

Prevalence and Factors Associated with Tongue Coating Changing Among Dyslipidemia Patients in Chiang Rai, Thailand: A Chinese Medical Practices

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ABSTRACT

Introduction: Dyslipidemia belongs to the category of ‘blood turbidity’ in Traditional Chinese medicine. The deficiency and excess of viscera, the ups and downs of qi and blood, the profit and loss of body fluid, the severity of the disease, etc., can be objectively reflected on the tongue coating.

Objective: To investigate the characteristics of tongue coating changes in patients with dyslipidemia.

Method: This study was a cross-sectional study, with data collected from medical records and tongue imaging. All cases come from 266 patients with dyslipidemia who were diagnosed and treated in a total of 2 hospitals in Chiang Rai province, Thailand, namely Somdet Prayannasungworn Hospital and Public Health Service Center, Municipal No.2 (San Nong), from August 1, 2022 to October 31, 2022. This study was approved by the clinical research ethics committee of Chiang Rai Provincial Health Office, Thailand (CRPPHO 52/2565). Data was analyzed by descriptive statistics, including mean, standard deviation, percentages, and chi-square.

Results: A total of 266 individuals were recruited into the analysis; 38.72% were males, 61.28% were females, aged between 30 and 90 years. A large proportion of family history and comorbidities were Hypertension. BMI within 18.5–24.9 (Normal weight) and 25.0–29.9 (Pre-obesity). A large proportion of blood lipids; 40.60% were TC <200 mg/dL, 36.84% were TG<150 mg/dL, 33.83% were LDL-C<100 mg/dL and 49.62% were HDL-C 40–59 mg/dL. In terms of tongue coating, among the 266 patients with dyslipidemia, 132 cases of thin coating accounted for the highest proportion, reaching 49.62%, and other coatings from high to low were greasy coating, thick coating, dry coating, peeled coating, moist coating, slippery coating, and mirror tongue. Total Cholesterol (TC) >200mg/dL was associated with a thin coating (p-value <0.05).

Conclusion: The information from this study can be used to plan health prevention and promotion to improve patients with dyslipidemia and provides an objective basis for the wider application of tongue coating in guiding the traditional Chinese medicine treatment of Thai patients with dyslipidemia in Thailand.

Keywords: Thailand, Traditional Chinese medicine, Dyslipidemia, tongue diagnosis

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Introduction

Western medicine shows that blood lipids refer to the general designation of substances such as cholesterol and triglycerides in human blood, and the onset of dyslipidemia is caused by abnormal lipid metabolism. Whether total cholesterol, triglycerides, low-density lipoprotein levels are higher than normal, or high-density lipoprotein cholesterol levels are lower than normal, all are considered to be dyslipidemia. Recently, Aekplakorn et al included 19,021 Thai adults in their study to analyze the epidemiology of dyslipidemia in Thailand and judged dyslipidemia according to the blood lipid levels in the healthy physical examination of the subjects. The results showed that the total cholesterol, LDL-C, triglycerides, and HDL-C were 206.4, 128.7, 131.4, and 46.9 mg/dL, respectively. At the same time, the prevalence of low HDL-C in the Thai population was 47.1%, the prevalence rate of high triglycerides was 38.6%, and the prevalence rate of high LDL-C was 29.6%. The overall survey results showed that among 19,021 Thai adults, the prevalence rate of dyslipidemia was 66.5%, and the prevalence rate in northern Thailand was generally higher [1]. A cross-sectional study by the Medical Research Network of the Consortium of Thai Medical Schools (Medical Research Network of the Consortium of Thai Medical Schools) in 2010-2014 showed that 88.9% of diabetic patients had dyslipidemia [2]. Dyslipidemia is a modern medical term. There is no record of this disease name in Traditional Chinese medicine. In recent years, according to the pathological characteristics of its onset, some Chinese medicine scholars have proposed that dyslipidemia belongs to the category of 'blood turbidity' in Traditional Chinese medicine [3, 4]. In the history of Traditional Chinese medicine, there are concepts about dyslipidemia including vertigo, chest obstruction, phlegm retention, etc. In the article 'Lingshu Wei Qi Disorder', it is said: 'People have fat, grease, and flesh...' In addition to 'flesh', the two parts of fat and grease represent blood lipids to a certain extent; According to the article 'Lingshu Wulong Body Fluid Classification', 'The body fluid of the five grains, which is combined into a grease... tonifying the brain marrow...' According to the above traditional Chinese medicine theory, Traditional Chinese medicine believes that the fat and grease in the human body belong to one of the trace substances, that can provide energy for the development of the human body and daily activities, but the overexpression of the two substances in the human body can cause the occurrence and development of various diseases. During the onset of dyslipidemia, the change in the tongue coating is more obvious [5, 6]. In recent years, the modern application of tongue diagnosis in traditional Chinese medicine has attracted more and more attention from the academic circle. In addition to common clinical tongue diagnosis methods, many tongue diagnosis strategies combined with modern technology have emerged [7]. Ruan Ming and others included 97 patients with malignant tumors and

depression in their research included them in the experimental group, and analyzed their tongue coatings with the modern tongue diagnosis technology Four Diagnosis Instrument. The results showed that the grayscale of the tongue coatings in the experimental group was significantly lower in healthy people [5]. Li Hongqin and others included 80 patients with OSAHS in their study and analyzed their tongue coatings using modern tongue diagnosis technology. The results of the study showed that taking tongue color as an example, the disease of spotted tongue was the most serious, and the condition of patients with pale tongue was milder. In terms of tongue coating, patients with thin and white coating are milder, while yellow, thick, and greasy coating is the most serious condition. Most OSAHS patients are obese people, and the key indicator of obese people's tongue coating is yellow and greasy coating. This study is the traditional Chinese medicine classification of OSAHS provides a certain basis [6]. Que Tiesheng, et al [8] analyzed the tongue coatings of nearly 50 malignant tumor patients with the help of the four-diagnosis instrument. The test results showed that compared with normal people, the tongue coating of patients with malignant tumors was obviously darker and yellower. From the perspective of traditional Chinese medicine theory, due to the deficiency of qi and blood in such patients, the system in the body is not running smoothly, and the blood flowing to the tongue is insufficient. Therefore, tongue diagnosis can help us understand the development of the disease in patients with malignant tumors. Limin et al [9] observed the tongue images of patients with neurological deficits in patients with acute cerebral infarction, and the results showed that the more severe the disease, the more stagnant the sublingual collaterals. This also shows that tongue diagnosis has a certain diagnostic effect on such patients, and the research results can provide an important basis for the diagnosis of the severity of the disease. Ran et al [10] conducted a study on 520 patients with chest obstruction and randomly divided them into two groups, one with chest pain symptoms and the other with no chest pain symptoms. The tongue coating, tooth marks, and ecchymosis of each patient were observed with a tongue image acquisition instrument. It was found that the tongue coating area of the patients with chest pain symptoms was significantly more than that of the control group, and there were also significant differences in other indicators between the two groups. Zhao Jing et al [11] used the tongue hyperspectral data to collect 154 outpatient data from the cardiovascular department, and the results showed that there were significant differences in the tongue between hypertensive patients and hypertensive patients with coronary heart disease, indicating that it can be used as a diagnostic basis for disease development. Medical staff can judge the condition by observing and analyzing the patient's tongue image and taking corresponding measures in time.

The deficiency and excess of viscera, the ups and downs of qi and blood, the profit and loss of body fluid, the severity of the disease, the depth of the disease location, etc., can be objectively reflected on the tongue coating. From a clinical point of view, this study conducted a preliminary analysis of the prevalence of dyslipidemia patients and tongue coating changes in 266 Thai patients with dyslipidemia.

Methodology

A cross-sectional study was applied, with data collected from medical records and tongue imaging, aged 18 years or older. All cases come from 266 Thai patients with dyslipidemia who were diagnosed and treated at Somdet Prayannasungworn Hospital and Public Health Service Center, Municipal No.2 (San Nong), Chiang Rai Province, Thailand from August 1, 2022 to October 31, 2022. This study was approved by the clinical research ethics committee of Chiang Rai Provincial Health Office in Thailand (CRPHO 52/2565).

The inclusion criteria are: (1) Have been diagnosed with dyslipidemia; (2) age ≥ 18 years; gender is not limited; (3) Four blood lipids (TG, TC, LDL-C, HDL-C); (4) traditional Chinese medicine (TCM) tongue diagnosis; (5) Informed consent, willing to participate. The exclusion criteria are (1) Those under the age of 18; (2) Incomplete blood lipid testing and TCM tongue diagnosis; (3) Pregnant and lactating women; (4) Patients with infectious diseases and mental illness.

Data collection: sex, age, nationality, blood group, family history, comorbidities, weight, height, BMI, systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol (TC), triglyceride (TG), low-density lipoprotein (LDL-C) and high-density lipoprotein (HDL-C) of the patients were detected. The patient's tongue coating was taken and recorded after the patient agreed.

Data processing and analysis: After the collection of data, these were edited. All the collected data were summarized and scrutinized carefully and then recorded. Finally, relevant tables were prepared by the objectives of the study. Data is presented mostly in tabular form because it is simple in calculation, widely used, and easy to understand. Microsoft Excel program and IBM-SPSS Statistics program (Version 20, IBM Corp.) were used for data analysis, including mean, standard deviation, percentages, and chi-square.

Results

A total of 266 individuals were recruited into the analysis; there were 103 males and 163 females; aged 30-90 years, with an average age of (62.27 ± 9.63) years. A large proportion of family history and comorbidities were hypertension. BMI within 18.5–24.9 (Normal

weight) and 25.0–29.9 (Pre-obesity). A large proportion of blood lipids; 40.60% were TC < 200 mg/dL, 36.84% were TG < 150 mg/dL, 33.83% were LDL-C < 100 mg/dL and 49.62% were HDL-C 40-59 mg/dL (Table 1).

Table 1 General characteristics of patients with dyslipidemia

Characteristic	n	%
Total	266	100.0
Sex		
Male	103	38.72
Female	163	61.28
Age (years)		
30-39	4	1.50
40-49	19	7.14
50-59	76	28.57
60-69	110	41.35
70-79	48	18.05
80-89	8	3.01
≥ 90	1	0.38
<i>Mean = 62.27 years, SD = 9.63, Min = 35, Max = 90</i>		
Nationality		
Thai	266	100.0
Blood group		
A	52	19.55
B	66	24.81
O	135	50.75
AB	13	4.89
Family history of an illness		
Hypertension	99	37.22
Diabetes mellitus	68	25.56
Chronic kidney disease	3	1.13
COPD	2	0.75
Gout	2	0.75
Asthma	1	0.38
Throat cancer	1	0.38
Depressive disorder	1	0.38
Heart disease	1	0.38
Comorbidities		
Hypertension	225	84.59
Diabetes mellitus	145	54.51
Chronic kidney disease	82	30.83
Asthma	19	7.14
COPD	11	4.14
Coronary Artery Disease	11	4.14
Depressive disorder	6	2.26
Thyrotoxicosis	4	1.50
Epilepsy	3	1.13
Colon cancer	2	0.75
Atrial fibrillation	2	0.75
Generalized anxiety disorder	1	0.38
Rheumatoid	1	0.38
Tuberculosis	1	0.38
Post-traumatic stress disorder	1	0.38
Gout	1	0.38
Stroke	1	0.38

Characteristic	n	%
Weight (kg)		
40-49.9	35	13.16
50-59.9	73	27.44
60-69.9	93	34.96
70-79.9	36	13.53
80-89.9	19	7.14
90-99.9	8	3.01
≥ 100	2	0.75
Height (cm)		
130-139.9	6	2.26
140-149.9	49	18.42
150-159.9	116	43.61
160-169.9	74	27.82
170-179.9	20	7.52
≥ 180	1	0.38
BMI		
< 18.5 (Underweight)	8	3.01
18.5–24.9 (Normal weight)	110	41.35
25.0–29.9 (Pre-obesity)	110	41.35
30.0–34.9 (Obesity class I)	32	12.03
35.0–39.9 (Obesity class II)	4	1.50
≥ 40 (Obesity class III)	2	0.75
Systolic blood pressure (mmHg)		
< 120 (Optimal)	33	12.41
120-129 (Normal)	36	13.53
130-139 (High normal)	81	30.45
140-159 (Hypertension Level 1)	100	37.59
160-179 (Hypertension Level 2)	16	6.02
≥ 180 (Hypertension Level 3)	-	-
≥ 140 (Isolated systolic hypertension (ISH))	116	43.60
Diastolic blood pressure (mmHg)		
< 80	182	68.42
80-84	32	12.03
85-89	23	8.65
90-99	24	9.02
100-109	3	1.13
≥ 110	2	0.75
Isolated systolic hypertension (ISH) < 90	237	89.09
Total Cholesterol (mg/dL)		
< 200 (Desirable)	108	40.60
200-239 (Borderline high)	103	38.72
≥ 240 (High)	55	20.68
Triglyceride (mg/dL)		
< 150 (Normal triglycerides)	98	36.84
150-199 (Borderline-high triglycerides)	82	30.83
200-499 (High triglycerides)	83	31.20
≥ 500 (Very high triglycerides)	3	1.13
LDL-C (mg/dL)		
< 100 (Optimal)	90	33.83
100-129 (Near optimal/above optimal)	76	28.57
130-159 (Borderline high)	60	22.56
160-189 (High)	25	9.40
≥ 190 (Very high)	15	5.64

Characteristic	n	%
HDL-C (mg/dL)		
<40 (Low)	35	13.16
40-59	132	49.62
≥ 60 (High)	99	37.22

Prevalence of dyslipidemia patients found that classified by type of blood lipid; the highest percentage was abnormal triglyceride (63.16%), followed by abnormal total cholesterol (59.40%), abnormal LDL-C (37.60%), and abnormal HDL-C (13.16%) (Table 2).

Table 2 The differences in blood lipids among patients with dyslipidemia (n=266)

Blood lipid	n	%
Abnormal Total Cholesterol (> 200 mg/dL)		
Abnormal	158	59.40
Normal	108	40.60
Abnormal Triglyceride (> 150 mg/dL)		
Abnormal	168	63.16
Normal	98	36.84
Abnormal LDL-C (> 130 mg/dL)		
Abnormal	100	37.60
Normal	166	62.40
Abnormal HDL-C (< 40 mg/dL)		
Abnormal	35	13.16
Normal	231	86.84

In terms of tongue coating, among the 266 Thai patients with dyslipidemia, 132 cases of thin coating accounted for the highest proportion, reaching 49.62%. Other coatings from high to low were greasy coating, thick coating, dry coating, peeled coating, moist coating, slippery coating, and mirror tongue, accounting for 28.20%, 6.77%, 6.39%, 4.14%, 2.26%, 1.88%, and 0.75%, respectively (Table 3).

Table 3 The differences of tongue coating by patients with dyslipidemia

Tongue coating	n	%
Thin coating	132	49.62
Greasy coating	75	28.20
Thick coating	18	6.77
Dry coating	17	6.39
Peeled coating	11	4.14
Moist coating	6	2.26
Slippery coating	5	1.88
Mirror tongue	2	0.75

This study found that abnormal total cholesterol was associated with thin coating statistically significantly (p-value <0.05). Patients with abnormal total cholesterol had a more thinner coating than patients with normal total cholesterol, 65.91%, and 34.09%, respectively (Table 4).

Table 4 The associated of abnormal total cholesterol and thin coating by patients with dyslipidemia

Total Cholesterol	Thin coating n (%)	No Thin coating n (%)	X ²	p-value
Abnormal Total Cholesterol	87 (65.91)	71 (52.99)	4.60	0.032*
Normal Total Cholesterol	45 (34.09)	63 (47.01)		

* Significant level at $\alpha=0.05$

Discussion

Dyslipidemia refers to a class of diseases mainly manifested by abnormal serum lipid metabolism. It is one of the important risk factors for various cardiovascular and cerebrovascular diseases such as heart disease and ischemic stroke. Traditional Chinese medicine refers to dyslipidemia as ointment fat, which is believed to be caused by insufficient innate endowment, improper diet, old age, weakness, and emotional disorders. The pathogenesis is weakness of the spleen, stomach, kidney yang, and abnormal distribution of water and grain essence and body fluids, leading to phlegm turbidity and endogenous dampness.

Observation is the first of the four diagnostic methods in traditional Chinese medicine. As an important component of observation in traditional Chinese medicine, tongue diagnosis has extremely important significance and value in determining the rise and fall of positive qi, the nature of pathogenic diseases, the depth of disease location, and predicting the prognosis and prognosis of diseases in clinical practice. The theory of traditional Chinese medicine points out that the tongue, as an important organ of the human body, can reflect the operation of internal organs to a certain extent. Therefore, traditional Chinese medicine can understand the condition of the body by observing the changes in the tongue. Once there is a problem with an organ in the body, it will affect the blood flow to the tongue and eventually lead to corresponding changes in the tongue. The tongue is not only an important organ of the human body but also reflects the development of certain diseases [12]. With the rapid development of modern medicine, new technologies such as artificial intelligence and big data analysis can provide strong support for us to optimize tongue diagnosis. With the support of the above technologies, the characteristics of tongue diagnosis can be further refined, thus laying a solid foundation for clinical diagnosis [13]. Clinically, the common changes in traditional Chinese medicine tongue coating include thin coating, greasy coating,

thick coating, dry coating, peeled coating, moist coating, slippery coating, and mirror tongue. Tongue coating refers to a layer of coating spread on the tongue surface, which fumigates the stomach qi upwards from the stomach qi. Food turbidity is formed by condensing on the tongue surface.

In this study, a total of 266 patients with dyslipidemia in Thailand were included. In terms of tongue coating distribution, 132 cases with thin coating accounted for the highest proportion, and other coatings from high to low were greasy coating, thick coating, dry coating, peeled coating, moist coating, slippery coating, and mirror tongue. Total Cholesterol (TC) >200mg/dL was associated with a thin coating (p-value <0.05).

In terms of thin coating, it is mainly divided into two directions: If it is in a state of health, suggesting that the stomach has qi for growth and development. If it is in a state of illness, it means that the condition is mild and the stomach qi is not injured. In conclusion, the distribution of tongue coating in patients with dyslipidemia in Thailand is mainly thin coating, which means that the condition is mild and patients with abnormal total cholesterol had more thin coating than patients with normal total cholesterol. However, tongue diagnosis mainly relies on the naked eye recognition of traditional Chinese medicine doctors under natural light, which can largely guide clinical diagnosis and treatment. At present, due to the lack of a unified standard for tongue diagnosis in traditional Chinese medicine, most research has focused on a certain disease, indicator, or technology. Due to the different instruments, methods, and technologies used and the inability to consider multiple aspects, there may be bias in the data and some limitations. Therefore, the path of objectification, informatization, and scientific sound of traditional Chinese medicine tongue diagnosis is still long, and researchers need to continuously research and explore to promote the development of objectification of tongue diagnosis and the process of scientific sound of traditional Chinese medicine.

Conclusion

The information from this study can be used to plan health prevention and promotion to improve patients with dyslipidemia in Chiang Rai, Thailand. In traditional Chinese medicine clinical treatment based on syndrome differentiation, accurate diagnosis needs to grasp the changing regularity of tongue coating and distinguish its commonness and individuality. This study provides an objective basis for the wider application of tongue coating in guiding the traditional Chinese medicine treatment of Thai patients with dyslipidemia in Thailand.

Recommendations

The current study can be interpreted as a first step in the research on tongue coating changes among dyslipidemia patients in Chiang Rai, Thailand in Chinese medical practices. The number of cases observed in this paper is small, there is still a need for future research to expand the sample size and extend the research in the future.

Competing interests

The authors had no competing interests to declare.

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