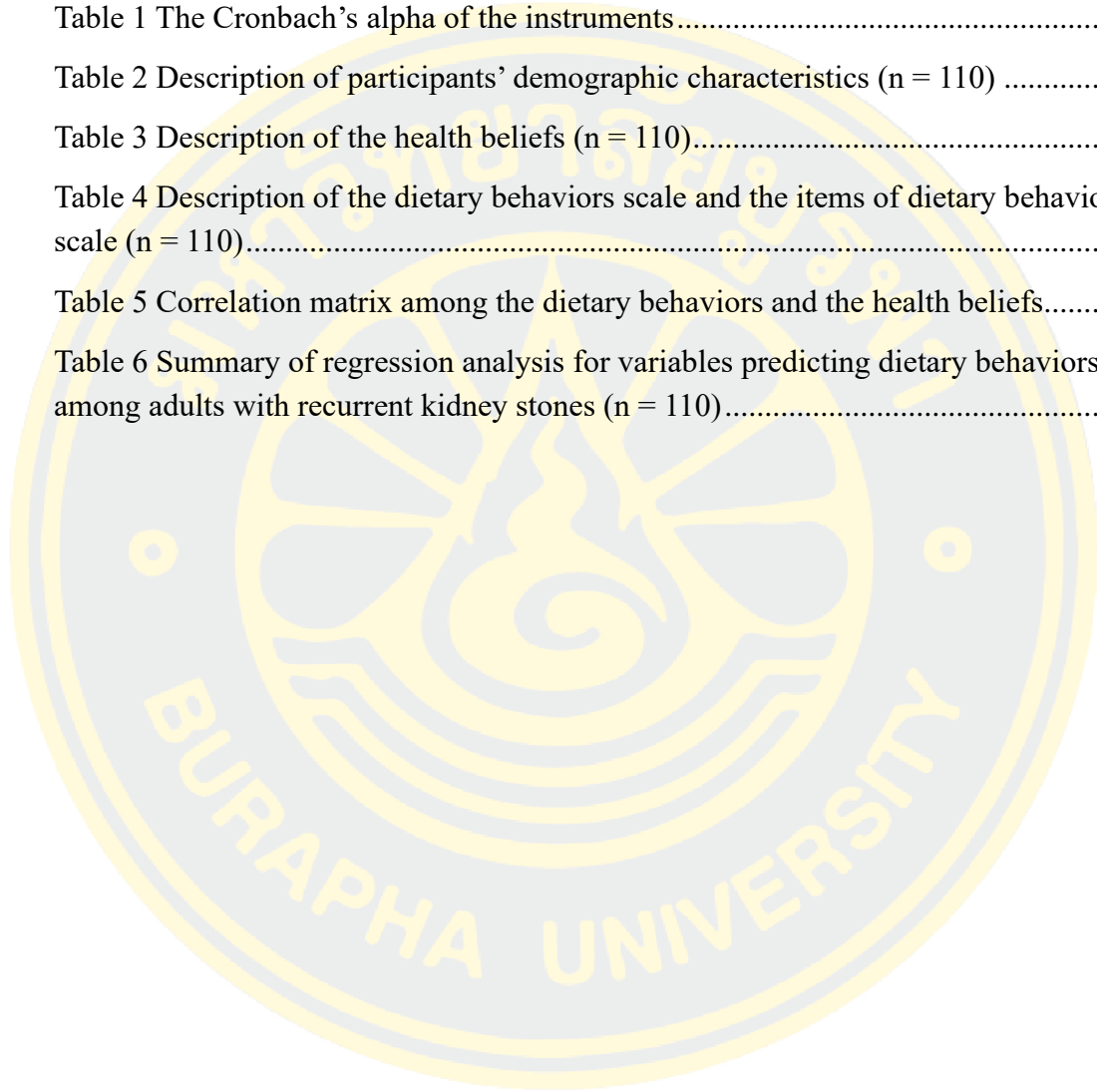
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CHAPTER 1

INTRODUCTION

Background and significance of the study

Kidney stone is a common disease around the world. The incidence of kidney stones is about 1%-19.1% in Asia, 5%-9% in Europe, and 7%-13% in North America (Abufaraj et al., 2020; Hill et al., 2022; Liu et al., 2018; Sorokin et al., 2017). Moreover, the incidence of kidney stones showed an increasing trend. In the USA, an updated survey based on the data from the National Health and Nutrition Examination Survey revealed that the incidence of kidney stones was 11.9% in males and 9.4 in females during 2017-2018, while, it was only 11.6% in males and 6.5 in females during 2007-2008 (Abufaraj et al., 2020). In fact, many stone sufferers do not know they have kidney stones because stones have no symptoms. As a result, the real incidence of kidney stones may be higher. A survey based on ultrasonography in China found that, about 61.2 million people have kidney stones currently, and in the south of China, the lifetime incidence rate can reach 26.6% (Zeng et al., 2017). The recurrence rate of kidney stone diseases is also high.

Kidney stones recurrence refers to new stone formation or the original stones enlarged (D'Costa, Pais, et al., 2019). But there are different definitions of recurrent kidney stones in different studies, therefore the rate of recurrence is different (D'Costa, Pais, et al., 2019). According to a review, the recurrence rate ranges from 6% to 7% after 1 year, 21%-53% within 3 to 5 years, and the lifetime recurrence rate can reach 60%-80% (Liu et al., 2018). A survey conducted in the USA revealed that the recurrence rate, including symptomatic recurrence and radiographic recurrence, within five years was 67%, and this figure is higher than other studies (D'Costa, Haley, et al., 2019). In light of this high recurrence rate, the proportion of repeat surgical treatment has increased significantly (Wang et al., 2017). A result from another study found that 24.5% of recurrent stone formers underwent repeat operation (Iremashvili et al., 2019).

There is evidence showed that the process of kidney stones treatment with lifestyle improvement can reduce the health-related quality of life of patients (Khan et

al., 2016), younger patients with kidney stones have lower health related quality of life than older, female patients have lower health related quality of life than male patients (Stern et al., 2019). Moreover, if stone cause urinary obstruction, it can lead to irreversible loss of renal function (Fontenelle & Sarti, 2019). Researchers found that patients with kidney stones had a 60 percent higher risk of chronic kidney disease and a 40 percent higher risk of end-stage kidney disease (Sofia et al., 2016). Except the physical and mental impact to the patient, kidney stones may take time away from the patient's normal work or life. According to a cross-sectional survey which conducted in the United States, the researchers investigated the median length of stay of patients with kidney stones was 2.1 days and the median cost of hospitalization was \$6290 (Cone et al., 2018). In the United States, the cost of kidney stones was 3.79 billion dollars in 2014, and researchers predicted that the cost would increase by 1.24 billion dollars a year by 2030 (Antonelli et al., 2014). According to the data which from the National Healthcare Insurance system, in China, the cost of treating single kidney stone of 2-3cm is estimated at RMB 1857-1999 yuan (Pan et al., 2013), which is a higher expense and it's a greater burden for many low-income families.

As mentioned above, kidney stone is a common disease with high incidence and high recurrence rate. Meanwhile, the occurrence of kidney stones brings burden to patients, medical resources and economy. Even though this disease can be treated, but remove the stone does not prevent it recurrence, therefore, prevention of the recurrence stones is a key point in the management of kidney stones (D'Costa, Haley, et al., 2019; Skolarikos et al., 2015). There are two ways to prevent kidney stones formation, one is diet modification, the second is using medications. Pharmaceutical therapies and dietary behaviors modification can be used to prevent kidney stones (Khan et al., 2016; Zisman, 2017). According to different type of kidney stones and the metabolic risk factors of patients, specific pharmacological intervention can be performed. There is at least one of the three abnormalities is present in patients with calcium stones, they are hypercalciuria, hypocitraturia, and hyperuricosuria. Use thiazides to treat hypercalciuria and thus prevent the formation of calcium stones; supplementation of citrate and alkali can be used to treat hypocitraturia; allopurinol and febuxostat can reduce uric acid in the urine if patients with hyperuricosuria. Potassium citrate can be used to treat uric acid stones to make the urine pH reach 6.5-

7. Urease inhibitor therapy can be used to slow the speed of struvite stone growth (Zisman, 2017).

As for the diet therapies, previous studies showed that people with kidney stones should avoid the following risk factors in their dietary behaviors to prevent the recurrence stones: insufficient fluid intake will lead to low urine volume and thus urine supersaturation; excess animal protein intake will increase excretion of calcium and uric acid and also decreased urinary citrate; excess sodium intake can lead to increased calcium deposition in renal; low calcium intake will lead to increased oxalate urinary excretion, thus maintain normal calcium intake is recommended; oxalate in diet contributes to urinary oxalate which then increase risk of oxalate calcium stone formation; vitamin C as the precursor of oxalate will also increase risk of stone formation; excess alcohol intake will lead to higher urinary acid excretion, which increases risk of uric acid (Boarin et al., 2018; Han et al., 2015). Dietary behavior modification is considered the most effective and cost-effective strategy because medication therapy is dependent on patients' stone composition analysis or patients' metabolic risk factors.

Dietary behaviors refer to people's daily food and drink selection and the amount of its consumed (Marijn Stok et al., 2018). Based on the risky dietary factors, according to the American Urological Association (AUA), the Chinese Urological Association (CUA) and evidence-based (Anon, 2015; Huang, 2019; Pearle et al., 2014; Taguchi et al., 2019), the recommended dietary behaviors to prevent the recurrence of kidney stones including: (1) the daily fluid intake is above 2.5 to 3.0L, so that the daily urine output can be maintained above 2.0~2.5L (2) limit intaking of animal protein, including meat, fish, seafood, poultry and eggs (3) limit sodium intake, packaged foods, ready-to-eat foods, fast foods and restaurant meals have high in sodium (4) eat calcium-rich foods, including milk, dairy products, calcium-fortified foods and beverages, fish canned with bones, to maintain normal calcium consumption, (5) limit high-oxalate foods, including spinach, okra, beets, Swiss chard, star fruit, rhubarb, dried figs, peanuts, tree nuts, soybeans, black tea, wheat bran, buckwheat and dark chocolate (6) make sure vitamin C supplement less than 1000 milligrams per day (7) it's best to avoid alcohol. However, in reality, this recommended diet is often not adopted by patients with kidney stones, even though

they can get the information from physicians after they are diagnosed with kidney stones.

Study showed that kidney stones formers had low fluid intake, high intake of coffee and tea, sodium and sugar which contribute to a higher incidence of kidney stones (Sofia et al., 2016). Similarly, the growth trend of the incidence of kidney stones in the United States is likely related to dietary factor (Scales et al., 2012). A Norwegian study also noted that the increased incidence of uric acid stones may be associated with changes in dietary behaviors (meat consumption has increased in Norway) (Kravdal et al., 2019). A survey conducted in Zhejiang, China found that people, who prefer a high protein diet (including seafood, meat and eggs), had higher incidence rate of kidney stones, and the coastal city residents not having the habit of often drinking water (He et al., 2008). Another research conducted in China which studied the dietary behaviors of patients with kidney stones found that in their samples, 73.21% of people with kidney stones prefer a high-fat diet, 76.79% prefer animal innards, 75% prefer seafood (Cheng & Han, 2019). To sum up, it can be concluded that most of patients with kidney stones have poor dietary behaviors. To help people with kidney stones modify their dietary behaviors, it's important to study what factors affect their dietary behaviors. Once these factors are identified, further interventions can then be developed for modifying dietary behaviors.

In fact, dietary behaviors play an important role in prevention of various diseases. Given the importance of dietary behaviors to the prevention or control of disease, many theories or models of behavior change have been developed, such as the Health Belief Model, the Theory of Planned Behavior, the Social-Cognitive Theory (Sleddens et al., 2015). As mentioned earlier, poor dietary behaviors persist even when patients with kidney stones known about appropriate dietary behaviors. Similarly, the Health Belief Model was developed in order to understand the failure of people to adopt disease prevention strategies (Champion & Skinner, 2008), this is consistent with the background of this study. According to the Health Belief Model, there are three parts: modifying factors, individual beliefs, and action, these three parts will influence individual behaviors. Individual beliefs including perceived threat, perceived benefits, perceived barriers and perceived self-efficacy. As the major components of the HBM, individual beliefs are considered as the strong related

factors to peoples' actions (Champion & Skinner, 2008). Since the modifying factors, including age, gender, ethnicity, personality, socioeconomics and knowledge, are uncontrollable factors. Besides, these factors and also the cues to action in the HBM had been confirmed in previous studies (Liu et al., 2022; Penafiel et al., 2022; Stout et al., 2023), thus, in this study, researcher focused on the influence of individual beliefs on dietary behaviors, as follow.

Perceived threat (perceived susceptibility and perceived severity) is the belief of individuals that they are likely getting a condition and they believe a serious consequence of the condition would be happened (Champion & Skinner, 2008). A qualitative study on factors influencing the behavior of patients with kidney stone which based on the Health Belief Model found that patients who perceived a susceptibility to recurrent kidney stones and believed in the severity of recurrent stones had better eating behaviors (McCauley et al., 2012). However, another study concluded no significant difference about perceived susceptibility and perceived severity among different group of patients which successful or no successful in improving fluid intake (Tarplin et al., 2016). These conclusions were inconsistent and lack of data support that perceived susceptibility could influence the dietary behaviors of patients with kidney stones.

Perceived benefits refer to the people's belief that adopting a certain action can effectively prevent the occurrence of the certain condition, or reduce the impact of the condition (Champion & Skinner, 2008). A research showed that depending on the number of previous stone attacks, the minimum level of benefit for patients would be different (McCauley et al., 2012). According to another study by Doan (2013), the researcher found that perceived benefits were related with dietary behaviors in patients with kidney stones ($r = .826, p < .05$). However, there is a lack of data to support the influence relationship between perceived benefits and improvement of dietary behaviors.

Perceived barriers refer to an individual's believe that there will be obstacles during changing their behavior (Champion & Skinner, 2008), such as a mental handicap or a time handicap and which then will influence individual's daily lives and work. Moreover, results from a study by Doan (2013) found that perceived barriers were related with dietary behaviors in patients with kidney stones ($r = -.717, p < .05$).

Another researcher also concluded that perceived barriers among different group of patients which successful or no successful in improving fluid intake (Tarplin et al., 2016).

Perceived self-efficacy is people's confidence of modifying their health-related behavior successfully (Champion & Skinner, 2008). According to results from previous study, patients who successfully modified fluid intake behavior reported higher self-efficacy than those who did not (McCauley et al., 2012). Similarly, the study by Doan (2013) found that perceived self-efficacy were related with dietary behaviors in patients with kidney stones ($r = .722, p < .05$). Also, there is still lack of data to support the influence relationship between perceived self-efficacy and dietary behaviors improvement.

As mentioned above, most of patients with recurrent kidney stones had poor dietary behaviors, which then lead to the stone formation. In addition, some Chinese cultures, such as preferring pickled products, drinking culture, and tea culture, are risk factors of stone formation (Gu & Ming, 2020; Huang et al., 2019; Tan et al., 2019). Moreover, in Wenzhou, which is a coastal city in China, the residents had more risk factors such as preferring seafood and insufficient fluid intaking (Jiao et al., 2023; Jinrong et al., 2017). These risk factors make people exposed to the environment prone to have the stone recurrence. Since there is limitation of research studies to predictive influence of individual beliefs on dietary behaviors in patients with recurrent kidney stones based on the Health Beliefs Model in China, a country with a large population, this study was conducted. In this study, dietary behaviors were selected as the dependent variable, and perceived threat, perceived benefits, perceived barriers, perceived self-efficacy were selected as the independent variables, patients with recurrent kidney stones were selected as the target population. The purposes of this study were to describe dietary behaviors and to examine its influencing factors based on the Health Belief Model among patients with recurrent kidney stones in Wenzhou, China. The research results expected to provide effective evidence for the intervention of hospital nurses to change dietary behaviors of patients with recurrent kidney stones, to prevent the expansion of stones or formation of new stones and improve their quality of life in clinical practice.

Objectives of the study

1. To describe the dietary behaviors among adults with recurrent kidney stones in Wenzhou, China.
2. To examine influencing factors of dietary behaviors among adults with recurrent kidney stones in Wenzhou, China.

Research hypotheses

Perceived threat, perceived benefits, perceived barriers, and perceived self-efficacy together can predict dietary behaviors in patients with recurrent kidney stone in Wenzhou, China.

The scope of the study

This study examined whether perceived threat, perceived benefits, perceived barriers, perceived self-efficacy can predict the dietary behaviors among adults with recurrent kidney stone in Wenzhou, China. Data will be collected in the First Affiliated Hospital of Wenzhou Medical University, China.

Conceptual framework

This study was based on the Health Belief Model (HBM) (Champion & Skinner, 2008) and literature review. The HBM was developed in the 1950s by social psychologists in the U.S. Public Health Service and subsequently modified by Leventhal, Rosenstock, Becker and other authors. The HBM has three parts which are modifying factors, individual beliefs, and action. Individual beliefs (including perceived threat, perceived benefits, perceived barriers, perceived self-efficacy) would be influenced by modifying factors (including age, gender, ethnicity, personality, socioeconomics, knowledge), and then individual beliefs may predict individual behaviors. As the major components of HBM, individual beliefs are considered as the strong related factors to people's action (Champion & Skinner, 2008).

In this study, perceived threat, perceived benefits, perceived barriers, and perceived self-efficacy were selected as the independent variables. Perceived threat reflects whether people have the perception that they are likely getting a condition (such as a disease), and it would lead to serious consequence. If patients don't think

they are at risk, and they don't believe the serious consequence, they don't take preventive action, their chances of adopting the behavior are greatly reduced (Champion & Skinner, 2008). For instance, if patients believe that the pain they experience during the attack of a kidney stone is unbearable, it would motivate them to adopt the prevent action to stop that from happening.

Perceived benefits refer to the belief that the prevent behavior are effective, and it can reduce the risk or impact (Champion & Skinner, 2008). Perceived barriers can be considered as a negative factor to affect individual's behavior, the more barriers patients perceive, the less motivation they have to change their behavior (Champion & Skinner, 2008). Perceived self-efficacy is that patients' confidence about improving their behavior successfully. The more confident patients are, the more likely they are to change their behavior (Champion & Skinner, 2008). In conclusion, individuals who perceived high threat, high benefits, high confidence, and low barriers to prevent the recurrence kidney stones may perform good dietary behaviors. Therefore, this study was conducted to describe dietary behaviors and to examine its influencing factors among adults with recurrent kidney stones in Wenzhou, China. Research conceptual framework for this study is shown in Figure 1.

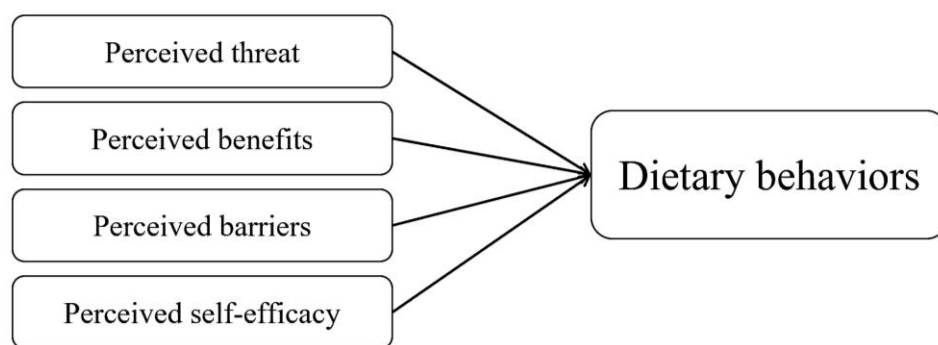


Figure 1 Conceptual Framework

Definition of Terms

Adults with recurrent kidney stone refer to person who were diagnosed by physician with kidney stones before and return visit because of new stone formation or the original stones enlarged.

Perceived threat refers to perception of adults with recurrent kidney stones that they are likely to get kidney stones recurrence and they believe a serious consequence of the recurrent kidney stones. Perceived threat was measured by the Health Beliefs Scale, which was developed by the researcher base on the Health Belief Model.

Perceived benefits refer to perception of adults with recurrent kidney stones that modifying their dietary behaviors, adopting and keeping a healthy balanced diet can reduce the risk of getting stone again. Perceived benefits were measured by the Health Beliefs Scale, which was developed by the researcher base on the Health Belief Model.

Perceived barriers refer to perception of adults with recurrent kidney stones that there are obstacles during modifying their dietary behaviors. Perceived barriers were measured by the Health Beliefs Scale, which was developed by the researcher base on the Health Belief Model.

Perceived self-efficacy refers to the confidence of adults with recurrent kidney stones that they can successfully improve their dietary behaviors to prevent recurrence of the stone. Perceived self-efficacy were measured by Health Beliefs Scale, which was developed by the researcher base on the Health Belief Model.

Dietary behaviors refer to person's daily food and drink selection and the amount of its consumed to prevent kidney stones. In this study, dietary behaviors for preventing kidney stones are sufficient fluid and appropriate calcium intake, and appropriate restriction of oxalate, sodium, vitamin C and alcohol intake. Dietary behaviors were measured by The Dietary behaviors Scale, which was developed from the literature review and the Chinese Urological Association (CUA) guidelines (Huang, 2019).

CHAPTER 2

LITERATURE REVIEW

This chapter present an overview of kidney stones, dietary behaviors in person with recurrent kidney stones, health belief model, and influencing factors related to dietary behaviors in person with recurrent kidney stones.

Overview of kidney stones

This section introduces the incidence, pathology, type of kidney stones, signs and symptoms, treatment, and risk factors of the stone formation.

Incidence of kidney stones

The incidence of kidney stones varies geographically, according to previous studies, it was about 1%-19.1% overall (Abufaraj et al., 2020; Liu et al., 2018; Sorokin et al., 2017). Study which based on the data of the National Health and Nutrition Examination Survey (NHANES) in the United States had proved that the incidence was 5.2% in 1994 but increased to 8.4% in 2010 (Scales et al., 2012). Some research data shows that China also has a high incidence rate. In 2012, another survey which conducted in Beijing, a northern area of China, indicated that the incidence of kidney stones was 3.61% in that area(Jiang et al., 2017). These two studies showed quite different incidence rate in China, which explains the difference incidence in different regions. A pan-national epidemiological study of kidney stones which based on the urinary tract ultrasonography conducted in China in 2014 had got a more accurate incidence of kidney stones, and it compared the incidence in different area of China. The results shown that the average incidence of kidney stones in China is 6.4%, the findings also shown that the life-time incidence of kidney stones in the south area (26.6%) were much higher than in the northern area (1.1%) of China (Zeng et al., 2017).

It's worth noting that the recurrence is very common in patients with kidney stones. The recurrence rate ranges from 6% to 7% after 1 year, 21%-53% within 3 to 5 years, and the lifetime recurrence rate can reach 60%-80% (Liu et al., 2018). According to previous studies conducted in China, the recurrence rate was higher, which was 14.1%-19.51% within 1 year (Li., 2020; Xu et al., 2018). In addition, the

recurrence rate may be underestimated because asymptomatic stones may pass undetected. A survey conducted in the USA, including symptomatic recurrence and radiographic recurrence, the recurrence rate within five years was 67% (D'Costa, Haley, et al., 2019).

Pathology of kidney stones

Kidney stones is that stone formed in kidneys or bladder and remained in the urinary tract. After stone formation, it may be excreted with the urine, or it may stay in the urinary tract. According to the location of the stone, it can be divided into kidney stone, ureteral stone, bladder stone and urethral stone. Kidney stones belong to the upper urinary tract. Evidence has showed that stones may form in kidney at least by the following ways: (1) in free solution in the renal pelvis, (2) as overgrowths on subendothelial papillary mineral deposits, (3) as extensions of intratubular mineral plugs (Han et al., 2019).

The stone can cause urinary tract damage, obstruction, or infection, which are related to stones' location, size, amount, the inflammation level and severity of obstruction. And the stone often happened in the renal pelvis and calyces, it can cause hydrops or empyema, and then, it may lead to atrophy of renal parenchyma, or even lead to perirenal infection. Once stones block the ureteropelvic junction or ureter, acute complete urinary tract obstruction or chronic incomplete urinary tract obstruction may occur. If the obstruction is not removed in time, hydronephrosis will happen, and results in damage to renal parenchyma and renal function.

The cause of stone formation is not very clear, a variety of causes may lead to different types of stones, however, in essence, it is due to the increase of substances excreted in the kidney, resulting in excessive saturation of stone components in urine, then crystals are formed in the kidney and grown up gradually, and become stones eventually (Han et al., 2019). According to previous studies, urinary supersaturation is associated with dietary behaviors. Insufficient fluid intake will lead to low urine volume and thus urine supersaturation; excess animal protein intake will increase excretion of calcium and uric acid and also decreased urinary citrate; excess sodium intake can lead to increased calcium deposition in renal; low calcium intake will lead to increased oxalate urinary excretion; oxalate in diet contributes to urinary oxalate; vitamin C as the precursor of oxalate will also increase risk of stone formation; excess

alcohol intake will lead to higher urinary acid excretion, which increases risk of uric acid (Boarin et al., 2018; Han et al., 2015).

Type of kidney stones

There are four types of kidney stones which classified by its components including calcium oxalate (CaOx), calcium phosphate (CaP), uric acid, struvite and cystine.

Calcium stones: the major components of this type can be CaOx or CaP crystals, these two crystals may exist alone or coexist. Hypercalciuria, hyperoxaluria and hypocitraturia are the main risk factors of CaOx stones. Hypercalciuria, hypocitraturia and high urinary PH are the main risk factors of CaP stones (Khan et al., 2016).

Uric acid stones: account for 8-10% of kidney stones all over the world. Uric acid is the main cause of uric acid stones. The person who has uric acid stones may because of excess intake of purine-rich foods, or excessive secretion of uric acid (Khan et al., 2016).

Struvite stones: the main cause of this type of stone is infection. It can grow to occupy the renal pelvis and calyces within a short time, therefore, named staghorn stone (Khan et al., 2016).

Cystine stones are the rare type of stones. The formation of this type of stones is because of an autosomal recessive defect of cystine transporter in kidneys, cystine can't dissolve in normal urinary. Therefore, it often leads to recurrent kidney stones (Khan et al., 2016).

Signs and symptoms of kidney stones

The symptoms of kidney stones are typical renal colic, hematuria, nausea, vomiting and infection of urinary tract (UTI). Since nonobstructive stones usually do not cause pain, therefore, there might have person who have kidney stones but never had any symptoms (Han et al., 2019), this kind of person may diagnose with kidney stones when they have regular physical check-up.

Since ureters are highly innervated, the typical renal colic would be felt when stones move from the renal to the ureter. The location of pain may move as the stones move (Han et al., 2019). The pain is severe, so it is often accompanied by nausea and vomiting. Hematuria can be microscopic or gross, gross hematuria is less common and often occurs after physical activity.

Diagnosis of kidney stones

An evaluation of patients is needed to assess the risk factors of their stones' formation, including medical and surgical history, medication history, family history, environment, dietary habits.

Physical exam is also important. Basic metabolic tests and urine examination use to assess the renal function and whether there is a urinary tract infection (UTI).

Imaging use to detect stones' location, size, and to check whether obstruction occurs. Including computed tomography (CT), ultrasound, plain film, and magnetic resonance imaging (MRI). CT scan is the gold standard (Khan et al., 2016).

Treatment of kidney stones

Most stones can pass spontaneously, however, 10-20% person who have stones need to seek surgical help to remove their stones because of the severe pain, renal function damage, sever infection due to the stones, cause urinary tract obstruction.

The main surgical methods are shockwave lithotripsy (SWL) (Khan et al., 2016), percutaneous nephrolithotomy (PCNL), and ureteroscopy lithotripsy (URL). SWL use shockwave to break stones, and stones can be excreted spontaneously after its were shattered. PCNL is using fluoroscopy or ultrasound guidance to get in to renal from the surgical incision of the skin, shatter and remove the stones. URL is using a scope through urethra, bladder, ureter, and into renal, urologist can find the location of the stones by using the scope, and then remove (Han et al., 2019).

When person come to an emergency room because of the stones, the treatment including Non-steroidal Anti-inflammatory Drugs (NASIDs) to control pain, intravenous fluids to promote urine output, antiemetics used to relieve nausea (Han et al., 2019).

Risk factors of kidney stones

The current treatment methods have been adequate to deal with kidney stones in different conditions, however, as mentioned before, the incidence and recurrence rate of kidney stones are still high. Therefore, risk factors of kidney stones are of great concern to scholars, and many publications have focused on this area. Currently confirmed risk factors of kidney stones are as following:

Gene

Many studies have indicated that many human genes are responsible to promote high calcium load, which eventually leads to stone formation. For example: mutation in SLC34A3 will cause hypercalciuria; mutation in CYP24A1 will cause infantile idiopathic hypercalcemia; mutation in SLC26A1 will cause hyperoxaluria (Sayer, 2017). Evidence showed that the formation of cystine, uric acid and calcium oxalate stones will be influenced by genes (Liu et al., 2018). However, not all genetic risk factors related to kidney stones are known. Family history of kidney stones may indicate that the family members have risk genes associated with kidney stones.

Gender

According to a literature review, men are more likely to develop kidney stones than women. Researchers indicated that the reasons for the different incidence of male and female may be because of testosterone in men may help stone formation, while estrogen, which is rich in women, may inhibit stone formation. Moreover, prostatic hyperplasia can lead to urethral blockage in men, which may help the stone formation (Liu et al., 2018). Moreover, there are differences in different types of stones between male and female. For example, CaOx and uric acid stones were found more common in male than female; carbapatite and struvite were more common in female (Ye et al., 2020).

Age

Because of heavier workload in working age, which results in unhealthy dietary behaviors such as ignoring the importance of drinking. Therefore, the incidence of kidney stones is highest between 30 to 60 years old (Liu et al., 2018). Another survey conducted in China also found the overall peak age for kidney stones was 31-60 years, with a peak of 31-50 for men and 41-60 for women (Ye et al., 2020).

Family history

As mentioned before, family history as a risk factor of kidney stones might be because of genes. Moreover, since dietary behaviors are also a risk factor for stone formation, and family members often have similar dietary behaviors. Therefore, those people with family history are more likely to become kidney stone formers. A family history of kidney stones increases the risk 2.5 times (Nojaba & Guzman, 2020).

Environment

The formation of kidney stones is influenced by environment temperature. High temperature will accelerate the evaporation of water in the human body, leading to urine supersaturation, which will gradually form stones. Thus, the incidence of kidney stones is higher in tropics and subtropics (Liu et al., 2018). The incidence of different types of stones also varies in different regions. For example, a study conducted in China revealed that CaOx stones was highest in southwestern, carbapatite stones was highest in eastern, uric acid stones and struvite stones were highest in northeastern, cystine stones was highest in northern (Ye et al., 2020).

Dietary behaviors

An unbalanced and unhealthy diet can lead to excessive or inadequate intake of certain substances, which have a big impact on the risk for developing kidney stones. Insufficient fluid and calcium intake; excess animal protein, oxalate, sodium, vitamin C, and alcohol intake will increase the risk of stone formation (Boarin et al., 2018; Haewook. Han et al., 2015). Dietary behaviors are considered as the most effective and modifiable factor to prevent stone formation.

Other diseases

Kidney stones are often associated with other diseases such as obesity, diabetes, hypertension, and metabolic syndrome (Khan et al., 2016). Since gout patients have hyperuricemia, thus gout is associated with uric acid stones formation. Urinary tract infections can also affect the formation of kidney stones (Sorokin et al., 2017). What's more, patients with kidney stones are as a risk of hypertension, chronic kidney disease and even end-stage renal disease (Khan et al., 2016).

In conclusion, kidney stone is a common disease with high incidence and high recurrence rate. Imaging examination can accurately and effectively diagnose kidney stones. For stones in different size and location, there are different methods of treatment. However, since the treatment of kidney stones can't prevent it recurrence. Therefore, intervention from modifiable risk factors of kidney stones to prevent the formation of stone is the key, and dietary behaviors are the most effective and modifiable factor to prevent the recurrence of kidney stones.

Dietary behaviors

This section introduces the definition of dietary behaviors, the substances in the diet which influencing the formation of stones, recommended diet of kidney stones and dietary behaviors among Chinese patients with recurrent kidney stones.

Definition of dietary behaviors

Dietary behaviors among patients with recurrence kidney stones refer to people's daily food and drink selection and the amount of its consumed in their daily lives to prevent kidney stones (Doan, 2013; Marijn Stok et al., 2018).

Due to the variety of stone types, there is no uniform recommended dietary standards for patients with kidney stones, even the American Urologic Association (AUA) guideline for the management of kidney stones (Pearle et al., 2014) only provide different dietary recommendations for patients with different stone types. Besides, the primary and recurrence stone may be different types. Therefore, the purposeful dietary behaviors for different stone types are only appropriate for the patients who have known stones components and the stones are still in the body, but not appropriate for the prevention of recurrence of kidney stones. Studies have shown that the Mediterranean diet and the DASH diet are effective in reducing the incidence of stones (Leone et al., 2017). This type of diet is generally balanced, low in fat and rich in nutrients. Moreover, many studies support that patients with kidney stones need a healthy and balanced diet (Ferraro et al., 2020; Fontenelle & Sarti, 2019; Khan et al., 2016; Skolarikos et al., 2015). Therefore, in this study, patients with recurrent kidney stones were expected to change their dietary behaviors to be healthy and balanced.

Substances in the diet that affect the formation of stones

Dietary behaviors regarded as a very important role in the formation of kidney stones. The types of foods that are of major concern in the field of kidney stone formation are fluids, animal protein, sodium, calcium, oxalate, vitamin C, and alcohol.

Fluids

Increasing water intake is a widely recognized recommendation to prevent the formation and recurrence of kidney stones (Sorokin et al., 2017). Increased water intake can increase urine volume and reduce the supersaturation of the substance of

stone formation in urine (Han et al., 2019). It's worth noting that sugary drinks such as pop, fruit drinks coffee and tea are not recommended (Anon, 2015). However, as is known to all, the Chinese love tea, and it has a history of thousands of years in China, many people even drink tea instead of water.

Animal protein

Dietary with too much animal flesh, including meat, fish, seafood, poultry, and eggs, may lead to high uric acid in urine and urine acidification, which can lead to uric acid stones. because animal protein contain sulfur containing amino acids, which produces acid load and thus leads to low urine pH and hypocitraturia (Morgan & Pearle, 2016). Moreover, obesity is associated with high animal protein intake, and this situation are becoming increasingly common in the Chinese population (Wang et al., 2017). Therefore, limit animal protein is needed to prevent stone formation.

Sodium

Excess sodium may cause extra calcium absorption into the blood or inhibit calcium absorption from urine to renal tubular epithelial cells, and then increasing calcium excretion and precipitation in kidney (Liu et al., 2018). It also decreasing urinary citrate (Morgan & Pearle, 2016). Packaged foods, ready-to-eat foods, fast foods and restaurant meals contain lots of sodium (Anon, 2015). However, sodium intake in China is twice the maximum recommended by the World Health Organization (Tan et al., 2019).

Calcium

As what mentioned before, calcium is the most common substance in stones. There are studies found that decrease of calcium absorption and increase of calciuria would be happened if calcium intake was insufficient, and then the risk of kidney stones would be increase(Bayomy et al., 2020; Sorensen et al., 2012). Inadequate calcium intake may lead to increased intestinal absorption of oxalate and urinary excretion of oxalate(Khan et al., 2016). Calcium-rich foods such as milk or dairy products, calcium-rich tofu, soy, rice drinks, orange juice and fish canned with bones are recommended (Anon, 2015). Calcium deficiency is common among adults in nine provinces in China (Huang et al., 2019).

Oxalate and vitamin C

The accumulation of oxalate in the body is one of the factors leading to kidney stones. spinach, okra, beets (root and leaves), Swiss chard star fruit, rhubarb, dried figs peanuts, tree nuts (pecans, almonds, hazelnuts) soybeans (including tofu and meat substitutes made with soy) black tea wheat bran buckwheat dark chocolate are high in oxalate (Anon, 2015). Vitamin C is the precursor of oxalate, which can be metabolized to oxalate, thus supplementing vitamin C will increase the excretion of oxalate (Han et al., 2019). Researchers indicated that although increased oxalate-rich foods will lead to increased urinary oxalate excretion, however, calcium in the same foods inhibits oxalate excretion, so the two effects may form a balance (Ziemba & Matlaga, 2017).

Alcohol

Since the high content of purines in alcohol, especially beer. And excessive purine intake will lead to urate overproduction, and thus lead to hyperuricemia (George & Minter, 2020). Therefore, excessive alcohol intake will lead to higher uric acid excretion and urinary calcium excretion (Han et al., 2019). Unlike in western countries, drinking is usually the main way of social contact in China. Therefore, the frequency and amount of drinking will increase, even if they are not willing to drink. Moreover, men are about 13 times more likely to drink alcohol than women (Gu & Ming, 2020).

Recommended dietary behaviors to prevent the recurrence of kidney stones

Adopting dietary behaviors modification to prevent the formation and recurrence of kidney stones is the best option for patients, which is without the risk of surgery and medication, and is safer and more economical. The recommendation of the AUA (Pearle et al., 2014) and evidence-based (Anon, 2015; Taguchi et al., 2019) of the dietary behaviors to prevent the formation and recurrence of stones are suggested as follows:

- (1) drink plenty of fluid, to make sure the urine volume of at least 2.5 liters daily.
- (2) limit intaking of animal protein, including meat, fish, seafood, poultry and eggs.

(3) limit sodium intake, packaged foods, ready-to-eat foods, fast foods and restaurant meals have high in sodium.

(4) eat calcium-rich foods, including milk, dairy products, calcium-fortified foods and beverages, fish canned with bones, to maintain normal calcium consumption.

(5) limit high-oxalate foods, including spinach, okra, beets, Swiss chard, star fruit, rhubarb, dried figs, peanuts, tree nuts, soybeans, black tea, wheat bran, buckwheat, and dark chocolate.

(6) make sure vitamin C supplement less than 1000 milligrams per day.

(7) it's best to avoid alcohol.

Dietary behaviors in Chinese patients with recurrent kidney stones

It was already examined that dietary intervention (OR = 0.59, 95%CI: 0.41~0.86, P = 0.006) can significantly reduce the recurrent rate of kidney stones (Li et al., 2011). However, dietary behaviors are often the area that stone formers tend to overlook, hence as mentioned before, the life-time recurrence rates can reach to 80% (Liu et al., 2018). With the development of economy, people's average income increasing gradually, which affects people's diet. For example, the intake of animal protein, saturated and unsaturated fatty acids have increased while dietary fiber has decreased.

In China, there are some diet cultures which are risk factors of stone formation, such as preferring pickled products, drink culture, and tea culture (Gu & Ming, 2020; Jiao et al., 2023; Tan et al., 2019). A survey conducted in a southern city of China found that people, who prefer a high protein diet (including seafood, meat and eggs), had higher incidence rate (13.8%) of kidney stones (He et al., 2008). A research studied the residents in another southern city of China found that people with kidney stones prefer animal innards (76.79%), seafood (75%) and beverages (71.43%) than healthy people (Cheng & Han, 2019).

In Wenzhou, which is a coastal city in southern China, there are some of more specific dietary behaviors at risk in stone formation. Due to the coastal location of Wenzhou, seafood is a common dish on the dining table of Wenzhou residents. However, as mentioned above, frequent consumption of seafood is easy to lead to high uric acid, which can lead to the formation of uric acid stones. In addition,

Wenzhou tea culture has a history of thousands of years. Tea drives the local economy and local residents have the habit of drinking tea daily. Wenzhou wine culture is also prominent in the custom and etiquette. Many festivals and human relations are carried out with wine as the center of the project. Therefore, "wine" in Wenzhou etiquette and customs very early occupied an important position (Yilong, 2014).

Summary

Above all, foods rich in different substances may lead to different types of stone formation, but the mechanism by these substances is complex, some can promote while others can inhibit the formation of stone. Substance that can promote and substance that inhibit may present in the same food, these two kinds of effect can offset each other. At present, the dietary behaviors of patients with kidney stones are recommended to be as healthy and balanced as possible. As a risk factor of stone formation, unhealthy dietary behaviors are common in patients with kidney stones. Therefore, it is very important to study the factors related to the dietary behaviors in order to help to modify unhealthy dietary behaviors. According to the literature review, the health belief model can help to understand the related factors of dietary behaviors. Previous studies had used this model to explore the influenced factors related to dietary behaviors among patients with kidney stones, thus, this study will further study the prediction of factors that have been shown to influence dietary behaviors.

The Health Belief Model

This section describes the origins, components, and relationships between these components of a revised version of the Health Belief Model (HBM) by Champion and Skinner (2008).

The HBM was originally created in the early 1950s by social psychologists in the U.S. Public Health Service who try to understand why people do not take preventive health measures to check if they are suffering from any diseases in advance (Hochbaum et al., 1952). Since the model has been created, it is widely used to understand why people choose to adopt or not adopt a variety of health-related behaviors. Many prospective or retrospective studies of preventive-health behaviors

(PHB) or sick-role behaviors (SRB) or the reason of clinic-visits were based on health belief model (Janz & Becker, 1984).

The concepts of the HBM were derived from a psychological and behavioral theory, which believe that individual's behaviors are dependent on two factors: (1) a judgment of the value of a goal. When associated with health-related behaviors, is the idea of avoiding illness; (2) an estimate of the likelihood of achieving the goal. When associated with health-related behaviors, is a judgment of whether a health behavior can prevent or ameliorate disease (Janz & Becker, 1984). Initially, these concepts were perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and cue to action, however, few studies accessed "cue to action". After decades of application and update, the main concepts of the model are perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cue to action (Champion & Skinner, 2008).

The relationship between these concepts were described in different versions in the past decades. The original version has three main parts, which are individual perceptions, modifying factors, and likelihood of action. Individual perceptions include perceived susceptibility and perceived severity of disease. Modifying factors include demographic variables, sociopsychological variables, perceived threat of disease and cues to action. Likelihood of action include perceived benefits, perceived barriers, and likelihood of taking recommended preventive health action (Becker et al., 1977). The newest of modeling the relationships also has three parts which are modifying factors (include age, gender, ethnicity, personality, socioeconomics, knowledge), individual beliefs (include perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and perceived self-efficacy), action (include individual behaviors and cues to action). Modifying factors will affect individual beliefs, and individual beliefs will affect action. Perceived susceptibility and severity of disease are together referred to as perceived threat. Cues to action can also affect individual behaviors (Champion & Skinner, 2008).

Age can influence an individual's actions in various ways. For example, young children may lack the cognitive and emotional abilities to make rational decisions, while older adults may experience physical limitations that affect their actions. For the dietary behaviors, younger person has different food preferences than

older adults (Ogundijo et al., 2022). Gender can influence an individual's actions due to societal expectations and cultural norms. For instance, women may be more likely to follow dietary guidelines and restrict their caloric intake to conform to societal standards of beauty (Zambrano et al., 2022). Ethnicity can influence an individual's actions due to cultural and societal norms that may vary across different ethnic groups. And it also influenced an individual's dietary behaviors due to differences in cultural food preferences and traditions (Zambrano et al., 2022). Personality traits such as extraversion, agreeableness, and conscientiousness can influence an individual's actions. Individuals who are open to trying new foods may be more likely to incorporate a variety of foods into their diet, while those who are more conscientious may be more likely to follow a strict diet plan (Liu et al., 2022; Ogundijo et al., 2022). Socioeconomic status can influence an individual's actions due to differences in access to resources and opportunities. For example, individuals with low socioeconomic status may have limited access to education, healthcare, and job opportunities, which can affect their food choices (Ogundijo et al., 2022; Stout et al., 2023). Knowledge: Knowledge can influence an individual's actions by providing them with information and understanding of certain situations. For instance, individuals with knowledge of healthy eating habits and the benefits of certain nutrients may be more likely to make informed dietary choices (Ogundijo et al., 2022).

Perceived threat is the combination of perceived susceptibility and severity. Perceived susceptibility is that people feeling that they are vulnerable to be exposed in a condition, which may be a disease in the field of health. It is a subjective perception of people that they are at risk of exposure to a condition (Champion & Skinner, 2008). Perceived severity is that people feeling that the condition may lead to a serious consequence, which might be medical consequence or social consequence (Champion & Skinner, 2008).

Perceived benefits are that people believe there are some measures can keep them away the condition. Even people perceived susceptibility and severity, they won't take any action or change anything unless they realize the benefits of the action or change (Champion & Skinner, 2008).

Perceived barriers are the negative part of the action or change. The individual will weigh the advantages and disadvantages of taking action, and the negative side will be perceived barrier to adopt the action (Janz & Becker, 1984). Perceived self-efficacy is that people have confidence to take the action and achieve the goal. Perceived self-efficacy is the last concept to be added in the model. For the outcome of individual behavior, people must be confident that they can overcome the barriers to achieve the goals after perceiving threat and benefits (Champion & Skinner, 2008).

Cues to action is the suggestions or strategies that people received, which can help to modify their health-related behavior. According to researchers, the cues can be considered as a trigger, directly help people's action (Champion & Skinner, 2008).

Summary

The modifying factors and also the cues to action in the HBM as the influenced factors, had been confirmed in previous studies, however, the linkages of the health beliefs and individual's action are not defined (Champion & Skinner, 2008). Therefore, it is necessary to examine the relationship between individual beliefs and individual behavior in different contexts.

Factors influencing dietary behaviors

This section introduces factors which influencing the dietary behaviors among patients with kidney stones. According to the revised version of Health Belief Model (Champion & Skinner, 2008), individual beliefs, including perceived threat, perceived benefits, perceived barriers and perceived self-efficacy, can affect individual behavior.

Perceived threat is the combination of perceived susceptibility and severity. Perceived threat means person believe they are likely to get a condition, such as getting a disease, and they believe the certain condition may result in a serious consequence. The more serious the patient belief, the greater the chance of taking preventive measures. A qualitative study showed that patients who have recurrent kidney stones believe they are more likely to develop stones than those patients with first kidney stones. Patients with first kidney stone may do not think stone will

recurrence in the future (McCauley et al., 2012). Patients with the higher susceptibility, the greater the chance of taking preventive action. A study found no statistically significant difference in perceived susceptibility between groups that were successful, moderately successful, or unsuccessful in increasing fluid intake (Tarplin et al., 2016). However, in another study, perceived susceptibility had statistically related with dietary behaviors (OR = 3.47) (Larki et al., 2018). In a cross-sectional study, only 22.8% patients perceived the severity of kidney stones, researchers concluded that patients with recurrent kidney stones had low compliance to keep dietary recommendation, that might because of lacking perceived kidney stones severity in such patients (Bos et al., 2018). However, in a qualitative study, all participating patients who have kidney stones reported high severity (pain) (McCauley et al., 2012). While another study found no statistically significant difference in perceived severity between groups that were successful, moderately successful, or unsuccessful in increasing fluid intake (Tarplin et al., 2016).

Perceived benefits are that people believe taking a certain action can effectively prevent or reduce risks. The study revealed that there is on statistically significant difference in perceived benefits between groups that were successful, moderately successful, or unsuccessful in increasing fluid intake (Tarplin et al., 2016). The more benefits the patient realized, the greater the chance of taking preventive measures. According to another study, depending on the number of previous stone attacks, the minimum level of benefit for patients will different (McCauley et al., 2012). A study found that perceived benefits was strongly related with dietary behaviors in patients with kidney stones ($r = .826, p < .05$) (Doan & Preechawong, 2014).

Perceived barriers refer to people's perception of the difficulty of taking the actions. For example, it is costly, may cause pain, and conflicts with the schedule of daily life. When people perceived greater barriers, they will be reluctant to take precautions. Similarly, a study resulted that those with kidney stones who were very successful in improving drinking behavior perceived less barriers ($P < .001$) than those moderately successful, and unsuccessful (Tarplin et al., 2016). A study found that perceived barriers was strongly related with dietary behaviors in patients with kidney stones ($r = -.717, p < .05$) (Doan & Preechawong, 2014).

Perceived self-efficacy is that people have confidence of taking the preventive action and preventing of adverse outcomes successfully. Researchers found that self-efficacy is important to influencing the behavior intention, self-efficacy is significant association with perceived barriers (Deshpande et al., 2009). In another study, those with kidney stones who were very successful in improving drinking behavior had higher self-efficacy ($P = .026$) than those moderately successful, and unsuccessful (Tarplin et al., 2016). A study found that perceived self-efficacy was strongly related with dietary behaviors in patients with kidney stones ($r = .722$, $p < .05$) (Doan & Preechawong, 2014).

To sum up, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and perceived self-efficacy were related with dietary behaviors among patients with kidney stone, however, previous studies lack data support, and the effect between these factors and dietary behaviors have not been confirmed. Moreover, only perceived susceptibility, perceived severity of kidney stones, perceived benefits, perceived barriers, and perceived self-efficacy of modifying dietary behaviors together can provide motivation can help patients to the greatest extent to take action to improve dietary behaviors.

Summary

In conclusion, from the literature review, dietary behaviors as vital factors which may lead to occurrence and recurrence kidney stones; therefore, the intervention to modifying people's dietary behaviors are important for people to prevent kidney stones formation or recurrent kidney stones. However, there are few studies based on the Health Belief Model to explore the factors related to the dietary behaviors of adults with recurrent kidney stones, especially in China, a country with a large population and a high incidence and recurrence rate of kidney stones. Moreover, few studies have explored the effect of all individual beliefs together in the health belief model on individual behavior. Therefore, this study was based on the Health Belief Model, and studied with the residents in Wenzhou, China, which is a coastal city with a high incidence of kidney stones as the target population. The purposes of the study were to determine the dietary behaviors of patients with recurrent kidney stones, and to examine influencing factors of dietary behaviors. The results of this study are expected to provide evidence for health care workers to help modifying

dietary behaviors in people with recurrent kidney stones to prevent stone expanding or forming new stone and improving their quality of life.



CHAPTER 3

METHODOLOGY

This chapter presents the methodology of the study which include research design, research setting, population and sampling, research instruments. validity and reliability of the instruments, protection of the rights of human subjects, data collection method, and data analysis.

Research Design

In this study, a predictive design was used to examine whether, perceived threat, perceived benefits, perceived barriers, perceived self-efficacy can predict dietary behaviors among adults with recurrent kidney stones in Wenzhou, China.

Research setting

This study was conducted at the Urology Outpatient Department of the First Affiliated Hospital of Wenzhou Medical University in Wenzhou, Zhejiang Province, China. This hospital is a general hospital with 3380 beds and 6295 fully employed workers, served for patients who have medical demands. Minimally invasive therapy of kidney stones is the key development direction of the Urology Outpatient Department. This department opens on Monday to Friday from 8:30 a.m. to 16:30 p.m. Approximately, there are around 30 adults with recurrent kidney stones visit the outpatient department every workday (from Monday to Friday).

Patients come to the Urology Outpatient Department, nurses registered them, and call their names when it's their turn. The doctor assessed patients' health status and gave them a checklist of physical examinations they need to do. The nurse guides them if there is something unclear. After the patients finish examinations and get the results, they will bring it back for the doctor. The doctor determined whether the patients need to be hospitalized or prescribed oral medication based on the examination results. Finally, a nurse or physician provided a health education leaflet for the prevention of kidney stones, which records the diet and appropriate lifestyle for patients with kidney stones.

Population and Sample

Population

The research population was adults with recurrent kidney stones who were diagnosed by physician with a new stone formation, or the original stones enlarged from the Urological Department of the First Affiliated Hospital of Wenzhou Medical University during March 21st, 2022 to May 31st, 2022. More than 100 kidney stone patients visit the Urological Department of the First Affiliated Hospital of Wenzhou Medical University every week, about one-third of them were patients with recurrent kidney stones.

Sample

The sample was collected among adults with recurrent kidney stones who visited the First Affiliated Hospital of Wenzhou Medical University. The sample for this study was recruited from the target population following the inclusion criteria:

1. Aged between 18 and 60 years old.
2. Have a good orientation to place and time and have no history of mental illness.
3. Be able to understand, read, write, and speak Chinese.
4. Have stable conditions if they have comorbidities.

Sample size

The sample size in this study was calculated by R 4.2.2 software in test for regression analysis. Setting in this study are: $\alpha = 0.05$, power = 0.8, moderate effect size was $f^2 = 0.15$ (Cohen, 1988), 92 samples were needed based on this calculation.. Considering the possibility of invalid questionnaire, 20% was added based on 92, that was, at least 110 samples.

Sample recruitment

Simple random sampling by lottery was used in this study. Each patient was selected at random, and each member of the population had an equal chance of being selected.

The day before the visit, the researchers used the Hospital Appointment System to review whether the patients attending the Urology Outpatient Department

met the inclusion criteria for the study with the help of a nurse at the clinic. Those who met the criteria were numbered, the numbers were written on small pieces of paper and placed in a box, and six numbers were randomly selected. The selected patients were asked by the researcher whether they would like to participate in the study. Patients who expressed a willingness to participate in the survey were included in the study. 5-6 participants were randomly selected every working day (Monday to Friday), and the recruitment was stopped when the number of participants reached the sample size of this study.

Instruments development

Due to the lack of appropriate instrument for measuring health beliefs and dietary behaviors of patients with recurrent kidney stones, and specific in this population in Wenzhou, China. Research instruments of this study were developed by researchers. The health belief scale was developed based on literatures review and the health belief model (Champion & Skinner, 2008). The dietary behaviors scale was developed based on the Chinese Urological Association (CUA) guidelines (Huang, 2019).

Brislin (1976) translation - back translation method was used to translate the instrument of this study. Two experts who were good at both English and Chinese were invited to participate in the translation process. Firstly, the English version of the instruments were translated into Chinese by the researcher, then one expert translated the Chinese version back into English, and another expert compared the original English version of the instruments with the English version of the back-translated instruments to evaluate the compatibility of meaning between English version and Chinese version, and finally generated the final Chinese version of the instruments.

The instruments were validated by 30 cases from target population before the main study. The reliability testing revealed that the Cronbach's α of perceived threat, perceived benefits, perceived barriers, and perceived self-efficacy were 0.823, 0.810, 0.842, 0.777 and 0.891 respectively, and the Cronbach's α of the dietary behaviors scale was 0.664. Finally, there were three instruments in this study, which were the demographic questionnaire, the health belief scale, and the dietary behaviors scale.

Research Instruments

There were three research instruments for this study.

1. The demographic questionnaire

The demographic questionnaire included 17 items, divided in 2 parts: individual characteristics and health information of the participants. Firstly, the individual characteristics included gender, age, marital status, highest level of education, average individual income, occupation, living arrangement; Secondly, the health information included family history of kidney stones, number of diagnoses of kidney stones, time since the first diagnosed with kidney stone, any treatment for kidney stones, co-morbidities, alcohol drinking status, received any information on kidney stone prevention, nutritional supplement, cooking mode, body mass index.

2. The health belief scale

The health belief scale was used to measure the perception of the participants related to the prevention of recurrence kidney stones. There were 37 items with 4 subscales including perceived threat, perceived benefits, perceived barriers, and perceived self-efficacy. The answers were indicated by applying a 5-point Likert Type scale, with the following given responses: “5 = strongly agree”, “4 = agree”, “3 = neutral”, “2 = disagree” and “1 = strongly disagree”.

Perceived threat subscale consists of 9 items: item 1, 2, 3, 4, 5, 6, 7, 8, 9. The total score was calculated by summation of the score for the 9 items, ranging from 9 to 45. The higher score reflects the high levels of perceived threat.

Perceived benefits subscale consists of 12 items: item 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21. The total score was calculated by summation of the score for the 12 items, ranging from 12 to 60. The higher score reflects the high levels of perceived benefits.

Perceived barriers subscale consists of 13 items: item 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34. The total score was calculated by summation of the score for the 13 items, ranging from 13 to 65. The higher score reflects the high levels of perceived barriers.

Perceived self-efficacy subscale consists of 3 items: item 35, 36, 37. The total score was calculated by summation of the score for the 3 items, ranging from 3 to 15. The higher score reflects the high levels of perceived self-efficacy.

3. The dietary behaviors scale

The dietary behaviors scale was developed by the researcher based on the Chinese Urological Association (CUA) guidelines (Huang, 2019) to measure the dietary behaviors of the participants. The dietary behaviors consist of 19 items. The answers were indicated by applying a 5-point Likert Type scale with the following given responses to positive items: “5 = routinely”, “4 = frequently”, “3 = sometimes”, “2 = seldom” and “1 = never”, and with the following given responses to negative items: “1 = routinely”, “2 = frequently”, “3 = sometimes”, “4 = seldom” and “5 = never”. Positive scoring items were item 1, 5, 6, 11, 12 and 19, while negative scoring items were item 2, 3, 4, 7, 8, 9, 10, 13, 14, 15, 16, 17 and 18.

The total score was calculated by summation of the score for the 19 items, ranging from 19 to 95, the higher score reflects the high levels of dietary behaviors.

Quality of the Instruments

The content validity of the instruments of this study was evaluated by six experts in kidney stones disease (five university professors and one doctor working in the hospital urology department) from Thailand and China using the content validity index (CVI). The content validity index score of the health belief scale and the dietary behaviors scale were .97 and .94 respectively.

Before the procedure of data collection, the reliability of the instruments was tested with 30 patients with recurrent kidney stones who have the same characteristics and as the samples of this study, for the health belief scale and the dietary behaviors scale, the Cronbach's alpha of each scale was as follow:

Table 1 The Cronbach's alpha of the instruments

Variables	The Cronbach's α (tryout)	The Cronbach's α (main study)
Perceived threat	.823	.750
Perceived benefits	.842	.825
Perceived barriers	.777	.776
Perceived self-efficacy	.891	.837
The dietary behaviors scale	.664	.871

Protection of the rights of human subjects

This research proposal was approved by the Institutional Review Board of Burapha University (Protocol code G-HS077/2564) and the Ethics Committee of the First Affiliated Hospital of Wenzhou Medical University (Protocol code KY2022-027).

Participants were informed about the aim and the procedures of this study carefully before obtaining their consent, and they have rights to participate or to refuse to participate in this study. After they agreed to participate in this study, they signed a consent form, and data collection carried out after the consent form was signed. Participants were informed that they have right not to answer any questions that make them uncomfortable, and they also have right to withdraw from this study at any time. This study will not cause any harm to participants.

All collected information were anonymous and were only used in this research. All the collected information were kept in a safe place where only the researcher can access it, and it will be destroyed one year after the study is published.

Data Collection Method

1. The research proposal was submitted to the Institutional Review Board of Burapha University and the Ethics Committee of the First Affiliated Hospital of Wenzhou Medical University for approval of data collection.

2. After approval, researcher introduced the purpose of the study and the procedure of data collection to doctors and nurses of the Urology Outpatient Department of the First Affiliated Hospital of Wenzhou Medical University to get cooperation.

3. The researcher was at the Urology Outpatient Department every weekday from 8:30 to 16:30. Find patients who met the inclusion criteria from the Hospital Appointment System, used the simple random sampling technique to selected participants, and invited them who were willing to participate in this study. Due to the global pandemic situation, the data collection process of this study took measures to prevent the spread of the virus. At the entrance of Urology Outpatient Department, patients were required to wear masks all the time, went through temperature screening, and they were asked to show a health QR code (an official way to declare residents' health status). Only those who displayed a green code and temperature below 37.3°C were allowed entry into the outpatient department.

4. The researcher met the patients while they were waiting for the doctor. The participants were informed about the purpose of the study, ethical consideration, and voluntary nature of the study to the potential participants. Obtained the patient's consent and signed the consent form.

5. After the potential participants visit physicians, the researcher took patients in a special private room to do the demographic questionnaire, The health belief scale and the dietary behaviors scale. The special private room was routinely disinfected daily, and the researcher wore masks as required. Every participant maintains one-meter social distancing from other participants and researchers. After doing the questionnaire, participants took any belonging away, the researcher used alcohol pads to disinfect used pen.

6. The questionnaires have a total of 73 items and took 15 to 25 minutes for each patient. Researcher checked and collected data every workday (Monday to Friday). 5 to 6 patients were recruited in one day.

7. The data collection process repeated until the sample size was reached.

Data Analysis

The alpha (α) level of statistical significance was set at 0.05. The data was analyzed as follow:

1. The descriptive statistics including frequency statistics, mean and standard deviation were used to describe the demographic characteristics of the participants.
2. The assumptions of multivariate regression were examined, including linear relationship, homoscedasticity, independent errors, no outliers, variance in all predictors, multicollinearity, normally distributed residuals. All assumption were met.
3. The standard multivariate regression analysis, enter method, was used to determine the predictor of dietary behaviors among patients with recurrent kidney stones in Wenzhou, China.

CHAPTER 4

RESULTS

This chapter presents results of the study. The results are divided into three parts. The first part describes the characteristics of the participant. The second part describes the independent and dependent variables. The last part presents factors influencing the dietary behaviors among adults with recurrent kidney stones.

Part 1 Demographic characteristics of adults with recurrent kidney stones

The frequency, percentage, means and standard deviation of demographic characteristics of adults with recurrent kidney stones are shown in Table 2. One hundred and ten participants who met the inclusion criteria were invited and agreed to participate in this study. More than half of the participants were male (64.5%). The overall age ranged from 28 to 60 years old ($M = 47.99$, $SD = 7.68$), with the highest proportion of participants aged between 51 and 60 years old (41.8%). The majority of the participants were married (89.1%). 53.6% of participants had a middle income, which was between 2000 to 5000 yuan. Most of the participants living with family members or others (92.7%).

Of all 110 participants, 34.5% received operational treatment, and 24.5% had undergone operational and medical treatment. More than a third had other diseases (39.1%), with hypertension the most common (55.8%). There were 40% of participants had not received information about kidney stones prevention. In addition, nearly half of the participants were overweight (45.5%) and 7.3% were obesity.

Table 2 Description of participants' demographic characteristics (n = 110)

Characteristic	Frequency (n)	Percent (%)
Gender		
Male	71	64.5
Female	39	35.5
Age ($M = 47.99$, $SD = 7.68$, Min = 28, Max = 60)		
21-30 years	1	0.9
31-40 years	21	19.1
41-50 years	42	38.2
51-60 years	46	41.8
Marital status		
Single	2	1.9
Married	98	89.1
Divorced	5	4.5
Widowed	5	4.5
Highest level of education		
Illiteracy	16	14.5
1-6 years education	27	24.5
7-9 years education	49	44.6
10-12 years education	10	9.1
Bachelor's degree or above	8	7.3
Average individual income (1 Yuan = 0.139 USD)		
Less than ¥ 2000	23	20.9
¥ 2000-¥ 5000	59	53.6
¥ 5000- ¥ 8000	22	20
More than ¥ 8000	6	5.5

Table 2 (Continued)

Characteristic	Frequency (n)	Percent (%)
Occupation		
Unemployed	6	5.5
Employed	104	94.5
Private company staff	30	27.3
Private business owner	8	7.2
Civil servant	2	1.8
Farmers	28	25.5
Manual worker	14	28.8
Online ride hailing driver	6	7.7
Wechat business	5	1.9
Household service	5	26.9
Retirement	3	13.4
Lawyer	1	5.8
Photographer	1	4.8
Designer	1	4.8
Living arrangement		
Living alone	8	7.3
Living with family members or others	102	92.7
Family history of kidney stones		
No	84	76.4
Yes	26	23.6
Number of diagnoses of kidney stones ($M = 2.76$, $SD = 0.91$, $Min = 2$, $Max = 6$)		
Two times	48	43.6
Three times	50	45.5
Four times or more	12	10.9

Table 2 (Continued)

Characteristic	Frequency (n)	Percent (%)
The time since the first diagnosis with kidney stone		
Less than 5 years	32	38.2
5-10 years	47	25.5
More than 10 years	31	36.3
Previous treatment		
Operation	38	34.5
Medication	32	29.1
Both operation and medication	27	24.5
Diet control or exercise	13	11.9
Co-morbidities*		
None	67	60.9
Having co-morbidities	43	39.1
Hyperlipidemia	9	20.9
Hypertension	24	55.8
Diabetes	14	32.6
Coronary heart disease	3	7.0
Others [#]	10	23.3
Alcohol drinking status		
No history of drinking alcohol	71	64.5
Current alcohol drinker	28	25.5
Former alcohol drinker	11	10
Received information about kidney stones prevention		
No	44	40.0
Yes	66	60.0

Table 2 (Continued)

Characteristic	Frequency (n)	Percent (%)
Taking nutritional supplement*		
No	63	57.2
Yes	37	33.6
Vitamin C	12	32.4
Vitamin D	4	10.8
Calcium tablet	31	83.8
Cooking mode		
By myself	39	35.5
By my family	64	58.1
Buy from the restaurant	6	5.5
Others	1	0.9
BMI ($M = 23.80$, $SD = 3.57$, $Min = 18.34$, $Max = 34.23$)		
<18.5	3	2.7
18.5-23.9	49	44.5
24-27.9	50	45.5
>28	8	7.3

*Multiple choice question; # including tumor, hepatitis B, tuberculosis and psoriasis.

Part 2 Description of perceived threat, perceived benefits, perceived barriers, perceived self-efficacy, and dietary behaviors among adults with recurrent kidney stones.

The mean scores and standard deviation were used to describe the variables of this study. The mean scores of perceived threat were 35.35 ($SD = 4.46$), perceived benefits were 39.96 ($SD = 6.01$), perceived barriers was 35.32 ($SD = 6.41$), and perceived self-efficacy was 10.55 ($SD = 2.11$). The detail description of the independent variables is shown in Table 3.

Table 3 Description of the health beliefs (n = 110)

Dependent variables	Possible score	Actual score	<i>M</i>	<i>SD</i>
Perceived threat	9-45	23-45	35.35	4.46
Perceived benefits	12-60	27-54	39.96	6.01
Perceived barriers	13-65	22-48	35.32	6.41
Perceived self-efficacy	3-15	6-15	10.55	2.11

Table 4 presents description of the dietary behaviors. By overall, the mean score of dietary behaviors was 54.90 out of 95 (SD = 8.61). Among the 19 items, the five behaviors with the lowest scores were controlling weight through diet (2.53±1.24), eating coarse grains and fiber (2.54±1.10), drinking alcohol (2.62±1.64), intaking high calcium milk or yoghurt, tofu, or small fish (2.65±1.12), and drinking enough water (2.69±1.24), which means that the above five behaviors were the most prominent dietary behaviors among participants that increased the risk of stone recurrence.

Table 4 Description of the dietary behaviors scale and the items of dietary behaviors scale (n = 110)

	Routinely (5) n (%)	Frequently (4) n (%)	Sometimes (3) n (%)	Seldom (2) n (%)	Never (1) n (%)	<i>M</i>	<i>SD</i>
Dietary behaviors (total)						54.9	8.61
Possible score = 19-95							
Actual score = 38-78							
1. I drink water more than 2.5L per day (equivalent to the amount of 5 bottles of mineral water).	12(10.9)	17(15.5)	25(22.7)	37(33.6)	19(17.3)	2.69	1.24
2. I drink a cup of coffee, black tea, or carbonate drink (such as cola).	30(27.2)	9(8.2)	19(17.3)	35(31.8)	17(15.5)	3.00	1.46
3. I drink a glass of grape juice or apple juice.	32(29.1)	12(10.9)	24(21.8)	22(20.0)	20(18.2)	3.13	1.48
4. I drink a glass of red wine or a can of beer.	11(10.0)	15(13.6)	41(37.3)	18(16.4)	25(22.7)	2.89	1.65
5. I drink a glass of orange juice, cranberry juice, or lemonade.	8(7.3)	17(15.4)	29(26.4)	41(37.3)	15(13.6)	2.72	1.24
6. I drink high calcium milk or yoghurt, eat tofu, or small fish.	13(11.8)	21(19.1)	40(36.3)	18(16.4)	18(16.4)	2.65	1.12

Table 4 (Continued)

	Routinely		Frequently		Sometimes		Seldom		Never		<i>M</i>	<i>SD</i>
	(5)	n (%)	(4)	n (%)	(3)	n (%)	(2)	n (%)	(1)	n (%)		
7. I eat kale, almonds, peanuts, beets, parsley, spinach, rhubarb, mushroom or chocolate.	10(9.1)	30(27.3)	22(20.0)	36(32.7)	12(10.9)	2.94	1.22					
8. I eat salty food or add more than a teaspoon (2g) of salt in my meal.	13(11.8)	21(19.1)	30(27.3)	29(26.4)	17(15.4)	2.91	1.19					
9. I eat a processed food such as processed meat or processed fish.	13(11.8)	14(12.7)	39(35.5)	24(21.8)	20(18.2)	2.85	1.24					
10. I eat red meat (such as poultry meat, beef, pork) more than 80g (equivalent to the weight of two eggs) per day.	12(10.9)	20(18.2)	19(17.3)	42(38.2)	17(15.4)	2.78	1.23					
11. I eat fruits and vegetables (except cabbage, beets, parsley, spinach, rhubarb).	7(6.4)	14(12.7)	27(24.5)	45(40.9)	17(15.5)	2.71	1.24					
12. I eat coarse grains and fiber (such as rice bran).	21(19.1)	34(30.9)	35(31.8)	12(10.9)	8(7.3)	2.54	1.10					
13. I take supplement vitamin C.	29(26.3)	42(38.2)	29(26.4)	6(5.5)	4(3.6)	3.44	1.14					

Table 4 (Continued)

	Routinely		Frequently		Sometimes		Seldom		Never		<i>M</i>	SD
	(5) n (%)	(4) n (%)	(3) n (%)	(2) n (%)	(1) n (%)	(1) n (%)	(1) n (%)					
14. I take supplement vitamin D.	15(13.6)	17(15.6)	25(22.7)	26(23.6)	27(24.5)	3.78	1.02					
15. I take additional calcium daily. (by yourself, not by prescription)	11(10.0)	22(20.0)	48(43.6)	19(17.3)	10(9.1)	2.70	1.36					
16. I eat animal offal such as liver or kidney and poultry skins.	20(18.2)	24(21.8)	21(19.1)	24(21.8)	21(19.1)	3.05	1.07					
17. I eat seafood such as crab, shrimp, skinned herring, sardines, or anchovies.	26(23.7)	11(10.0)	13(11.8)	15(13.6)	45(40.9)	2.98	1.39					
18. I drink alcohol.	10(9.1)	15(13.7)	23(20.9)	37(33.6)	25(22.7)	2.62	1.64					
19. I control my body weight by eating more fruits, vegetables and foods high in fiber instead of high calorie foods (such as chocolate and fat meat).	12(10.9)	17(15.5)	25(22.7)	37(33.6)	19(17.3)	2.53	1.24					

Part 3 Factors influencing dietary behaviors among adults with recurrent kidney stones

The assumptions testing of multiple regression analysis were examined. Scatter plots were drawn to verify the linear relationship between independent variables and dependent variables; the histogram and the normal P-P Plot were drawn to examine normally distributed data; Tolerance and VIF were used to determine no multicollinearity; F-test were used to examine homoscedasticity; Student Deleted Residual was between -3 to +3 and cook's distance <1 , and centered leverage value <0.2 , thus, there's no outlier. All assumptions were met.

The Pearson correlation test was used to examine the relationship among the dependent variables and independent variables and relationships among the independent variables, also for multicollinearity checking. A Multiple regression analysis was used to examine whether perceived threat, perceived benefits, perceived barriers, perceived self-efficacy can predict dietary behaviors.

Table 5 indicated that perceived threat had a small positive significant correlation with dietary behaviors ($r = .234, p < .01$), and perceived barriers had a moderately negative significant correlation with dietary behaviors ($r = -.389, p < .01$). However, there was no significant correlation between perceived benefits ($r = .052, p = .29$), perceived self-efficacy ($r = .111, p = .12$) with the dietary behaviors.

Table 5 Correlation matrix among the dietary behaviors and the health beliefs
(n = 110)

Variables	Dietary behaviors	Perceived threat	Perceived benefits	Perceived barriers	Perceived self-efficacy
Dietary behaviors	1				
Perceived threat	0.234**	1			
Perceived benefits	0.052	0.127	1		
Perceived barriers	-0.389**	0.088	-0.144	1	
Perceived self-efficacy	0.111	-0.105	.162*	-0.138	1

* $p < .05$, ** $p < .01$

The results of multiple regression analysis indicated that perceived threat, perceived benefits, perceived barriers, perceived self-efficacy explained 20.4% in the variance of dietary behaviors among adults with recurrent kidney stones ($\text{Adj } R^2 = .204$, $F = 8.001$, $p < .001$). The results also show that perceived threat ($\beta = .287$, $p = .001$), perceived barriers ($\beta = -.409$, $p = .001$) can significantly predict the dietary behaviors of adults with recurrent kidney stones. However, perceived benefits ($\beta = -.059$, $p = .506$), perceived self-efficacy ($\beta = .094$, $p = .287$) could not significantly predict the dietary behaviors of adults with recurrent kidney stones. The summary results of regression analysis are shown in Table 6.

Table 6 Summary of regression analysis for variables predicting dietary behaviors among adults with recurrent kidney stones (n = 110)

Predicting variables	<i>B</i>	<i>SE</i>	β	<i>T</i>	<i>p</i> -value
Perceived threat	.867	.264	.287	3.29	.001
Perceived benefits	-.132	.198	-.059	-.668	.506
Perceived barriers	-.861	.184	-.409	-4.689	.001
Perceived self-efficacy	.601	.561	.094	1.071	.287
Constant = 53.604, $R^2 = .234$, Adj $R^2 = .204$, $F = 8.001$, $P < .001$					

CHAPTER 5

CONCLUSION AND DISCUSSION

This chapter presents summary of the findings and discussion of the results according to the objectives and hypotheses of this study. Finally, the implications for practice and future research are discussed.

Summary of findings

The aims of this study were to ascertain the dietary behaviors and its influencing factors among adults with recurrent kidney stones in Wenzhou, China, based on the Health Belief Model (HBM). 110 participants were randomly recruited, and they were required to fill three questionnaires, including the demographic questionnaire, the health belief scale, and the dietary behaviors scale. The health belief scale contains four subscales, they are perceived threat, perceived benefits, perceived barriers, and perceived self-efficacy. The Cronbach's alpha for each subscale was .750, .825, .776, .837, respectively. The Cronbach's alpha of dietary behaviors scale was .871.

The results of this study indicated that more than half of the participants were male (64.5%). The overall age ranged from 28 to 60 years old ($M = 47.99$, $SD = 7.68$), with the highest proportion of participants aged between 51 and 60 years old (41.8%). The majority of the participants were married (89.1%). 53.6% of the participants had a middle income (2000 to 5000 yuan). Of all 110 participants, 34.5% received operational treatment, and 24.5% had undergone operational and medical treatment. There were 40% of participants had not received information about preventing kidney stones. More than half of the participants were overweight (52.8%). In addition, more than half (56.4%) of the participants had three or more relapses.

According to the results, the mean scores of each health belief subscales and dietary behaviors scale were at a moderate level. The mean scores of each subscale of the health belief scale were 35.35 ($SD = 4.46$, score range 9-45) for perceived threat, 39.96 ($SD = 6.01$, score range 12-60) for perceived benefits, 35.32 ($SD = 6.41$, score range 13-65) for perceived barriers, and 10.55 ($SD = 2.11$, score range 3-15) for

perceived self-efficacy. The mean scores of dietary behaviors were 54.90 (SD = 8.61, score range 19-95).

Results from the multiple regression analysis, perceived threat, perceived benefits, perceived barriers, and perceived self-efficacy explained 20.4% in the variance of dietary behaviors among adults with recurrent kidney stones (Adj $R^2 = .204$, $F = 8.001$, $p < .001$). And perceived threat ($\beta = .287$, $p = .001$), perceived barriers ($\beta = -.409$, $p = .001$) can significantly predict the dietary behaviors of adults with recurrent kidney stones. However, perceived benefits ($\beta = -.059$, $p = .506$), and perceived self-efficacy ($\beta = .094$, $p = .287$) could not significantly predict the dietary behaviors of adults with recurrent kidney stones.

Discussion

The purpose of this study is to describe the dietary behaviors of the study population and test its influencing factors. Therefore, the discussion section focuses on objectives of the study.

1. Dietary behaviors of adults with recurrent kidney stones

The mean score of dietary behaviors scale was 54.90 out of 95 (SD = 8.61), which reflects that the dietary behaviors of the participants in this study were not too low and not too high. Results from this study were also consistent and inconsistent to previous studies.

Previous studies have also found that people with kidney stones have poorer dietary behaviors than those without stones. Rodrigues et al. (2020) compared the diets of patients with and without kidney stones, the results showed that the intake of sodium chloride and protein in patients with kidney stones was significantly higher than that in patients without kidney stones. Furthermore, compared with patients without kidney stones, patients with kidney stones consumed more vegetables and beans, while the consumption of fruits and low-fat dairy products was relatively low. Similarly, the results of a meta-analysis of risk factors for Chinese adult urinary calculi showed that, compared with patients with non-urinary calculi, the dietary behaviors of those with urinary calculi is worse. Specific poor dietary behaviors are drinking less water, high salt intaking, smoking, drinking alcohol, eating less vegetables, high protein intaking, eating less fruits, drinking less tea, and overweight

(Zhang et al., 2018). The above findings could explain that more than half of the patients in this study (56.4%) had three or more relapses of recurrent kidney stones. The reasons for poor dietary behaviors in patients with recurrent kidney stones in this study may be as follows:

There were more male than female participants in the study, and men generally manage their diets less rigorously than women. From the perspective of family role, food cooking at home is usually completed by women, which leads to men's meals are often influenced by their families (Blanco-Metzler et al., 2021). It reflects that health education is equally important to patients and their family members. In addition, men are often expected to be the primary breadwinners and may spend more time working outside the home. As a result, they are often influenced by social norms that promote drinking more alcohol, can also lead to less time for meal preparation and reliance on fast food or convenience foods that are often high in calories, fat, and salt (Flannigan et al., 2019; Punjani et al., 2018).

Furthermore, in this study, 39% of the participants were illiterate or had received less than 6 years of education, and 83.6% had less than 9 years of education. People with low education levels might not have access to or understand information on healthy dietary behaviors (Wittink & Oosterhaven, 2018). Even through health education for kidney stone patients has been carried out in the hospital, 40 percent of patients in this study reported never receiving information about kidney stone prevention. They also might lack of knowledge to seek such kind of information. People with low education levels may face higher levels of stress due to financial difficulties or job insecurity, which lead to emotional eating and a reliance on unhealthy dietary behaviors, such as drinking alcohol (Zellner et al., 2006). Therefore, more understandable ways of health education need to be developed.

The study findings also revealed that 52.8 percent of participants in the study were overweight. Research showed that overweight patients had less healthy eating behaviors than people of normal weight. That's might because overweight patients may turn to food as a coping mechanism for stress or emotional issues, leading to overeating and unhealthy food choices (Zellner et al., 2006). Moreover, overweight patients may not consume enough fruits and vegetables, and instead rely

on processed or fast food that is high in calories and low in nutrients (Elizabeth et al., 2020).

Considering each dietary behavior, the study results revealed that, among the 19 items, participants had lowest scores in five dietary behaviors including controlling weight through diet (2.53 ± 1.24), eating coarse grains and fiber (2.54 ± 1.10), drinking alcohol (2.62 ± 1.64), consuming high calcium milk or yoghurt, tofu, or small fish (2.65 ± 1.12), and drinking less water (2.69 ± 1.24).

Controlling weight through healthy diet is one of the behaviors with low scores (2.53 ± 1.24) in the dietary behaviors scale of this study, which reflects that participants in this study were less likely to control their weight through healthy diet. Numerous studies have confirmed that obesity is a risk factor for kidney stone formation (D'Alessandro et al., 2019; Halinski et al., 2021). Urine oxalate, uric acid, sodium, and phosphate levels were higher in people with a higher body mass index (Lieske, 2014). It is well established that people with lower BMI have significantly lower levels of oxalate in their urine (Schwen et al., 2013).

The results of this study also indicated that the intake frequency of grain or fiber (2.54 ± 1.10). Previous studies have shown that intake of vegetables, fruits and fiber can reduce the risk of kidney stone formation. Among these factors, increasing fiber may contribute the most (Sorensen et al., 2014). Therefore, it is recommended to increase the intake of fruits, vegetables, whole grains, and fiber.

The average score of drinking alcohol was 2.62 (SD = 1.64), which reflected the participants' high frequency of alcohol consumption. Alcohol consumption has been reported to be a risk factor for kidney stone formation (Zhang et al., 2018). As mentioned above, the study participants were mostly male, and men are more likely to be influenced by social norms that promote them to drink alcohol. Therefore, in health education, it is very important to adopt effective strategies to persuade patients not to drink, such as motivational Interviewing, providing factual information (the risks of alcohol abuse); providing personalized feedback on a patient's drinking behavior to help them realize how much alcohol they consume and how it affects their health; encouraging self-reflection and teaching coping skills (Cavalcante Paz et al., 2023).

The results also indicated that the participants consumed less calcium-rich foods (2.65 ± 1.12). This finding is consistent with previous research. In China, a high

incidence of micronutrient insufficiency in adult was investigated, with calcium deficiency being the most serious problem (Huang et al., 2019). Hypercalciuria is an important cause of calcium stone formation. However, studies have confirmed that ensuring normal calcium intake in diet is a protective factor to prevent stone formation. That's because low calcium intake will lead to decrease of calcium in the intestine, and then lead to excessive absorption and excretion of oxalate, ultimately increasing the risk of oxalate stone formation. Therefore, it is recommended to take 1000~1200mg calcium from calcium containing foods every day (Siener, 2021; Sorensen et al., 2012). But calcium supplements are not recommended because it increase the risk of stone formation (Gul & Monga, 2014).

Increasing fluid intake to increase urine volume can effectively reduce the supersaturation of stone components, thereby preventing stone recurrence. A meta-analysis found that compared with the people who drinking water less than 1L per day, the risk of getting kidney stone in the people who drinking water more than 2L per day is reduced by about half (Ticinesi et al., 2016). Therefore, regardless of the composition of the stone, increasing fluid intake is recommended as a good behavior. According to the guideline (Huang, 2019), the recommended daily fluid intake is more than 2.5 ~3L. However, in this study, the results of the dietary behaviors scale revealed that the average score of participants who drink water more than 2.5L in a single day is 2.69 (SD = 1.24), which means that the frequency of participants drinking 2.5L in a single day within a week is between "seldom" and "sometimes". This may be because 30% participants of this study were freelancers, which included manual workers and ride-hailing drivers. The nature of these kind of occupation may result in them not always having enough time or conditions to drink water.

Compared with recommended dietary behaviors for the prevention of kidney stone recurrence, the results showed that participants in the study had poor dietary behaviors which were more likely to lead to kidney stones recurrence. The finding could explain why more than half of the participants (56.4%) had three or more relapses. Clinical health education strategies need to be optimized to improve the efficiency of health education. For example, animated video was used to deepen the understanding of the low education level or middle-aged people, and telephone

follow-up was used to remind the patients of the matters needing attention in healthy diet (Alonso-Domínguez et al., 2019; Bennell et al., 2022).

2. Factors influencing dietary behaviors among adult with recurrent kidney stones

To our knowledge, there is no study that puts perceived threat, perceived benefits, perceived barriers, and perceived self-efficacy into one model to verify its predictive effect on the dietary behaviors of adults with recurrent kidney stones. This study confirmed that the above four health beliefs together explained 20.4% of the individual dietary behaviors of this population ($\text{Adj } R^2 = 20.4\%$, $F = 8.001$, $p < .001$). The results also showed that perceived threat can predict dietary behaviors ($\beta = .287$, $p = .001$), and perceived barriers can predict dietary behaviors significantly ($\beta = -.409$, $p = .001$). However, there was no significant correlation between perceived benefits, perceived self-efficacy and dietary behaviors.

Perceived threat refers to an individual's belief about the potential negative consequences of not following a healthy diet. Perceived benefits refer to an individual's belief about the positive outcomes of following a healthy diet. Perceived barriers refer to the obstacles or challenges that an individual perceives as preventing them from following a healthy diet. These barriers can include factors such as lack of time, lack of access to healthy foods, or cost (Mokaya et al., 2022). Perceived self-efficacy refers to an individual's belief in their ability to successfully follow a healthy diet. This can be influenced by factors such as knowledge about nutrition, skills in food preparation, and support from others (Dean et al., 2022). All of these factors work together can predict an participants' dietary behaviors. Which means people who perceives a high level of threat from consuming unhealthy foods, believes strongly in the benefits of a healthy diet, does not perceive significant barriers to following a healthy diet, and has high self-efficacy in their ability to make healthy food choices is more likely to have a healthy diet.

The result of perceived threat ($\beta = .287$, $p = .001$), as a significantly predictor of the dietary behaviors, indicated that participants were more likely to adopt healthy dietary behaviors when they perceived threat of recurrent kidney stones would have serious consequences. This finding is consistent with previous research. Studies showed that higher perception of susceptibility and severity can predict better

dietary behaviors (Akokuwebe et al., 2020; Bos et al., 2018; Larki et al., 2018; McCauley et al., 2012).

The predictive effect of perceived threat on dietary behaviors in adults with recurrent kidney stones can be explained by the HBM (Champion & Skinner, 2008). Perceived threat, which defined as combination of perceived susceptibility and perceived severity, is a construct of the HBM that has great relevance in health-related behaviors. According to Champion & Skinner (2008), when people believe that they are likely to get a disease, and they perceived the disease will lead to serious consequences, they would have a motivation to avoid the disease. The result of this study showed that perceived threat had a high mean score (35.35 ± 4.46), given the total score of 45. Which means participants in this study generally had higher perception of threat and could led them to follow better dietary behaviors.

This study also verified that perceived barriers is a predictor of dietary behaviors ($\beta = -.409, p = .001$). In this study, the more barriers that patients with recurrent kidney stones perceived, the less likely they were taken dietary modification to prevent the occurrence of kidney stones. Other researches support this finding (Morovati Sharifabad et al., 2015; Tarplin et al., 2016).

According to HBM (Champion & Skinner, 2008), perceived barriers mean that the patient is aware of the tangible or psychological costs of the recommended action, which may be financial burden, unpleasant, inconvenience, or time limited. These barriers can counteract perceived benefits, resulting in an inverse effect on the individual's ultimate behavior. Morovati Sharifabad et al. (2015) stated that the biggest barrier to adopting the appropriate diet to prevent kidney stones in patients with recurrent kidney stones was lack of knowledge about the diet, followed by an unwillingness to follow the diet and to drink enough water every day.

However, results from the study found that perceived benefits and perceived self-efficacy could not predict dietary behaviors among adults with recurrent kidney stones in Wenzhou, China. The reasons for the results are as follows.

Perceived benefits in this study means that individuals are more likely to adopt preventive dietary behaviors if they believe that behaviors will reduce the risk of recurrent kidney stones. Research has shown that if people perceived the benefits of healthy dietary and start planning their diet, the ourcome behavior is more likely to

be achieved (Sogari et al., 2018). However, in this study, perceived benefits was not a predictor to participants' dietary behaviors, this finding is consistent with Lee et al. (2020). The reason for this result can be explained as follows. Champion & Skinner (2008) mentioned that the relationships between constructs in HBM are uncertain. In addition, it may also be because that perceived barriers have greater impact on the outcome behaviors, and the impact counteracts the influence of perceived benefits, which lead to the influence of perceived benefits on the dietary behaviors is not significant.

To success the behavior change, people must feel confidence (perceived self-efficacy) to overcome the barriers and finally take action. Therefore, perceived self-efficacy is vital for behavior changing. However, the results of this study showed that perceived self-efficacy is not a predictor of participants' dietary behaviors, which is inconsistent with the results of other relevant studies (Doan & Preechawong, 2014; Hardcastle et al., 2015; Tarplin et al., 2016). This result can be explained by the incomplete measurement of perceived self-efficacy. In this study, there are only three items to evaluate perceived self-efficacy of participants, which may result in inadequate evaluation. Therefore, it is difficult to analyze its relationship with dietary behaviors.

Based on the HBM, this research selected 5 constructs of HBM as independent variables. The results showed that only perceived threat and perceived barriers can significant predict dietary behaviors. Higher level of perceived threat further predicted a higher chance of taking dietary modification to prevent recurrence of kidney stones, and higher level of perceived barriers further predicted a lower chance of taking dietary modification to prevent recurrence of kidney stones. Perceived barriers had the greatest effect on behavioral intention of dietary modification to prevent kidney stones among all participants, followed by perceived threat. Perceived benefits and perceived self-efficacy could not predict dietary behaviors of participants. However, all independent variables directly or indirectly influenced dietary behaviors of participants, which is consist with the HBM.

Implications

The results of this study showed that patients with recurrent kidney stones had poor dietary behaviors, mainly focusing on not using diet to control weight, eating grains less frequently, frequent drinking, less intaking of high calcium milk or yoghurt, tofu, or small fish, and lack of water. Clinical nurses should strengthen health education in these aspects. The study found that 58.1% of patients' meals were prepared by their families, so it is important to educate their families about the preventive diet of kidney stones. The way of health education also need attention. The way that can be easily understood and attractive teaching method of health education for those with low education level, should be developed.

In addition, this study found that perceived barriers have the greatest impact on dietary behaviors of adults with recurrent kidney stones. Therefore, clinical nurse should communicate more with the patient, not only to tell patients about the correct dietary behaviors to prevent kidney stones, but also to know about the obstacles patients face, such as not being able to drink enough water because of their occupation, and to help patients find way to overcome the obstacles so as to achieve the ultimate goal of healthy dietary behaviors.

Future Research

In this study, selected factors explained 20.4% in the variance of dietary behaviors among adults with recurrent kidney stones, which means there are more factors influenced dietary behaviors. In addition, perceived self-efficacy has no significant influence on dietary behaviors in this study, future research should focus on developing comprehensive instrument to measure perceived self-efficacy of adults with recurrent kidney stones, then examine the relationship between perceived self-efficacy and dietary behaviors among adults with recurrent kidney stones. And a comprehensive instrument to measure dietary behaviors is also needed. The participants in this study were limited to one location, future study could design more sites to generalize the results. In addition, in this study, medium effect size was used to calculate the sample size. In future studies, small effect size could be used to calculate the sample size to further verify the predictive effect of health beliefs on the

dietary behaviors of patients with recurrence. Finally, future research should develop more attractive and impressive health education methods to increase peoples' perception of threat and reduce the perception of barriers, thereby improving their dietary behaviors.



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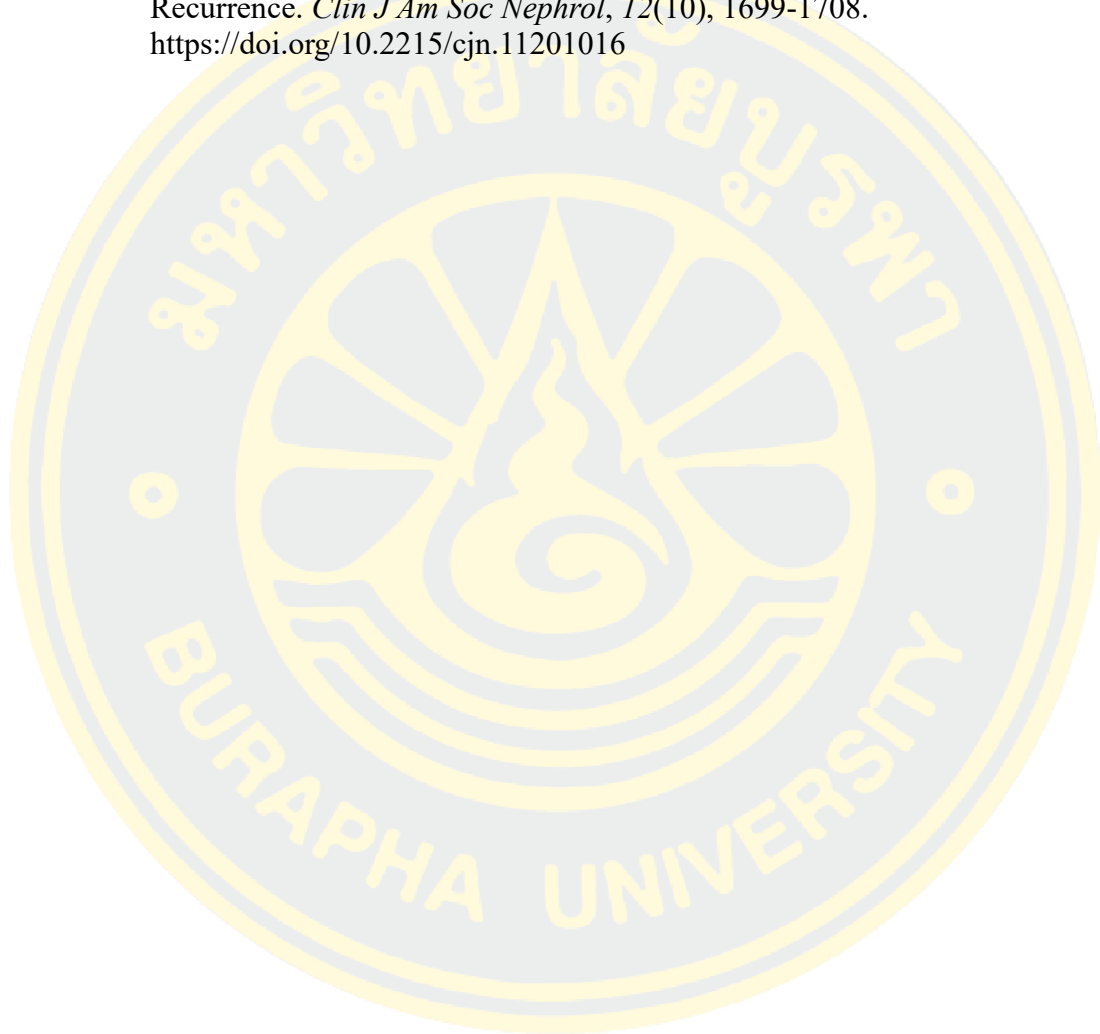
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APPENDICES



APPENDIX A

Questionnaires in English and Chinese

Part 1: The demographic questionnaire

Direction: Please read the questions carefully and give an honest answer. Please write “√” in the box of your answer or write your information in the space provided.

1. Age: _____ years
2. Weight _____ Height _____
3. Gender:
 - 1 Male 2 Female
4. Marital status
 - 1 Single 2 Married 3 Divorced 4 Widowed
5. Highest level of education
 - 1 Less than primary 2 Primary school
 - 3 Secondary school 4 High school
 - 5 Graduate and up
6. Average individual income
 - 1 Less than ¥ 2000 2 ¥ 2000-¥ 5000
 - 3 ¥ 5000- ¥ 8000 4 More than ¥ 8000
7. Occupation
 - 1 Unemployed 2 Enterprises/institutions staff
 - 3 Private business owner 4 Civil servant
 - 5 Farmers
 - Others (please specify) _____
8. Living arrangement
 - 1 Living alone 2 Living with family members or others
9. Family history of kidney stones
 - 1 No 2 Yes, how many people _____
10. The number of times you have been diagnosed with kidney stones ___(include this time)
11. Time since you first diagnosed with kidney stone: ___year ___month
12. What treatment did you have for your kidney stones in the past?
 - 1 Operation
 - 2 Medication
 - 3 Both operation and medication
 - 4 Others (please specify) _____
13. Do you have co-morbidities?
 - 1 None 2 Hyperlipidemia
 - 3 Hypertension 4 Diabetes

5 Coronary heart disease 6 Chronic kidney disease

7 Others (please specify) _____

14. Alcohol drinking status

1 No history of drinking alcohol

2 Current alcohol drinker

Duration _____ years Quantity _____ glass/day

3 Former alcohol drinker

Duration _____ years Quantity (in the past) _____ glass/day

15. Have you ever received information regarding kidney stone prevention?

1 No

2 Yes, please specify:

2.1 Health personals such as nurses, doctors etc.

2.2 Newspapers and books

2.3 Internet

2.4 Radio and television

2.5 Others (please specify) _____

16. Do you take nutritional supplement?

1 No

2 Yes, please specify _____

17. Usually, who cook for you?

1 By myself

2 By my family

3 Buy from the restaurant

4. Others (please specify) _____

Items	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Perceived barriers					
22. It is difficult for me to drink water (include tea and other drinks) more than 2.5 L every day.					
.....					
.....					
.....					
.....					
.....					
.....					
.....					
.....					
34. I don't know how to prevent the recurrence of kidney stones.					
Perceived self-efficacy					
35. I have enough confidence to promote myself to develop good dietary behaviors to prevent recurrent kidney stones.					
.....					
37. In different situations, I can stick to good dietary behaviors to prevent recurrent kidney stones.					

Part 3: The Dietary Behaviors Scale

Direction: Please try to recall the frequency of in taking in these foods in the last week. Please answer every question; mark (✓) at you selected answer. Only one answer for each question.

5 = Routinely means you practice the dietary behavior regularly or daily, or 5-7 times a week.

4 = Frequently means you often practice the dietary behavior regularly, or 3-4 times a week.

3 = Sometimes means you practice the dietary behavior occasionally, or 1-2 times a week.

2 = Seldom means you practice the dietary behavior rarely, or 1-2 times a month.

1 = Never means you do not practice the dietary behavior at all.

Dietary behavior	Routinely (5)	Frequently (4)	Sometimes (3)	Seldom (2)	Never (1)
1. I drink water more than 2.5L per day (equivalent to the amount of 5 bottles of mineral water).					
.....					
.....					
.....					
.....					
.....					
.....					
.....					
.....					
19. I control my body weight by eating more fruits, vegetables and foods high in fiber instead of high calorie foods (such as chocolate and fat meat).					

.....Thank you for your information.....

第一部分：人口调查问卷

说明：请仔细阅读问题，并诚实作答。请在您的答案的方框内打“√”或在所提供的空白处填写您的信息。

1. 年龄：_____ 岁
2. 体重 _____ 身高 _____
3. 性别：
 - 1 男 2 女
4. 婚姻状况
 - 1 单身 2 已婚
 - 3 离异 4 丧偶
5. 最高教育水平
 - 1 小学以下 2 小学
 - 3 中学 4 高中
 - 5 大学毕业及以上
6. 个人平均收入
 - 1 小于 ¥ 2000 2 ¥ 2000-¥ 5000
 - 3 ¥ 5000- ¥ 8000 4 ¥ 8000以上
7. 职业
 - 1 失业 2 企业/事业单位工作人员
 - 3 私营企业主 4 公务员
 - 5 农民 其他 _____
8. 居住的情况
 - 1 独自生活 2 与家人或其他人一起生活
9. 肾结石家族史
 - 1 无 2 有，多少人 _____
10. 您被诊断为肾结石的次数 _____ (包括这次)
11. 您第一次被诊断为肾结石的时间：_____年 _____月

12. 您过去对肾结石做过什么治疗?

- 1 手术治疗 2 药物治疗
 3 手术和药物治疗 4 其他 (请说明) _____

13. 您有其他并发症吗?

- 1 无 2 高血脂
 3 高血压 4 糖尿病
 5 冠心病 6 慢性肾病
 7 其他 (请说明) _____

14. 饮酒状态

- 1 无饮酒史
 2 目前是饮酒者: 持续时间 _____ 年 量 _____ 杯/天
 3 以前是饮酒者: 持续时间 _____ 年量 (过去) _____ 杯/天

15. 您是否收到过关于预防肾结石的信息?

- 1 没有
 2 是的, 请详细说明:
 2.1 卫生人员如护士、医生等
 2.2 报纸和书籍
 2.3 互联网
 2.4 广播和电视
 2.5 其他 (请说明) _____

16. 您服用营养补充剂吗?

- 1 没有
 2 有, 请详细说明 _____

17. 通常谁给你做饭?

- 1 自己做
 2 家人做
 3 饭店买
 4 其他 (请说明) _____

条目	非常不同意	不同意	中立	同意	非常同意
20. 限制富含嘌呤的食物（如动物内脏、家禽皮、海鲜、蘑菇、酒精）的摄入可以降低复发肾结石的风险。					
.....					
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.....					
.....					
37. 在不同的情况下，我都可以坚持良好的饮食行为，防止复发肾结石。					

第三部分：饮食行为量表

说明: 请试着回忆一下在过去的一周中摄入这些食物的频率。请回答每一个问题；在选定的答案上打(√)。每个问题只有一个答案。

5 = 常规: 意思是您定期或每天都进行的饮食行为, 或者一周5-7次。

4 = 经常: 意思是您有规律地进行的饮食行为, 或一周3-4次。

3 = 有时: 意思是您偶尔进行的饮食行为, 或一周1-2次。

2 = 很少: 意思是您很少进行的饮食行为, 或一个月1-2次。

1 = 从不: 意思是您从不进行的饮食行为。

饮食行为	常规 (5)	经常 (4)	有时 (3)	很少 (2)	从不 (1)
1. 我每天喝超过2.5L水 (相当于5瓶矿泉水的量).					
.....					
.....					
.....					
.....					
.....					
.....					
.....					
.....					
.....					
19. 我通过多吃水果、蔬菜和高纤维食物代替高热量食物(如巧克力和肥肉)来控制我的体重。					

.....感谢您提供的信息.....



APPENDIX B

Invitation letters



MHESI 8137/ 1486

Graduate School, Burapha University
169 Longhad Bangsaen Road,
Saensuk, Muang, Chonburi
Thailand, 20131

July 20th, 2021

Assist. Prof. Dr. Jufang Li
School of Nursing, Wenzhou Medical University,
Chashan Town, Ouhai District, Wenzhou City,
Zhejiang Province, P.R.China

Subject: Invitation to be an expert content to validate research instruments

Dear Assist. Prof. Dr. Jufang Li:

Enclosure: 1. Thesis proposal
2. Research instruments

Ms. HETING LIANG ID 62910070, a graduate student of the Master of Nursing Science Program (International Program), Major in Adult Nursing Pathway, Faculty of Nursing, Thailand, was approved her thesis proposal entitled: "Factors Influencing Dietary Behaviors of Adults with Recurrent Kidney Stones in Wenzhou, China" under supervision of Assist. Prof. Dr. Khemaradee Masingboon, the principle advisor and offer you to be an expert content.

On behalf of the Graduate School, Burapha University, therefore, I would like to invite you who are highly knowledgeable, capable and experienced being a qualified person to validate the research instruments (as attached). You can contact Ms. HETING LIANG via mobile phone +86-1351-1837-243 or E-mail: 413330772@qq.com

Please kindly consider.

Sincerely yours,

(Assoc. Prof. Dr. Nujjaree Chaimongkol)
Dean of Graduate School, Burapha University

Graduate School Office
Tel: +66 3810 2700 ext. 701, 705, 707
E-mail: grd.buu@go.buu.ac.th
<http://grd.buu.ac.th>



MHESI 8137/ 1487

Graduate School, Burapha University
169 Longhad Bangsaen Road,
Saensuk, Muang, Chonburi
Thailand, 20131

July 20th, 2021

Dr. Pan Huang
School of Nursing, Wenzhou Medical University,
Chashan Town, Ouhai District, Wenzhou City,
Zhejiang Province, P.R.China

Subject: Invitation to be an expert content to validate research instruments

Dear Dr. Pan Huang:

Enclosure: 1. Thesis proposal
2. Research instruments

Ms. HETING LIANG ID 62910070, a graduate student of the Master of Nursing Science Program (International Program), Major in Adult Nursing Pathway, Faculty of Nursing, Thailand, was approved her thesis proposal entitled: "Factors Influencing Dietary Behaviors of Adults with Recurrent Kidney Stones in Wenzhou, China" under supervision of Assist. Prof. Dr. Khemaradee Masingboon, the principle advisor and offer you to be an expert content.

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Please kindly consider.

Sincerely yours,

(Assoc. Prof. Dr. Nujjaree Chaimongkol)
Dean of Graduate School, Burapha University

Graduate School Office
Tel: +66 3810 2700 ext. 701, 705, 707
E-mail: grd.buu@go.buu.ac.th
<http://grd.buu.ac.th>



MHESI 8137/ 1488

Graduate School, Burapha University
169 Longhad Bangsaen Road,
Saensuk, Muang, Chonburi
Thailand, 20131

July 20th, 2021

Dr. Keming Wu
Department of Urology,
The First Affiliated Hospital of Wenzhou Medical University,
Shangcai Village, Nanbaixiang Street, Ouhai District,
Wenzhou City, Zhejiang Province, P.R.China

Subject: Invitation to be an expert content to validate research instruments

Dear Dr. Keming Wu:

Enclosure: 1. Thesis proposal
2. Research instruments

Ms. HETING LIANG ID 62910070, a graduate student of the Master of Nursing Science Program (International Program), Major in Adult Nursing Pathway, Faculty of Nursing, Thailand, was approved her thesis proposal entitled: "Factors Influencing Dietary Behaviors of Adults with Recurrent Kidney Stones in Wenzhou, China" under supervision of Assist. Prof. Dr. Khemaradee Masingboon, the principle advisor and offer you to be an expert content.

On behalf of the Graduate School, Burapha University, therefore, I would like to invite you who are highly knowledgeable, capable and experienced being a qualified person to validate the research instruments (as attached). You can contact Ms. HETING LIANG via mobile phone +86-1351-1837-243 or E-mail: 413330772@qq.com

Please kindly consider.

Sincerely yours,

A handwritten signature in blue ink, appearing to read 'Nujjaree Chaimongkol'.

(Assoc. Prof. Dr. Nujjaree Chaimongkol)
Dean of Graduate School, Burapha University

Graduate School Office
Tel: +66 3810 2700 ext. 701, 705, 707
E-mail: grd.buu@go.buu.ac.th
<http://grd.buu.ac.th>

MHESI 8137/ 1529



Graduate School, Burapha University
169 Longhaad Bansaen Rd.
Saensuk, Muang, Chonburi
Thailand, 20131

July 30th, 2021

Dr. Pan Huang
School of Nursing, Wenzhou Medical University,
Chashan Town, Wenzhou City,
Zhejiang Province, P.R.China

Subject: Invitation to be an expert content to translate a research instruments

Dear Dr. Pan Huang:

Enclosure: 1. Thesis proposal
2. Research instruments

Ms. HETING LIANG ID 62910070, a graduate student of the Master of Nursing Science Program (International Program), Major in Adults Nursing Pathway, Faculty of Nursing, Thailand, was approved her thesis proposal entitled: "Factors Influencing Dietary Behaviors of Adults with Recurrent Kidney Stones in Wenzhou, China" under supervision of Assist. Prof. Dr. Khemaradee Masingboon as the principle advisor and offer you to be an expert content.

On behalf of the Graduate School, Burapha University, therefore, I would like to invite you who are highly knowledgeable, capable and experienced being a qualified person **to translate the research instruments (as attached) from Chinese to English**. You can contact Ms. HETING LIANG via mobile phone +86-1351-1837-243 or E-mail: 413330772@qq.com

Please kindly consider.

Sincerely yours,

A handwritten signature in blue ink that reads 'Sorut Wongsuttitham'.

(Assist. Prof. Dr. Sorut Wongsuttitham)
Associate Dean of Graduate School, Burapha University
Acting of Dean of Graduate School, Burapha University

Graduate School Office
Tel: +66 3810 2700 ext. 701, 705, 707
E-mail: grd.buu@go.buu.ac.th
<http://grd.buu.ac.th>



MHESI 8137/1497

Graduate School, Burapha University
169 Longhad Bangsaen Road,
Saensuk, Muang, Chonburi
Thailand, 20131

July 20th, 2021

Assist. Prof. Dr. Jufang Li
School of Nursing, Wenzhou Medical University,
Chashan Town, Wenzhou City,
Zhejiang Province, P.R.China

Subject: Invitation to be an expert content to translate a research instruments

Dear Assist. Prof. Dr. Jufang Li:

Enclosure: 1. Thesis proposal
2. Research instruments

Ms. HETING LIANG ID 62910070, a graduate student of the Master of Nursing Science Program (International Program), Major in Adult Nursing Pathway, Faculty of Nursing, Thailand, was approved her thesis proposal entitled: "Factors Influencing Dietary Behaviors of Adults with Recurrent Kidney Stones in Wenzhou, China" under supervision of Assist. Prof. Dr. Khemaradee Masingboon, the principle advisor and offer you to be an expert content.

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Please kindly consider.

Sincerely yours,

(Assoc. Prof. Dr. Nujjaree Chaimongkol)
Dean of Graduate School, Burapha University

Graduate School Office
Tel: +66 3810 2700 ext. 701, 705, 707
E-mail: grd.buu@go.buu.ac.th
<http://grd.buu.ac.th>



APPENDIX C

Participant information sheet and consent form

เอกสารชี้แจงผู้เข้าร่วมโครงการวิจัย
(Participant Information Sheet)

รหัสโครงการวิจัย :

(สำนักงานคณะกรรมการพิจารณาจริยธรรมในมนุษย์ มหาวิทยาลัยบูรพา เป็นผู้ออกรหัสโครงการวิจัย)

โครงการวิจัยเรื่อง : ...Factors influencing dietary behaviors of adults with recurrent kidney stones in Wenzhou, China.....

Dear participants

I am Heting liang, a postgraduate student at Faculty of Nursing, Burapha University Thailand. My study is “Factors influencing dietary behaviors of adults with recurrent kidney stones in Wenzhou, China”. The objectives of this study are to ascertain the dietary behaviors and to examine influencing factors of dietary behaviors among adults with recurrent kidney stone who visit the urological department of the First Affiliated Hospital of Wenzhou Medical University, China.

This study will be a survey study. Participating in this study is voluntary. If you agree to participate in this study, you will answer the following questionnaires, which will take approximately 15-25 minutes. During the data collection period, the researcher will clarify any question posed by the participants for clarity regarding the language or content. You will not get any direct benefits by participating in this study. However, the results of this study will serve as evidence in developing care models and interventions which can help nurses and the health care workers to change dietary behaviors of patients with recurrent kidney stones, and to prevent the recurrence of the stones, resulted in improving the quality of life of patients with recurrent kidney stones. There will be no identified physical and psychological risk to the person participating in the study and no risk to the society.

You have the right to end your participation in this study at any time, and no necessary to inform the researcher, and it will not affect the quality of services you receive from the hospital. Any information collected from this study, including

your identity, will be kept confidential. A coding number will be assigned to you and your name will not be used. Findings from the study will be presented as a group of participants and no specific information from any individual participant will be disclosed. All data will be accessible only to the researcher which will be destroyed one year after publishing the findings. You will receive a further explanation of the nature of the study upon its completion, if you wish.

The research will be conducted by Ms. Heting Liang under the supervision of my major-advisor, Assistant Professor Dr. Khemaradee Masingboon. If you have any questions, please contact me at mobile number: +8613511837243 or by email 413330772@qq.com, and/or my advisor's e-mail address khemaradee@nurse.buu.ac.th. Or you may contact Burapha University Institutional Review Board (BUU-IRB) telephone number **038-102-620** or email buuethics@buu.ac.th. Your cooperation is greatly appreciated. You will be given a copy of this consent form to keep.

Heting Liang



เอกสารแสดงความยินยอม
ของผู้เข้าร่วมโครงการวิจัย (Consent Form)

รหัสโครงการวิจัย :

(สำนักงานคณะกรรมการพิจารณาจริยธรรมในมนุษย์ มหาวิทยาลัยบูรพา เป็นผู้ออกรหัส
โครงการวิจัย)

โครงการวิจัยเรื่องFactors influencing dietary behaviors of adults with recurrent kidney
stones in Wenzhou, China.....

Date of data collectionMonth.....Year

Before giving my signature below, I have been informed by researcher Miss Heting Liang about the purposes, method, procedures, benefits and possible risks associated with participation in this study, and I understood all of the explanations. I consent voluntarily to participate in this study. I understand that I have the right to leave the study at any time, without fearing that it might affect the quality of health care services that I will receive from the hospital.

The researcher Miss Heting Liang has explained to me that all data and information of the participants will be kept confidential and only be used for this study. I have read and understood the information related to participation in this study clearly and I am signing this consent form.

Signature

Participant

(.....)



APPENDIX D

Ethical approval letter and data collection letter

สำเนา

ที่ IRB3-112/2564



เอกสารรับรองผลการพิจารณาจริยธรรมการวิจัยในมนุษย์
มหาวิทยาลัยบูรพา

คณะกรรมการพิจารณาจริยธรรมการวิจัยในมนุษย์ มหาวิทยาลัยบูรพา ได้พิจารณาโครงการวิจัย

รหัสโครงการวิจัย : G-HS077/2564

โครงการวิจัยเรื่อง : Factors influencing dietary behaviors of adults with recurrent kidney stones in Wenzhou, China

หัวหน้าโครงการวิจัย : Ms.HE TING LIANG

หน่วยงานที่สังกัด : คณะพยาบาลศาสตร์

BUU Ethics Committee for Human Research has considered the following research protocol according to the ethical principles of human research in which the researchers respect human's right and honor, do not violate right and safety, and do no harms to the research participants.

Therefore, the research protocol is approved (See attached)

1. Form of Human Research Protocol Submission Version 2 : 15 November 2021
2. Research Protocol Version 2 : 15 November 2021
3. Participant Information Sheet Version 1 : 19 October 2021
4. Informed Consent Form Version 1 : 19 October 2021
5. Research Instruments Version 2 : 15 November 2021
6. Others (if any) Version - : -

วันที่รับรอง : วันที่ 16 เดือน พฤศจิกายน พ.ศ. 2564

วันที่หมดอายุ : วันที่ 16 เดือน พฤศจิกายน พ.ศ. 2565

ลงนาม นางสาวมร แยมประทุม

(นางสาวมร แยมประทุม)

ประธานคณะกรรมการพิจารณาจริยธรรมการวิจัยในมนุษย์ มหาวิทยาลัยบูรพา
ชุดที่ 3 (กลุ่มคลินิก/ วิทยาศาสตร์สุขภาพ/ วิทยาศาสตร์และเทคโนโลยี)

MHESI 8137/ 2095



Graduate School, Burapha University
169 Longhaad Bangsaen Rd.
Saensuk, Muang, Chonburi
Thailand, 20131

November 24th, 2021

To President of the First Affiliated Hospital of Wenzhou Medical University,

Enclosure: 1. Certificate ethics document of Burapha University
2. Research Instruments (Try out)

On behalf of the Graduate School, Burapha University, I would like to request permission for Ms. He Ting Liang to collect data for testing the reliability of the research instruments.

Ms. He Ting Liang, ID 62910070, a graduate student of the Master of Nursing Science program, major in Adult Nursing Pathway, Faculty of Nursing, Burapha University, Thailand, was approved her thesis proposal entitled: "Factors Influencing Dietary Behaviors of Adults with Recurrent Kidney Stones in Wenzhou, China" under supervision of Assist. Prof. Dr. Khemaradee Masingboon as the principle advisor. She proposes to collect data from 30 adults with recurrent kidney stones who aged 18 to 60 years old in the Urology Outpatient Department, the First Affiliated Hospital of Wenzhou Medical University, Wenzhou city, Zhejiang province, China.

The data collection will be carried out from December 1st - 17th, 2021. In this regard, you can contact Ms. He Ting Liang via mobile phone +86-1351-1837-243 or E-mail: 413330772@qq.com

Please do not hesitate to contact me if you need further relevant queries.

Sincerely yours,

(Assoc. Prof. Dr. Nujjaree Chaimongkol)
Dean of Graduate School, Burapha University

Graduate School Office
Tel: +66 3810 2700 ext. 701, 705, 707
E-mail: grd.buu@go.buu.ac.th
<http://grd.buu.ac.th>

MHESI 8137/ 2056



Graduate School, Burapha University
169 Longhaad Bangsaen Rd.
Saensuk, Muang, Chonburi
Thailand, 20131

November 24th, 2021

To President of the First Affiliated Hospital of Wenzhou Medical University,

Enclosure: 1. Certificate ethics document of Burapha University
2. Research Instruments

On behalf of the Graduate School, Burapha University, I would like to request permission for Ms. He Ting Liang to collect data for conducting research.

Ms. He Ting Liang, ID 62910070, a graduate student of the Master of Nursing Science program, major in Adult Nursing Pathway, Faculty of Nursing, Burapha University, Thailand, was approved her thesis proposal entitled: "Factors Influencing Dietary Behaviors of Adults with Recurrent Kidney Stones in Wenzhou, China" under supervision of Assist. Prof. Dr. Khemaradee Masingboon as the principle advisor. She proposes to collect data from 110 adults with recurrent kidney stones who aged 18 to 60 years old in the Urology Outpatient Department, the First Affiliated Hospital of Wenzhou Medical University, Wenzhou city, Zhejiang province, China.

The data collection will be carried out from December 20th, 2021 to May 31st, 2022. In this regard, you can contact Ms. He Ting Liang via mobile phone +86-1351-1837-243 or E-mail: 413330772@qq.com

Please do not hesitate to contact me if you need further relevant queries.

Sincerely yours,

(Assoc. Prof. Dr. Nujjaree Chaimongkol)
Dean of Graduate School, Burapha University

Graduate School Office
Tel: +66 3810 2700 ext. 701, 705, 707
E-mail: grd.buu@go.buu.ac.th
<http://grd.buu.ac.th>

临床研究伦理委员会

温州医科大学附属第一医院临床研究伦理委员会审查批件
(Review of Ethics Committee in Clinical Research (ECCR) of the First Affiliated Hospital
of Wenzhou Medical University)

受理编号 Acceptance Number: KY2022-027 批件号: 临床研究伦审 Issuing Number (2022) 第 (027) 号

项目名称 Project	探究温州地区复发性肾结石患者饮食行为的影响因素 Factors Influencing Dietary Behaviors of Adults With Recurrent Kidney Stones in Wenzhou, China.		
申办者 Applicant	温州医科大学附属第一医院	试验目的 Objective	临床科研 Clinical research
试验科室 Department	泌尿外科		
试验项目负责人 Principal Investigator	李海燕		
审查方式和时间 Form and Date	<input type="checkbox"/> 会议审查 Review Conference, 时间: _____ <input checked="" type="checkbox"/> 快速审查 Fast track, 时间: <u>2022年3月14日</u>		
审查地点 Review Site	新院 1-4A18 会议室		
审查材料 Documents for Review	1、医学临床科研项目及伦理审查申请表, v1.0 版; 2、临床研究方案, v1.0 版, 2021.3.31; 3、受试者知情同意书, v1.0 版; 4、研究者团队成员目录(职责); 5、主要研究者、团队成员简历及 GCP 证书, v1.0 版; 6、研究者责任声明; 7、CRF/临床观察表, v1.0 版。		
审查意见 Comments	<p>根据国家卫健委《涉及人的生物医学研究伦理审查办法》(2016)、WMA《赫尔辛基宣言》和 CIOMS《人体生物医学研究国际道德指南》的伦理原则, 经本伦理委员会审查, 同意该项目开展。</p> <p>According to the Regulations and Rules of "Ethical Reviews for Biomedical Research Involving Human Subjects" (2016) the National Health Commission of PRC, "Declaration of Helsinki" of WMA, and "International Ethical Guidelines for Human Biomedical Research" of CIOMS, the project was approved by ECCR.</p>		
主任委员/副主任委员签字 Signature of the ECCR Chair		签发日期 Date	2022.3.17
温州医科大学附属第一医院临床研究伦理委员会 (盖章) Ethics Committee in Clinical Research of the First Affiliated Hospital of Wenzhou Medical University (Seal)			
附注 (Note):			
1. 临床研究应在批准之日起 1 年内实施, 逾期未实施, 本批件自行废止。临床研究过程中将接受伦理委员会的跟踪审查, 审查频度为自批准之日起每 12 个月一次。(伦理委员会有权根据临床试验实际开展情况改变跟			

版本日期: 2021 年 06 月 21 日

BIOGRAPHY

NAME Ms. Heting Liang

DATE OF BIRTH 12 January 1996

PLACE OF BIRTH Tongzi county, Guizhou province, China

PRESENT ADDRESS Guiyang Road, Zunyi city, Guizhou Province, China

POSITION HELD student

EDUCATION 2014-2018 Bachelor of Nursing (B.S.N), Dali University, Dali, China.
2019-2023 Master of Nursing Science (International Program) (M.N.S), Faculty of Nursing, Burapha University, Chonburi, Thailand

