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RESEARCH ARTICLE

Self-care Behaviors and Lipid Profiles among an Ethnic Minority Adult Population in Thai Rural Communities

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Abstract:

Background:

Health perceptions and increased self-care behaviors can effectively prevent and control many diseases and improve one's health. This study aimed to investigate the association of self-care behaviors with lipid profiles and creatinine among an ethnic minority adult population in Thai rural communities.

Methods:

A cross-sectional study was performed from January to April 2021 among ethnic minorities from hill tribe communities of Phayao Province, Northern Thailand. A total of 252 adults ages 20 and older were recruited from various ethnic groups, including Indigenous (34.5%), Hmong (25.4%), and Mien (40.1%) peoples. The data were obtained from face-to-face interviews using questionnaires and from blood samples.

Results:

Multiple linear regression revealed that self-care behavior score was associated with ethnicity, age, education, and self-efficacy score ($p < 0.05$). Total cholesterol level was associated with ethnicity, gender, financial status, drinking alcohol, smoking, and underlying disease ($p < 0.05$). Low-density lipoprotein cholesterol level was associated with gender, financial status, and drinking alcohol ($p < 0.05$). Creatinine level was predicted by ethnicity, gender, age, smoking, and self-care behaviors ($p < 0.05$). Alcohol consumption was found to be a predictor of body mass index and blood pressure ($p < 0.05$).

Conclusion:

Health promotion programs for specific populations should emphasize public health benefits (*e.g.*, reducing risk factors of non-communicable diseases (NCDs), increasing health awareness and health beliefs for better outcome expectations, and enhancing the ability to perform self-health management routinely) in accordance with the local context of the studied population.

Keywords: Self-care behaviors, Self-efficacy, Lipid profile, Creatinine, Ethnic minority, Adult population.

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1. INTRODUCTION

According to the World Health Organization, non-communicable diseases (NCDs) have caused 40.5 million deaths worldwide, accounting for 71% of all death [1]. More than 50% of the population dies from premature death (death among people ages 30 to 69 years), which affects the global labor supply, productivity, and economy [1, 2]. The burden of NCDs-such as cardiovascular disease, stroke, hypertension, chronic renal failure, and cancer has increased in Thailand [3], and these diseases have become the top cause of mortality, accounting for 72% of all deaths in 2016 [3]. The top five NCDs in Thailand in terms of death rates are cancer, stroke, cardiovascular disease, diabetes, and hypertension; these

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diseases are largely the result of behavioral risk factors and metabolic aspects [1, 4]. Behavioral risk factors include smoking, physical inactivity, improper diet and nutrition, obesity, and alcohol consumption; metabolic risk factors are high blood pressure, high blood sugar, and high blood fats [4, 5]. These two main factors have been implicated in the development of chronic diseases [1, 4]. Previous studies have shown that most of these risks are generated by individuals' own behaviors related to lifestyle, the aging process, and working conditions [2].

Phayao Province is located in the upper north of Thailand and is administratively divided into nine districts with geographical areas of forests and steep mountains. Pong District is a remote area with diverse ethnic groups, social and cultural backgrounds, and traditions [6]. Many ethnic people live in the mountainous areas, and most of their ancestors migrated from northwestern Yunnan Province, China, to northern Thailand in the past century [7]. There are four main ethnic groups: Hmong, Mien (Yao), Thin, and Lishu [8]. Each of these ethnic groups has its own culture, tradition, language, and way of life. A review of the literature suggests that these minorities have primitive self-care behaviors, especially in terms of daily cooking [7]. Ethnic people use a variety of ingredients in most of the food depending on their socio-economic status [9]. Some tribes use a large amount of lard oil for cooking, while others use large amounts of salt [9]. One similarity among ethnic groups in terms of cultural patterns is drinking during traditional and religious ceremonies [8]. Ethnic minority groups are defined as vulnerable population and have been reported to have many health problems, including NCDs such as hypertension, diabetes, hyperlipidemia, and other diseases [7, 8]. A previous study in Chiang Rai Province in Thailand found that the majority of hill tribe members had poor knowledge and attitude scores regarding disease prevention and control [10]. Several factors, including smoking, excessive alcohol consumption, unhealthy diet, and physical inactivity, are behavioral risk factors that lead to the development of NCDs [11]. Similarly, a previous report outlined that most NCDs share common behavioral and/or biological risk factors [12]. In addition, previous studies have also concluded that risk factors for NCDs vary according to socio-demographic characteristics of a population [13, 14].

Health-promoting behaviors are one of the best ways to maintain and improve health [15]. Health-promoting activities allow people to track their health, which is useful for improving individual and community health [15, 16]. This study applied Pender's health promotion model (HPM) as a research planning framework [15]. HPM allows people to visualize several predictive factors of health-related behaviors, and it has been successfully used to predict changes in lifestyles among patients [17]. Various studies have emphasized the effectiveness of this model in controlling unhealthy behaviors [18, 19]. Previous studies have revealed that lifestyle modifications for better hypertension control can be achieved if well-planned activities are chosen based on knowledge and experience [20]. To the best of our knowledge, there have been no previous studies examining the relevance of HPM constructs in predicting disease control behaviors and lipid profile risk factors in this rural area. Moreover, there is currently little data on how an abnormal lipid profile can lead to serious health problems. Therefore, this study aimed to assess the associations among self-care behaviors, lipid profiles, and creatinine among an ethnic minority adult population in Thai rural communities.

2. METHODOLOGY

2.1. Materials and Methods

2.1.1. Study Design and Population

This cross-sectional study was conducted as part of the Unit of Excellence Project "Health Promotion and Quality of Life." The data were collected from January to April 2021 in Pha Chang Noi Sub-district, Pong District, Phayao Province. Access to primary health care systems is difficult in this area due to geographical distance. A secondary health care center is located about 109 kilometers away from the city center and is difficult to commute to; moreover, there are a limited number of medical personnel to provide health services. Green's formula [21] was used to calculate the sample size ($n \geq 50 + 8m$; where n is the number of samples used and m is the number of predictors studied). As a result, the minimum sample size needed was 154 people. Of the entire population of the district, 252 people met the inclusion criteria and voluntarily took part in the study.

The participants were recruited for the research project through village health volunteers, the village headman, and public health officers from the primary care unit. The inclusion criteria for the selected participants were (a) female and male adults ages 20 years and over who (b) were part of an ethnic minority group registered with the High Area of Health Development Center (Marginalized Ethnic Groups) Department of Health, Ministry of Public Health and Municipalities in the area; (c) had resided in the area for at least 2 years; (d) were able to communicate in a local language; and (e) had signed a written consent form before participating in the research. Persons with cognitive or psychological disorders or with gestational diabetes were excluded from the study.

2.1.2. The Tool of Data Collection

This study applied quantitative questionnaires from previous studies with the questions adapted for appropriateness to the local community. The questionnaire consisted of four parts. Part 1: Demographic characteristics included ethnicity, gender, age, marital status, education, working status, financial status, underlying diseases, alcohol consumption, and smoking. Part 2: NCD-related knowledge [22] had a total of 12 items. Questions were multiple choice, and the total possible score ranged from 0 to 12 points. Scores were divided into three levels: high (≥ 10 points), moderate (8– 9 points), and low (≤ 7 points). Part 3: Self-efficacy in NCD prevention was based on a previous study by Boonyathee and Pender's HPM [7, 11]. The measurement rating scale for the 10 items consisted of three levels: disagree, uncertain, and agree. The total possible score ranged from 0 to 30 points and was divided into three levels: high (≥4 points), intermediate (19–23 points), and low (≤17 points). Part 4: Self-care behaviors in NCD Prevention

was based on a previous study [7, 11]. It was comprised of 30 items equally divided into three areas: diet, exercise, and stress management. The rating scale had three levels: never practice, practice sometimes (1–4 times/ week), and practice regularly (≥ 5 times/week). The scores were divided into high (≥ 80%; ≥ 72 points), moderate (60–79%; 55–71 points), and low (< 60%, ≤ 54 points).

The item-objective congruence technique was used to validate all queries, and the questionnaires were checked by three external experts in their respective fields (internal medicine, behavioral health, and public health). After the reliability and validity had been checked, the questionnaires were tested with a sample of 30 people with demographics similar to the ethnic populations in this study. For Part 2 of the questionnaire, the Kuder–Richardson Formula 20 reliability score was 0.78. For Parts 3 and 4, the reliability of the questionnaire analysis using Cronbach's alpha coefficient was 0.82 and 0.80, respectively. The medical examination included body mass index (BMI), blood pressure measurement, and blood sampling. Blood samples were collected after overnight fasting. A lab test for biomarkers was interpreted and analyzed by a licensed medical technologist and tested by a qualified laboratory at the school of Allied Health Sciences, University of Phayao. An aliquot of 3 mL of plasma was sent for lab tests, while the remainder of the blood samples were separated and kept at -80°C for further investigation.

2.3. Data Collection Procedure

Prior to beginning the research, 10 research assistants were recruited from the sub-district area. The assistants were comprised of two public health scholars, one nurse, and seven village health volunteers with the ability to communicate in the local northern language and ethnic language as well as the research skills needed to access study participants. Four hours prior to data collection, a meeting between the researcher and assistants in the area was organized in order to clarify the objective of the research, data collection techniques, understanding of the questionnaire's assessment, scheduling interviews, and the rights and privacy of the study participants. Then, the village headman announced the overall objective of the research, explaining necessary information to the village in the local language. This information included how to schedule an appointment, that participants must abstain from eating and drinking 8 hours prior to having a blood sample drawn, and related information on self-preparation for data collection. After receiving the consent forms from participants, a 3-mL (5-mL blood specimen) was drawn, and the participants were interviewed using face-to-face interviews and questionnaires. All interviews were conducted in one day at the Pha Chang Noi Sub-district municipality auditorium with the help of the research assistants. The assistants interviewed each participant for approximately 10 to 15 minutes.

2.4. Statistical Analysis

Data were analyzed by SPSS Version 17 (SPSS Inc., Chicago, IL, USA). Multiple linear regression with the backward method was used to investigate factors associated with NCD prevention self-efficacy scores, self-care behavior scores, and medical examination results (BMI, blood pressure, total cholesterol, LDL, and creatinine). The method criteria set p-value < 0.05 as entry and p-value ≥ 0.10 as removal.

3. RESULTS

3.1. Sample Characteristics

The mean age of the participants was 45.3 years (SD = 10.05, Min = 30, Max = 74). Ethnic minorities were classified as Mien (40.1%), Indigenous (34.5%), and Hmong (25.4%). More than half of the respondents (51.6%) drank alcohol, and 29.4% smoked. The scores for knowledge ranged from 4 to 11, with a mean of 7.13 (SD = 1.76). The self-efficacy variable found that the scores ranged from 15 to 29, with a mean of 19.95 (SD = 2.51). The scores for self-care behaviors ranged from 47 to 73 (mean = 59.75, SD = 6.83) (Table **1**).

The mean BMI of the participants was 24.22 ± 3.71 kg/m^2. The mean (SD) systolic blood pressure (SBP) was 133.23 (17.42) mmHg and diastolic blood pressure (DBP) was 84.12 (10.26) mmHg. Interestingly, we found a prevalence of high total cholesterol (TC; defined as ≥ 200 mg/dl) in 59.1% (mean = 203.89, SD = 33.22). A high mean TC level was found in 65.3% of Mien, 62.5% of Mhong, and 49.5% of Indigenous participants. The low-density lipoprotein (LDL) cholesterol level was abnormal (≥ 100 mg/dl) for 69.8% of participants (mean = 119.83, SD = 31.05). A high mean LDL level was found in 76.2% of Mien, 70.3% of Mhong, and 62.1% of Indigenous participants. Results revealed that 4.4% of participants had serum creatinine levels ≥ 1.2 mg/dl, which was interpreted as abnormal. Only the Mien ethnic group had abnormalities in serum creatinine levels (Table **2**).

Table 1. General characteristics of the study participants.

Variables	Overall n= 252	Indigenous n= 87	Mien n= 101	Hmong n= 64
Gender	-	-	-	-
Male	108 (42.9)	30 (34.5)	44 (43.6)	34 (53.1)
Female	144 (57.1)	57 (65.5)	57 (56.4)	30 (46.9)
Age (years)	-	-	-	-
Mean ± SD	45.33±10.05	42.37±8.09	45.67±10.74	48.80±10.25
Min - Max	30-74	30-60	30-73	30-74
Marital status	-	-	-	-
Single/widowed/separated	163 (64.7)	59 (67.8)	69 (68.3)	35 (54.7)

(Table 1) contd.....

Married	89 (35.3)	28 (32.2)	32 (31.7)	29 (45.3)
Education	-	-	-	-
No	131 (52.0)	40 (46.0)	60 (59.4)	31 (48.4)
Yes	121 (48.0)	47 (54.0)	41 (40.6)	33 (51.6)
Working status	-	-	-	-
Not working	19 (7.5)	7 (8.0)	7 (6.9)	5 (7.8)
Currently working	233 (92.5)	80 (92.0)	94 (93.1)	59 (92.2)
Financial status	-	-	-	-
Insufficient	110 (43.7)	28 (32.2)	47 (46.5)	35 (54.7)
Sufficient	142 (56.3)	59 (67.8)	54 (53.5)	29 (45.3)
Underlying disease	-	-	-	-
No	179 (71.0)	68 (78.2)	68 (67.3)	43 (67.2)
Yes	73 (29.0)	19 (21.8)	33 (32.7)	21 (32.8)
Alcohol consumption	-	-	-	-
No	122 (48.4)	48 (55.2)	40 (39.6)	34 (53.1)
Yes	130 (51.6)	39 (44.8)	61 (60.4)	30 (46.9)
Smoking status	-	-	-	-
Non-smoker	178 (70.6)	69 (79.3)	61 (60.4)	48 (75.0)
Smoker	74 (29.4)	18 (20.7)	40 (39.6)	16 (25.0)
Knowledge on NCDs	-	-	-	-
Low level (scores ≤ 7)	140 (55.6)	39 (44.8)	65 (64.4)	36 (56.2)
Moderate level (scores 8 - 9)	85 (33.7)	27 (31.0)	33 (32.7)	25 (39.1)
High level (scores ≥ 10)	27 (10.7)	21 (24.1)	3 (3.0)	3 (4.7)
Mean ± SD	7.13±1.76	7.74±1.96	6.66±1.60	7.03±1.49
Min - Max	4-11	4-11	4-11	4-10
Self-efficacy in NCD prevention	-	-	-	-
Low level (scores ≤ 18)	101 (40.1)	29 (33.3)	50 (49.5)	22 (34.4)
Moderate level (scores 19 - 23)	115 (45.6)	35 (40.2)	44 (43.6)	36 (56.2)
High level (scores ≥ 24)	36 (14.3)	23 (26.5)	7 (6.9)	6 (9.4)
Mean ± SD	19.95±2.51	20.94±2.79	19.20±2.22	19.78±2.08
Min - Max	15-29	18-27	15-29	15-25
Self-care behaviors	-	-	-	-
Low level (scores ≤ 54)	78 (31.0)	20 (23.0)	43 (42.6)	15 (23.4)
Moderate level (scores 55 - 71)	157 (62.3)	56 (64.4)	54 (53.4)	47 (73.4)
High level (scores ≥ 72)	17 (6.7)	11 (12.6)	4 (4.0)	2 (3.2)
Mean ± SD	59.75±6.83	62.25±7.54	57.50±5.82	59.88±6.14
Min - Max	47-73	50-73	47-73	49-73

Table 2. Medical examination results of participants categorized based on minority group.

Variables	Overall n= 252	Indigenous n= 87	Mien n= 101	Hmong n= 64
Body Mass Index (BMI) (km/m^2)	-	-	-	-
Mean ± SD	24.22±3.71	24.51±3.72	24.26±3.91	23.76±3.38
Min - Max	16.02-36.85	16.02-36.84	18.01-36.20	17.48-31.39
Systolic blood pressure (SBP)	-	-	-	-
<140 mmHg	163 (64.7)	66 (75.9)	60 (59.4)	37 (57.8)
>140 mmHg	89 (35.3)	21 (24.1)	41 (40.6)	27 (42.2)
Mean ± SD	133.23±17.42	129.39±16.85	134.76±18.25	136.09±
Min - Max	90-186	90-168	100-186	105-185
Diastolic blood pressure (DBP)	-	-	-	-
<90 mmHg	181 (71.8)	67 (77.0)	72 (71.3)	42 (65.6)
>90 mmHg	71 (28.2)	20 (23.0)	29 (28.7)	22 (34.4)
Mean ± SD	84.12±10.26	82.57±11.35	84.66±9.32	85.38±10.01

(Table 2) contd.....

Min - Max	58-107	58-107	60-107	64-107
Total cholesterol (TC)	-	-	-	-
Normal (<200 mg/dl)	103 (40.9)	44 (50.6)	35 (34.7)	24 (37.5)
Hight (≥200 mg/dl)	149 (59.1)	43 (49.4)	66 (65.3)	40 (62.5)
Mean ± SD	203.89±33.22	198.88±34.85	203.42±31.84	211.45±32.22
Min - Max	127-310	129-272	127-310	147-310
Low-density lipoprotein cholesterol (LDL)	-	-	-	-
Normal (<100 mg/dl)	76 (30.2)	33 (37.9)	24 (23.8)	19 (29.7)
Hight (≥ 100 mg/dl)	176 (69.8)	54 (62.1)	77 (76.2)	45 (70.3)
Mean ± SD	119.83±31.05	122.25±36.96	118.73±26.32	118.29±29.40
Min - Max	72-240	72-240	73-200	72-194
Serum Creatinine	-	-	-	-
Normal (0.6-1.2 mg/dl)	241 (95.6)	87 (100.0)	90 (89.1)	64 (100.0)
Hight (≥1.2 mg/dl)	11 (4.4)	0 (0.0)	11 (10.9)	0 (0.0)
Mean ± SD	0.79±0.20	0.71±0.13	0.89±0.23	0.76±0.16
Min - Max	0.40-1.81	0.40-1.00	0.49-1.81	0.48-1.18

3.2. Factors Associated with the NCD Prevention Self-efficacy Scores, Self-care Behavior Scores, and Medical Examination Results among Participants

In the final model, ethnicity, age, underlying disease, and knowledge scores regarding NCDs were significantly associated with NCD prevention self-efficacy scores (r^2 = 70.0%). Ethnicity, age, education, and self-efficacy scores were significantly associated with NCD prevention self-care behavior scores (r^2 = 59.4%). In terms of the medical examination results, gender, financial status, and alcohol consumption were significantly associated with BMI (r2 = 6.4%). Age, financial status, and alcohol consumption explained 19.1% of the variance in SBP. Age and alcohol consumption accounted for 13.2% of the variance in DBP. Ethnicity, gender, age, education, financial status, alcohol consumption, smoking, and underlying diseases were all factors that predicted TC level (r^2 = 29.1%). Gender, education, financial status, alcohol consumption, and smoking were all predictors of LDL levels (9.9%). Ethnics, gender, age, smoking, and NCD prevention self-care behaviors all predicted creatinine levels (30.1%) (Tables **3**-**5**).

Table 3. Factors associated with self-efficacy scores in NCD prevention.

Factor	B	Beta	P-value	95% CI
Ethnics (Mien)	-.627	-.125	.003	-1.036, -0.218
Ethnics (Hmong)	-.439	-.078	.060	-0.896, 0.019
Age (years)	.021	.085	.027	0.002, 0.039
Underlying disease (yes)	-.584	-.109	.002	-0.959, -0.210
Knowledge (scores)	1.125	.811	.000	1.019, 1.230

Table 4. Factors associated with self-care behavior scores in NCD prevention.

Factor	B	Beta	P-value	95% CI
Ethnics (Mien)	-1.286	-.092	.028	-2.434, -0.138
Age (years)	-.063	-.093	.027	-0.119, -0.007
Education (yes)	2.699	.198	.000	1.500, 3.898
Self-efficacy (scores)	1.663	.611	.000	1.415, 1.912

Table 5. Factors associated with medical examination results.

Outcome	Factor	B	Beta	P-value	95% CI
BMI	Gender (Female)	1.448	0.193	0.003	0.498, 2.398
	Financial status (Sufficient)	0.854	0.114	0.065	-0.052, 1.761
	Drinking alcohol (Yes)	1.326	0.179	0.006	0.383, 2.270
Systolic BP	Age (years)	0.417	0.240	<0.001	0.198, 0.635
	Financial status (Sufficient)	-6.157	-0.176	0.007	-10.586, -1.728
	Drinking alcohol (Yes)	8.993	0.259	<0.001	5.066, 12.921
Diastolic BP	Age (years)	0.288	0.282	<0.001	0.169, 0.407
	Drinking alcohol (Yes)	4.597	0.224	<0.001	2.214, 6.980

(Table 5) contd.....

Total Cholesterol	Ethnics (Hmong)	10.830	0.142	0.012	2.432, 19.229
	Gender (Female)	19.875	0.297	<0.001	11.025, 28.724
	Age (Years)	0.401	0.121	0.055	-0.009, 0.812
	Education (Yes)	-7.173	-0.108	0.057	-14.568, 0.222
	Financial status (Sufficient)	-11.830	-0.177	0.005	-19.984, -3.676
	Drinking alcohol (Yes)	18.107	0.273	<0.001	10.070, 26.143
	Smoking (Yes)	15.272	0.210	<0.001	6.850, 23.695
	Underlying disease (Yes)	13.364	0.183	0.006	3.807, 22.921
LDL	Gender (Female)	7.916	0.127	0.050	0.000, 15.833
	Education (Yes)	-7.135	-0.115	0.067	-14.783, 0.513
	Financial status (Sufficient)	-11.209	-0.179	0.004	-18.778, -3.641
	Drinking alcohol (Yes)	8.677	0.140	0.038	0.475, 16.879
	Smoking (Yes)	7.670	0.113	0.087	-1.115, 16.456
Creatinine	Ethnics (Mien)	0.121	0.293	<0.001	0.076, 0.167
	Gender (Female)	0.078	0.190	0.001	0.033, 0.122
	Age (Years)	0.002	0.120	0.034	0.000, 0.005
	Smoking (Yes)	0.120	0.269	<0.001	0.071, 0.169
	Self-care behaviors (Scores)	-0.006	-0.191	0.001	-0.009, -0.002

4. DISCUSSION

This is the first study to evaluate the associations association between self-care Behaviors, lipid profiles, and creatinine among an ethnic minority adult living in the highlands of Phayao Province, Thailand. Furthermore, our study, using Pender's framework, describes the effects that occur due to biological, cultural, and societal factors in the subjects' rural highlands. Regarding the health status among ethnic minorities, it was found more than half of the participants had abnormal TC (59.1%, mean = 203.89) and LDL (69.8%, mean = 119.83) levels. Several similar studies have found that serum cholesterol concentrations tend to increase with age [7, 23 - 25]. A meta-analysis conducted in the Asia-Pacific region showed that 1 mmol/L higher than normal TC was associated with 45% (95%CI: 35–55%) risk of myocardial infarction or coronary death [26]. The prevalence of high creatinine was reported in 4.4% of the participants (mean = 0.79, SD = 0.20), indicating that these people were likely to be at risk of renal disease. In Thailand, the prevalence of the renal disease is 17.5%, while the global reported average is 13.4% [17 - 29]. A meta-analysis regarding the prevalence of chronic kidney disease indicated that an increase in creatinine level results in a decrease in renal function and that chronic kidney disease is significantly associated with risk factors such as obesity (OR = 1.33), high blood pressure (OR = 2.55), diabetes (OR = 2.25), and hypertriglyceridemia (OR = 1.45) [28].

For the knowledge scores regarding NCDs, more than half of the participants obtained low (55.6%) and moderate (33.7%) scores. This is a factor most of the participants were illiterate and residing in remote areas, which can be barriers preventing them from accessing education. Cognitive processes developed through learning and experience influence a person's ability to perform self-care management and make healthy behavior decisions [30]. Previous studies have found that more than half of ethnic minority people obtained knowledge scores at low and moderate levels [7, 31, 32]. Some studies have shown that language differences are a major barrier to communication among patients and health personnel [33] and can result in miscommunication and misinformation during a health visit [34, 35].

Regarding self-efficacy, most of the participants obtained moderate (45.6%) and low (40.1%) scores. This was because the participants had low self-expectation outcomes and decision-making power regarding health care practices for preventing and controlling NCDs. This is consistent with Bandura's finding that self-efficacy determines the manifestation of behaviors and actions aimed at better expectation outcomes [30]. As previous studies have shown, self-efficacy affects an individual's management of their health behavior in many ways, and low self-efficacy has been shown to lead to inadequate self-care behaviors among diabetes patients [25, 36].

In terms of self-care behaviors, the majority of participants obtained moderate (62.3%) and low (31.0%) scores. Our results show that engaging in risky behaviors, such as eating, smoking, and drinking alcohol, can lead to the development of NCDs. A review of the literature suggests that health care behaviors among ethnic minority groups are similar, especially in using sweet, salty, and oily ingredients (*e.g.*, coconut milk, salt, and lard oil) in daily cooking [7, 9]. Thus, ethnic minority adults' health care behaviors and practices rely on the beliefs, traditions, cultures, and lifestyles of their ethnic group [33]. Similar to previous research studies people with low and inadequate self-care behaviors (*e.g.*, cigarette smoking, alcohol consumption, physical inactivity, and insufficient consumption of fruits and vegetables) were at risk of developing NCDs [2].

Age, congenital disease, and knowledge were found to be significantly associated with self-efficacy. The Hmong and Mien participants had lower average self-efficacy scores than the Indigenous group. Individual factors such as age, gender, experience, and social environment affect an individual's learning process, which in turn affects their belief in their own potential to achieve set goals [30]. Some studies have suggested that patients with high self-efficacy tend to have better glycemic control than those with moderate or low self-

efficacy [25, 37, 38].

Ethnicity, age, and education were statistically associated with self-care behaviors. The Mien had lower self-care behavior scores compared to the Hmong and Indigenous groups. According to Pender's theory, individuals' characteristics and experiences influence their actions and behaviors regarding their health [15]. Previous studies have confirmed that individual factors such as age, ethnicity, and education can be significant predictors of healthcare behaviors [25, 33, 38, 39]. Additionally, people with high self-efficacy have shown statistically significant improvement in self-care behaviors [25, 33]. Previous studies, a multiple linear regression, also showed that high self-efficacy had a significant impact on the improvements of self-care behaviors among diabetic patients [36].

In terms of the studied variables, we found that participants who consumed alcohol were more likely to have a significantly higher BMI when adjusted for gender. The study also found that alcohol consumption was significantly associated with high SBP and DBP. According to Pender's theory, biological factors, including gender and BMI can, directly and indirectly, influence the commitment to practicing health-promoting behaviors [15, 17]. Similarly, found that alcohol consumption and ethnicity were factors affecting healthcare behavior [2, 40]. Several studies indicate that alcohol consumption had a significant impact on BMI and high blood pressure and that drinking was a risk factor for NCDs [2, 7]. The Hmong ethnic group had significantly higher TC levels compared to the Mien and Indigenous groups. Similar previous studies found that the Hmong ethnic group was statistically more likely to have higher blood lipids than the Akha ethnic group [9, 10].

The present study also found that smoking and drinking alcohol were significantly associated with TC. The participants in the present study were ethnic minority adults living in Phayao Province, and they had different social and cultural backgrounds, resulting in different health behavior practices. Many ethnic minority adults use alcohol in religious ceremonies [8, 33]. After offering the alcohol to a holy spirit, they will drink it. These minorities believe that drinking alcohol after offering it to the holy spirit will help them stay healthy, and they consider drinking alcohol as a symbol of their economic status [33]. Similar findings in West Nepal indicated that some ethnic groups offer alcohol to a holy spirit during religious rituals [2, 41]. Previous studies explained that self-care behaviors toward health among the highland ethnic groups were poor due to a high rate of alcohol consumption and cigarette smoking as well as ignorance of health consequences [8, 33].

In addition, we found that gender, education, smoking, drinking alcohol, and income adequacy were significantly associated with LDL. One possible explanation is that social and individual factors influence one's beliefs, leading to actions and consequences [30]. However, comparative results on the relationship between smoking habit, blood pressure, and LDL control in patients and found that smoking can be a significant predictor of the development of health complications [27, 42]. Diet and cultural lifestyle factors among these minority groups were inherited from their ancestors who migrated from China [8]. Moreover, smoking and drinking alcohol are also predictive factors for LDL cholesterol levels and are significantly positively associated with HbA1C in myocardial infarction patients [27, 43].

Ethnicity, age, gender, smoking, and self-care behaviors were found to be significantly associated with creatinine levels. The Mien ethnic group had higher creatinine levels than the other two groups. When analyzed using a multivariate regression model, age, female gender, and smoking were significantly positively associated with creatinine levels [29, 44]. A traditional way of life and cultural background influence health behavior practices among ethnic minority adults, which can be seen in their daily cooking, ritual ceremonies, and drinking behaviors [7, 27]. Studies previously reported that the Mien ethnic group uses verdant seasonings, such as salt and fish sauce, to enhance the flavors of their foods; similarly, other ethnic groups use unhealthy food for their cooking, such as large amounts of salt and monosodium glutamate [7, 9].

Limitations of this study. The study was performed with a small sample in a remote rural area in Phayao province Thailand, which is not necessarily representative of the general population. However, as a strength, this study was conducted on ethnic groups and during the area's COVID-19 outbreak. Additionally, information regarding health status obtained from self-reports may have some discrepancies. However, most of the participants were diagnosed at a healthcare facility in the community to prevent discrepancies from happening during the study. In future studies, additional variables may be identified, such as exercise, diet, stress management, and other related factors. Furthermore, additional biomarker types should be studied for comparison, and a follow-up should be conducted. A qualitative study may also be considered to explore cultural perspectives on health care behaviors to gain in-depth insight into the participants' health problems.

CONCLUSION

The study found an increase in the prevalence of lipid profiles and creatinine.

Due to the geographical distance, access to health services, educational institutions, and government operations was limited among these ethnic minorities. Knowledge gained from this study can be used as evidence for government agencies, policymakers, and local public health officials to improve the health and well-being of highland ethnic groups. Biological and social factors, especially female gender, should be an area of focus, as they have a higher risk of NCDs. The Mien and Hmong ethnic groups should undergo health screenings for early treatment and proactive health promotion programs. Behavioral modification programs should emphasize increasing NCD-related knowledge, how to make healthy food choices, food labels, and self-efficacy to reduce NCD risk factors and complications.

LIST OF ABBREVIATIONS

NCDs	=	Non-communicable diseases;
HPM	=	Health promotion model
SBP	=	Systolic blood pressure

DBP	=	Diastolic blood pressure
LDL	=	Low-density lipoprotein
TC	=	Total cholesterol.

AUTHORS' CONTRIBUTIONS

C Mafu, K Seangpraw, and P Ong-Artborirak led the conceptualization of the topic focus, design study, searched relevant literature and studies, and provided research materials. S Boonyathee, P Tonchoy, and S Kantow developed the methods section and data collection. N Auttama, M Choowanthanapakorn, P Ong-Artborirak data collection and interpretation. P Winaiprasert and K Seangpraw wrote the initial draft of the article, organized the discussion and provided support for the derived results. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by the University of Phayao Human Ethics Committee, Thailand (UP-HEC-1.2/023/64).

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All human research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

CONSENT FOR PUBLICATION

A written informed consent was obtained from each participant prior to the study.

AVAILABILITY OF DATA AND MATERIALS

The data that support the findings of this study are available on request from the corresponding author [K.S].

STANDARDS OF REPORTING

STROBE guidelines were followed.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest, financial or otherwise.

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