

# Health Literacy, Self-Care Behaviors, and Biochemical Parameters Among Hypertensive Patients with Renal Complications in the Tai Lue Ethnic Community of Thailand

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**Purpose:** Hypertension (HT) can cause renal complications or deterioration of kidney function. HT management is very important because it reduces the severity of illnesses. This study aimed to investigate the relationship between health literacy (HL), self-care behaviors (SCB), and biochemical parameters in hypertensive patients with renal complications.

**Methods:** A cross-sectional study of 405 hypertensive patients with renal complications among Tai Lue people living in Thailand was conducted using simple random sampling. Face-to-face interviews with questionnaires were used to collect information. Blood pressure (BP) and biochemical parameters, such as fasting blood sugar (FBS) and estimated glomerular filtration rate (eGFR), were measured.

**Results:** The participants' mean age was 68.3 years. A significant correlation was found between HL score, SCB score, systolic BP (SBP), diastolic BP (DBP), FBS, and eGFR ( $p < 0.01$ ). Multiple linear regression revealed that eating salty foods was a risk factor for SBP in males and for SBP and DBP in females. Body mass index (BMI) ( $B = 0.54$ ), sweet food consumption ( $B = 13.90$ ), and SCB score ( $B = -0.29$ ) were significantly associated with FBS level ( $R^2 = 17.8\%$ ,  $p < 0.05$ ). Employment ( $B = 2.55$ ), eating bland food ( $B = 4.07$ ), receiving information from family ( $B = 3.53$ ), SCB ( $B = 0.31$ ), and age ( $B = -0.51$ ) were all significant factors for eGFR ( $R^2 = 35.0\%$ ,  $p < 0.05$ ).

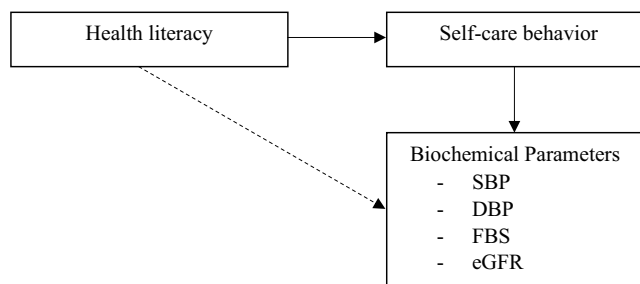
**Conclusion:** HL and SCB levels were associated with the health of hypertensive patients with renal complications in the Tai Lue ethnic community. The significance of organizing health education programs is to emphasize increasing HL to lead to self-care decisions and reduce complications in patients, resulting in improved SCB and quality of life in the future.

**Keywords:** health literacy, self-care behaviors, biological parameters, hypertension, renal complication

## Introduction

Untreated or uncontrolled high blood pressure (BP) is an important risk factor for the progression of chronic kidney disease (CKD), leading to morbidity and death.<sup>1,2</sup> When the estimated glomerular filtration rate (eGFR) is low, the kidney does not work optimally, and the incidence and severity of HT tend to increase.<sup>3</sup> HT prevalence in adults with CKD is 60.0%.<sup>3,4</sup> High BP has been identified as a major risk factor for the development of non-communicable diseases such as heart diseases, stroke, and chronic renal failure.<sup>4,5</sup> The number of new cases of HT is expected to increase by 29.0% by 2025 to approximately 1.15 billion people.<sup>6</sup> HT adversely affects the kidneys and contributes to physical dysfunction among patients, especially in elderly people.<sup>7</sup>

In Thailand, the death rate from HT was 13.10, 13.15, and 14.20 per 100,000 people in 2017–2019.<sup>8</sup> The leading causes of patients with CKD receiving renal replacement therapy in 2020 were HT (42.3%) and diabetes (41.5%).<sup>9</sup> Phayao Province is in north Thailand, with diverse ethnicities, cultures, and traditions. Eight ethnic minorities live there: the Hmong, the Mien, the Lisu, the Lu, the Lua, Thai highlanders, Tai Lue, and Thai Northeastern people,<sup>10</sup> each with



**Figure 1** Conceptual framework.

their own culture, language, and way of life. Minority groups have traditional SCB, including using local herbs, performing rituals, and ways of daily cooking.<sup>11</sup> Phayao Province is in the top 10 provinces in terms of deaths from HT, reporting a rate of 18.21–24.05 per 100,000 people.<sup>12</sup> HT was found to be very high among the Tai Lue ethnic group, especially in people aged 60 years and over (45.48%); 53.37% were patients with CKD stages 1–3 complications, more than other ethnic groups.<sup>10</sup> However, hypertension among older adults living in Thai communities can be prevented by self-care behaviors (SCB).<sup>13</sup>

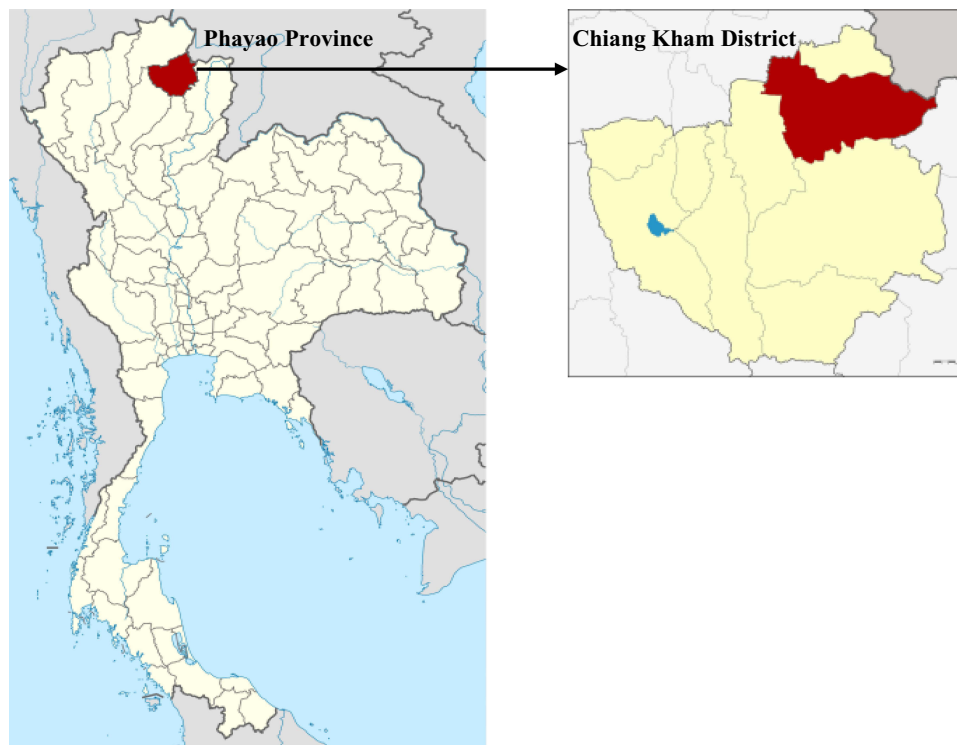
Health literacy (HL) is the ability to obtain the knowledge, skills, and confidence to take action toward health and understand necessary health information and services to make appropriate health decisions.<sup>14,15</sup> Individuals with higher education levels or socioeconomic status can have low HL if they struggle to understand and apply health information effectively.<sup>15,16</sup> Furthermore, HL is an effective factor in BP control for understanding BP measurements, risk factors and complications, necessary lifestyle changes, and treatment goals.<sup>17,18</sup> A previous study found numerous factors associated with SCB in hypertension patients with complications,<sup>19</sup> but the association between HL, SCB, and health outcomes is limited. Therefore, this study aimed to investigate the associations of HL, SCB, and blood biological parameters among hypertensive patients with renal complications in elderly Tai Lue people, based on the conceptual framework shown in (Figure 1). The findings can be used to adjust strategies for increasing knowledge and improving SCBs among hypertensive patients with renal complications in order to reduce disease severity and slow renal deterioration.

## Methodology

### Study Design and Sample Selection

This cross-sectional study was conducted between January and May 2023. Purposive sampling was employed to select a study area in Chiang Kham District, Phayao Province with a population including more than 20% of Tai Lue people (Figure 2). However, few studies were found using a theoretical concept framework focusing on an ethnic group. Simple sampling using lottery techniques was used to select research sites in ten sub-districts of Chiang Kham District, and five subdistricts were chosen: Yuan, Wiang, Fai Kwang, Nam Wan, and Chiang Ban. The researcher drew lots from the registries of hypertensive patients with kidney disease complications from Chiang Kham Hospital's HosXP system version 4.0. The sample size calculation used Khazaie's formula,<sup>20</sup>  $n = [(Z\alpha/2 \times \sigma)/E]^2$  when the population standard deviation (SD) is unknown:  $n$  = number of samples,  $Z\alpha/2$  = standard score at 95% confidence level (1.96),  $\sigma$  = SD, and  $E$  = acceptable value for tolerance error ( $\sigma/10$ ). The number of 385 participants resulted. Adding a 5% to prevent loss of the sample or incomplete data, 405 people participated in the study.

The inclusion criteria were females and males  $\geq 60$  years, an individual who has been diagnosed with hypertension and renal complications and has had at least one of these features detected for three months, such as albumin excretion rate (AER)  $> 30$  milligrams per day or  $eGFR < 60$  mL/min/1.73 m<sup>2</sup><sup>9</sup> and registered in the HosXP system version 4.0 (Secondary care) and HosXP Primary care unit (PCU) Phayao Province for at least 6 months, Tai Lue persons registered by the Highland Health Development Center and the municipality and residing in Chiang Kham District for at least 6 months, able to communicate in the local language, and who signed a written consent form and volunteered to participate. Persons with cognitive impairments, dementia, and blindness were excluded. Prior to conducting the research, an announcement was made to recruit research assistants from each subdistrict. The assistants included a nurse, two public health academics, and three village health



**Figure 2** Location of this study area in Chiang Kham District in Phayao, Thailand.

**Notes:** Adapted from [https://upload.wikimedia.org/wikipedia/commons/3/37/Thailand\\_Phayao\\_locator\\_map.svg](https://upload.wikimedia.org/wikipedia/commons/3/37/Thailand_Phayao_locator_map.svg).<sup>21</sup>

volunteers. A meeting was held to clarify the study purpose, the data collection process, techniques for completing the questionnaires, the participants' rights, privacy, re-checking the data, and related research matters step by step to ensure that everyone understood the process and took the same direction. The researcher translated the official language into the local language for the research assistants to ensure that the questionnaires' meanings stayed the same. For the data collection process, the researcher liaised with the District Public Health Office, Chiang Kham Hospital, and the Health Promoting Hospital in subdistrict. After obtaining the participants' written consent, the questionnaires were distributed. The questionnaires were self-administered by literate persons; the research assistant interviewed people who were illiterate face-to-face. The interviews were scheduled at the participant's home or the subdistrict Health Promoting Hospital between 9:00 a.m. and 5:00 p.m. or when convenient and lasted 20–30 minutes each.

## Data Collection Instruments and Procedure

The quantitative data collection tools were developed from a literature review and previous research. The researcher adapted the interview questionnaires<sup>22</sup> for use in rural areas and different ethnic groups, using a conceptual framework based on HL development.<sup>23</sup> The questionnaire comprised three parts: 1) sociodemographic information (age, gender, education, income, occupation, health status, BMI, food consumption, smoking, alcohol drinking, HT, and access to health services); 2) HL divided into six components, namely (i) ability to access information on HT and health services, (ii) HT knowledge (on pathogenesis, causes and symptoms, complications, risk behaviors, and abnormal conditions), (iii) health communication (communication about HT, requesting help, and interactions among family members, friends, or patients, village health volunteers, health staff, and people in the community), (iv) the ability to make informed decisions about HT and its prevention, and (v) health management and behavioral modification for HT prevention, focusing on daily self-reminders, competencies and skills for HT prevention and control, unhealthy food consumption and control, exercise, medication, stress management, and observation of any abnormalities or changes in the disease. The last component (vi) was on media literacy on health information, including questions focused on decision-making on reliable sources of information, healthy products, and preventive practice for HT. Part 2 contained 6 questions per section,

totaling 36 items. The characteristic of the questions were multiple choices, namely Yes, Not Sure, and No. The scoring criterion was, if correct equals to 1 point and if wrong equals to 0 points. The total score ranged from 0–36 points, and they were divided into 3 levels: critical literacy level ( $\geq 28$  points), interactive literacy level (21–27 points), and functional literacy level (scores  $\leq 20$  points). Part 3 of the questionnaire focused on SCB in HT prevention:<sup>22</sup> food consumption (10 items, not including food taste), medication (10 items), exercise (10 items), and stress management and relaxation (10 items), totaling 40 items. The questions were measured with a three-level rating scale never practiced, rarely practiced (1–3 times/week), and regularly practiced (4–7 times/week), divided into 3 levels: high scores  $\geq 80\%$  ( $\geq 96$  points), moderate scores between 60% and 79% (73–95 points) and low scores  $< 60\%$  ( $\leq 72$  points). Before using the questionnaires in the field, a try out was performed on 30 elderly people who had similar characteristics to those in the study. HL precision of Kuder-Richardson Formula: KR20 = 0.88. And for SCB questionnaire, the reliability was analyzed using Cronbach's alpha coefficient which was 0.87.

## Biochemical Parameters

The participants' blood samples were taken. They were prepared for a day, with holding water and food for at least 12 hours after 8:00 p.m. before arriving for blood collection at 7:00 a.m. the next morning. Medical technicians or professional nurses took 5 cc of blood from the patients and transported it to Chiang Kham Hospital's lab room. The blood biological indicators included fasting blood sugar (FBS) and eGFR, which was computed from creatinine using the CKD-EPI Equation.<sup>9</sup> Systolic BP (SBP) and diastolic BP (DBP) were measured using an automatic blood pressure measurement device.

## Statistical Analyses

Data were analyzed by SPSS Version 17 (SPSS Inc., Chicago, IL, USA). Continuous variables are expressed as mean  $\pm$  SD for normally distributed data. Categorical variables are expressed as numerals (percentages). The Pearson correlation coefficient ( $r$ ) was used to investigate relationships between variables such as HL, SCB, SBP, DBP, and chemical indicators (FBS and eGFR). Multiple linear regression using the stepwise method was used to identify factors such as general characteristics and self-care behavior that are associated with SBP, DBP, FBS, and eGFR in hypertensive patients with renal complications. The level of statistical significance was set at 0.05.

## Results

### Participant and Variables

Of the 405 participants, over half were female (64.0%), and the average age was 68.29 years (SD= 6.82, Min.-Max. = 60–94). Most participants (75.6%) were educated, had adequate income (66.7%), and worked (58.3%). Regarding food consumption, many (44.4%) ate bland food, followed by salty food (39.8%). They smoked cigarettes (8.9%) and drank alcohol (28.1%). Almost all received information from public health officers (93.1%), followed by village health volunteers, family, radio/television/announcements, and the internet/online media (82.5%, 46.7%, 30.9%, and 20.2%, respectively). In health terms, nearly half (45.7%) had a normal BMI, and 28.6% had obesity (mean =23.20, SD =3.34, Min.-Max. = 15.26–35.04). Considering HL levels, almost half had a functional literacy level (41.5%), followed by a critical literacy level (30.4%), and an interactive literacy level (28.1%) (mean 22.46, SD 6.15, range 5–33). In terms of SCB, the participants' scores were moderate (37.5%), high (32.3%), and low (30.2%) (mean =86.17, SD =15.48, Min.-Max. = 59–115). More than half had normal (65.2%) ( $<140$  mmHg) SBP levels, with 34.8% having abnormal levels (mean =133.46, SD =13.09, Min.-Max. = 91–184). Most DBP levels were normal (87.9%) ( $<90$  mmHg) followed by abnormal (12.1%) (mean= 78.35, SD =8.69, Min.-Max. = 54–103). In terms of blood biological parameters, more than half had eGFR at stage 2 (66.2%), followed by stage 1 (21.7%), stage 3 (11.9%), and stage 4 (0.2%) (mean =77.19, SD= 14.04, Min.-Max. = 27.47–99.16). Nearly 15% had abnormal FBS (14.8%) ( $\geq 110$  mg/dL) (mean =96.99, SD = 17.34, Min.-Max. = 70–195) (Table 1).

### Correlation Between Research Variables

The relationship between the HL score and the six HL components was statistically significant ( $p < 0.01$ ) (Table 2). The Pearson correlation coefficients were highest ( $r = 0.648$ ) between the communication and decision-making domains.

**Table 1** The Level of Health Literacy, Self-Care Behaviors, and Blood Biological Parameters Among Participants (n=405)

Variables	N (%)
<b>Health Literacy</b>	
Functional Literacy level (scores 0–21)	168(41.50%)
Interactive Literacy level (scores 22–27)	114(28.10%)
Critical Literacy level (scores 28–36)	123(30.40%)
Mean ± SD	22.46±6.15
Min. – Max.	5–33
<b>Self -Care Behaviors</b>	
Low level (scores 0–72)	122(30.20%)
Moderate level (scores 73–95)	152(37.50%)
High level (scores 96–120)	131(32.30%)
Mean ± SD	86.17±15.48
Min. – Max.	59–115
<b>Systolic blood pressure (SBP)</b>	
<140 mm/Hg	264(65.20%)
>140 mm/Hg	141(34.80%)
Mean ± SD	133.46±13.09
Min. – Max.	91–184
<b>Diastolic blood pressure (DBP)</b>	
<90 mm/Hg.	356 (87.90%)
>90 mm/Hg	49(12.10%)
Mean ± SD	78.35±8.69
Min. – Max.	54–103
<b>Chemical indicators;</b>	
<b>Estimated Glomerular Filtration Rate (eGFR)</b>	
Stage 1 (≥90 mL/min/1.73 m <sup>2</sup> )	88(21.70%)
Stage 2 (60–89 mL/min/1.73 m <sup>2</sup> )	268(66.20%)
Stage 3 (30–59 mL/min/1.73 m <sup>2</sup> )	48(11.90%)
Stage 4 (15–29 mL/min/1.73 m <sup>2</sup> )	1(0.20%)
Stage 5 (<15 mL/min/1.73 m <sup>2</sup> )	0(0.00%)
Mean ± SD	77.19±14.04
Min. – Max.	27.47–99.16
<b>Fasting Blood Sugar (FBS)</b>	
Normal (<110 mg/dl)	345(85.20%)
Abnormal (≥110 mg/dl)	60(14.80%)
Mean ± SD	96.99±17.34
Min. – Max.	70–195

Table 3 shows the relationship between all the study variables: HL, SCB, SBP, DBP, FBS, and eGFR. The total HL score was significantly correlated with the SCB score ( $r = 0.858$ ), SBP ( $r = -0.420$ ), DBP ( $r = -0.199$ ), FBS ( $r = -0.251$ ), and eGFR ( $r = 0.487$ ). The SCB score was significantly correlated with SBP ( $r = -0.486$ ), DBP ( $r = -0.225$ ), FBS ( $r = -0.318$ ), and eGFR ( $r = 0.504$ ).

## Factors Associated with Clinical Indicators

Table 4 shows the factors associated with BP levels, separately by sex, in hyper-tensive patients with renal complications using multiple linear regression. In the males, eating salty food ( $B = 6.21$ ) and the SCB score ( $B = -0.31$ ) were significant factors for the SBP level ( $R^2 = 31.7\%$ ,  $p < 0.05$ ), but only the SCB score ( $B = -0.15$ ) was a significant factor for the DBP level ( $R^2 = 6.6\%$ ,  $p < 0.05$ ). In the females, eating salty food ( $B = 4.87$ ), receiving information from village health volunteers ( $B = -6.87$ ), receiving information from radio/television/ announcements ( $B = -3.58$ ), and the SCB score ( $B = -0.21$ ) were all significant

**Table 2** Pearson Correlation Coefficients (r) Between Each Domain of Health Literacy Among Participants

Health literacy	1	2	3	4	5	6	7
1. Total HL score	1						
2. Access	0.788*	1					
3. Cognitive	0.729*	0.556*	1				
4. Communication	0.788*	0.486*	0.478*	1			
5. Decision	0.835*	0.572*	0.474*	0.648*	1		
6. Self-management	0.770*	0.535*	0.423*	0.574*	0.610*	1	
7. Media	0.725*	0.460*	0.486*	0.451*	0.534*	0.469*	1

Notes:\*Significance at the 0.01 level (2-tailed).

**Table 3** Pearson Correlation Coefficients (r) Between Health Literacy, Self-Care Behaviors, Blood Pressure, FBS, and eGFR Among Participants

	HL	SCB	SBP	DBP	FBS	EGFR
Total HL score	1					
Self-care behavior score	0.858*	1				
SBP	-0.420*	-0.486*	1			
DBP	-0.199*	-0.225*	0.387*	1		
FBS	-0.251*	-0.318*	0.223*	0.143*	1	
EGFR	0.487*	0.504*	-0.375*	-0.195*	-0.235*	1

Notes:\*Significance at the 0.01 level (2-tailed).

**Table 4** SCB and Other Factors Associated with BP Level Among Participants Using Stepwise Linear Regression, Separately by Sex

Factor	B	S.E.	Beta	P-value	95% CI	R <sup>2</sup>
SBP - Male						31.7%
Food taste						
• Salty	6.214	1.997	0.255	0.002	2.265, 10.162	
• Other	Ref.					
Self-care behavior (score)	-0.310	0.066	-0.384	<0.001	-0.441, -0.179	
SBP - Female						26.3%
Food taste						
• Salty	4.870	2.022	0.172	0.017	0.888, 8.853	
• Other	Ref.					
Receiving information						
• By health volunteer	-6.872	1.940	-0.194	<0.001	-10.692, -3.052	
• By radio/TV/announcements	-3.579	1.745	-0.125	0.041	-7.016, -0.142	
• Other	Ref.					
Self-care behavior (score)	-0.208	0.068	-0.236	0.002	-0.341, -0.075	
DBP - Male						6.6%
Self-care behavior (score)	-0.145	0.045	-0.257	0.002	-0.234, -0.055	
DBP - Female						5.6%
BMI (kg/m <sup>2</sup> )	3.211	1.106	0.176	0.004	1.034, 5.388	
Food taste						
• Salty	0.385	0.149	0.157	0.010	0.092, 0.677	
• Other	Ref.					

Abbreviation: Ref, Reference group.

**Table 5** SCB and Other Factors Associated with FBS and eGFR Among Participants Using Stepwise Linear Regression

Factor	B	S.E.	Beta	P-value	95% CI	R <sup>2</sup>
<b>FBS</b>						17.8%
BMI (kg/m <sup>2</sup> )	0.544	0.248	0.105	0.029	0.057, 1.032	
Food taste						
• Sweet	13.899	2.850	0.234	<0.001	8.295, 19.502	
• Other	Ref.					
Self-care behavior (score)	-0.289	0.052	-0.258	<0.001	-0.391, -0.187	
<b>EGFR</b>						35.0%
Age (years)	-0.512	0.094	-0.249	<0.001	-0.696, -0.328	
Occupation						
• Employed	2.547	1.277	0.090	0.047	0.035, 5.058	
• Unemployed	Ref.					
Food taste						
• Bland	4.071	1.494	0.143	0.007	1.133, 7.009	
• Other	Ref.					
Receiving information						
• By family	3.534	1.193	0.126	0.003	1.189, 5.879	
• Other	Ref.					
Self-care behavior (score)	0.310	0.049	0.342	<0.001	0.214, 0.407	

**Abbreviation:** Ref, Reference group.

factors for the SBP level ( $R^2 = 26.3\%$ ,  $p < 0.05$ ), whereas BMI ( $\beta = 3.21$ ) and eating salty food ( $B = 0.39$ ) were significant factors for the DBP level ( $R^2 = 5.6\%$ ,  $p < 0.05$ ). The FBS level was significantly related to BMI ( $B = 0.54$ ), sweet food consumption ( $B = 13.90$ ), and SCB score ( $B = -0.29$ ), accounting for 35.0% of the variance in FBS (Table 5). The protective factors for eGFR included employment ( $B = 2.55$ ), eating bland food ( $B = 4.07$ ), receiving information from family ( $B = 3.53$ ), and SCB ( $B = 0.31$ ), while age ( $B = -0.51$ ) was a risk factor ( $R^2 = 35.0\%$ ,  $p < 0.05$ ).

## Discussion

### HL Correlated with SCB and Biochemical Parameters

The findings of the research revealed associations between HL, SCB, and blood biological parameters such as BP, FBS, and eGFR among hypertensive patients with renal complications who were elderly Tai Lue people residing in rural northern Thailand. The participants' eGFR was mostly stage 2 (66.2%), abnormal FBS was low (14.8%), and almost half had a functional literacy level. When the six HL components were classified, the scores for ability to assess knowledge about HT and health services and cognitive skills were low and moderate, respectively.

HL scores were statistically significantly correlated with SCB, SBP, DBP, FBS, and eGFR. The HL items with low scores were information on HT and its complications: uncontrolled BP, HT leading to kidney failure, and a BP of 140/90 mmHg considered normal. This aligns with a systematic review that found that low HL is a major risk factor for poor BP control, leading to adverse health outcomes.<sup>24</sup> Interactive HL, which was the lowest in this study, refers to cognitive and social skills to actively participate in everyday situations and make informed choices to improve healthy behaviors.<sup>25</sup> Knowledge of HT was significantly associated with SCB (eg, weight control and medication intake), in line with research in Iran.<sup>26</sup> Some studies also indicate that patients with high knowledge of diabetes are 1.85 times more likely to achieve glycemic control goals than patients with low knowledge of diabetes.<sup>27</sup> Consistent with a previous study in northern Thailand, HL was statistically significantly associated with FBS and HbA1C.<sup>28</sup>

Almost half the participants had moderate SCB scores. Considering the questionnaire's individual items, the participants had poor food consumption behavior, in particular adding high amounts of seasoning (eg, salt, fish sauce, soy sauce) when cooking, eating food containing monosodium glutamate and high-sodium foods (eg, salted fish, fermented fish, rotten beans, and pickled mustard, a local food). Previous research indicates that most SCBs are moderate to low, which can be explained by social, cultural, and self-management factors, folk medicine treatment, self-medication

by buying from a drugstore, beliefs and traditional treatment, and lifestyles being risk factors affecting SCB.<sup>29</sup> This aligns with a study in Ethiopia that showed an overall level of self-care of 53.1%.<sup>30</sup> Several studies have indicated that differences in patients' SCBs are due to factors such as HL levels and/or self-care attitudes.<sup>31,32</sup>

## SCB and Other Factors Associated with Biochemical Parameters

Analyzing the relationship of variables, eating salty foods and SCB were associated with SBP levels in the males, while eating salty foods, receiving information from health volunteer and radio/TV/announcements, and SCB were associated with SBP levels in the females. SCB is a cost-effective tool in health management and preventing HT and its complications.<sup>30–32</sup> People with uncontrolled BP have been found to be twice as likely to have poor self-management as people with high BP ( $p=0.003$ ) and poor social support; both are independent predictors of poor SCB.<sup>30</sup> Also, SCBs were correlated with DBP levels in the males. BMI, eating salty foods, and SCB were statistically correlated with DBP levels in the females. Previous studies suggest differences may relate to differences in populations, livelihoods, cultures, economic status, and health facility access.<sup>30</sup> Consistent with a study by Irwan, food consumption in Southeast Asia continues to be closely affected by culture in terms of saltiness, oiliness, and using coconut milk in cooking.<sup>33</sup> Some studies suggest that females are at increased risk of DBP and likelier to have health complications compared to males.<sup>34</sup> BMI, salt intake, and smoking are associated with SCB and statistically significantly affect BP.<sup>33,35</sup> The long-term effects of uncontrolled BP may increase the incidence of CKD.<sup>36</sup>

We found that BMI, sweet food consumption, and SCB had statistically significant relationships with FBS with 17.8% variance. The participants had poor food consumption behaviors, which can be explained by the uniqueness of the Tai Lue community in term of indigenous food, a traditional way of life, and culture; they lack awareness to make the right food choices, resulting in poor dietary and health behaviors.<sup>11</sup> Similar to a study among ethnic northern Thais, the study participants mostly had moderate and low SCB scores; increased BMI was significantly associated with SCB and affected FBS.<sup>29</sup> This study's results are similar to those of research in India that reported that 62.9% of respondents' SCB level were unfavorable, influenced by negative perceptions of health status (odds ratio =  $-2.8$ ).<sup>37</sup>

Age, occupation, eating bland food, receiving information from family and SCB were significantly associated with eGFR with 35.0% variance. The results are similar to a previous study that described SCB as the ability to take care of oneself and perform necessary activities to achieve, maintain, or promote optimal health; self-care is individuals' ability to deal with illness, disability, economic status, and access to health information from various sources.<sup>38</sup> Diet is one of the main management modalities for alleviating metabolic disorders and renal function deterioration.<sup>38,39</sup> A study in Taiwan concluded that age and a BMI  $< 24$  kg/m<sup>2</sup> were significantly associated with CKD patients' self-care,<sup>39</sup> and other research found that SCB and disease awareness in patients with CKD are closely related.<sup>38,40</sup> Therefore, good SCB is one of the best ways to alleviate the adverse outcomes associated with CKD.

## Limitations and Recommendations

This study has several limitations. First, the participants were ethnic Tai Lue people residing in Chiang Kham District, Phayao Province; therefore, our findings cannot be representative of other populations across the country, highlighting the need for caution in interpreting the effects of study results in diverse populations. Second, this cross-sectional study could not draw causal conclusions but only link the relationships among HL, SCB, BP levels, and blood biological parameters. Third, reporting bias cannot be eliminated. Although the study tool was adapted from previous research and the questionnaire was tested for validity and reliability, the results may not be able to verify causal relationships among HL, SCB, BP level and chemical indicators because the context is different, and there may be discrepancies from the interviews in which the participants did not provide truthful information. Because the researcher is on the local public health team, future studies should focus on other factors associated with HT such as duration of illness, amount of drug used per day, albuminuria, and history of NSAID or steroid use and include the use of herbal medicines and dietary supplements. Prospective and randomized studies are required to confirm whether the cross-sectional findings can be translated into clinically useful interventions. A qualitative study of healthcare teams should be conducted on interventions to encourage patient involvement in health behaviors that help slow the progression of CKD and improve the quality of life among Tai Lue people.



## Conclusion

HL was associated with SCB, which may have an impact on BP levels, FBS, and eGFR control in elderly hypertensive patients with renal complications. These data can be used to improve renal function and develop a care plan for patients with high BP, such as improving HL by emphasizing access to accurate and reliable disease information, communicating, and making informed decisions about healthcare options to avoid complications. Furthermore, self-management skills programs that enable patients to address dietary choices, weight control, social support, and other relevant personal factors will result in positive health outcomes and help delay the progression of kidney deterioration.

## Data Sharing Statement

The datasets generated during and/or analyzed during the current study will be available upon reasonable request from the first author. Email: eungkaew@gmail.com

## Ethical Approval and Information Consent

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the University of Phayao Human Ethics Committee, Thailand (UP-HEC 1.3/004/66 approved 15 December 2022). The trial was registered participants gave a written informed consent prior to data collection.

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## Author Contributions

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

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## Disclosure

The authors report no conflicts of interest in this work.

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