Research Article

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Lifestyle Medicine Factors Associated with Blood Pressure Level among Pre-Ageing Individuals with Hypertension in a Network of Primary Care Units in Thailand

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Abstract

This research aims to study the lifestyle medicine factors associated with blood pressure level among pre-aging individuals with hypertension in a network of primary care units in Thailand. This study uses an analytic cross-sectional design. The purposive sampling was used to select the study area for data collection. Data were collected among 139 participants from September to December 2023. The blood pressure was measured in a sitting position using digital sphygmomanometer. The lifestyle medicine behavior was evaluated using a questionnaire developed by the researchers. Results of the multiple regression analysis showed that there was no significant correlation between sample characteristic and blood pressure levels. However, there were seven lifestyle medicine behaviors associated with the blood pressure level: moderate to vigorous exercise for at least 150 minutes per week; warming up and cooling down before and after exercise; monitoring pulse rate during exercise; consuming whole fruits equivalent to the size of a fist (four pieces per day), or bite-sized fruit pieces (six to eight pieces per day); consuming dried nuts and seeds four to five handfuls per week; monitoring weight or waist circumference; and drinking alcoholic beverages to aid sleep. Some lifestyle medicine factors were associated with blood pressure level among pre-aging people. These factors could be useful for the care of pre-aging individuals with hypertension.

Keywords: Lifestyle medicine, Hypertension, Pre-aging, Blood pressure level

What was Known

- Thailand is going to be an aging country and needs to prepare its population for that situation.
- Hypertension is one of the biggest health problems in Thailand that needs to be solved.
- Lifestyle medicine helps to control and prevent hypertension.

What's New and Next

- Lifestyle medicine has the possibility to be used as a primary treatment for hypertension.
- Research focusing on lifestyle medicine should be performed to promote the well-being of pre-aging people with hypertension.

Introduction

The increase in the aging population leads to an elevating number of non-communicable diseases (NCDs) in aging people and health problems regarding physical deterioration[1]. Hypertension is one of the NCDs which critically affects people. World Health Organization (WHO) found that nearly 1.3 billion people aged 30-79 years old had hypertension. Moreover, it is a factor that causes other diseases such as myocardial infarction, cerebrovascular disease, and kidney disease, which can lead to premature death[2]. In 2019-2020, the prevalence of hypertension increased, showing a relationship with age[3].

In 2021, Thailand was announced to be an aging society, similar to Singapore and Vietnam. This affects quality of life among people worldwide, both at present and in the future in economic, environment, and quality-of-life aspects[4]. Thus, it is important to make them independent and to reduce the risk of NCDs in the future. The appropriate age for preparing for an aging society is the pre-aging period, or people aged 45-59 years[4]. As for the risk of hypertension among people aged 45-59 years, smoking and alcohol consumption were identified as contributing factors[3].

The American College of Lifestyle Medicine[5] has proposed the root-cause treatment of chronic disease called "Lifestyle Medicine." Lifestyle medicine is defined as an evidence-based medical specialty that applies therapeutic lifestyle interventions to treat, reverse, and prevent chronic conditions. Lifestyle medicine has been shown to reduce the risk of NCDs such as diabetes mellitus, dyslipidemia, cardiovascular disease, and diseases related to the endocrine

system[6]. Regarding hypertension, diets mainly composed of meat and starch were predicted to cause poor blood pressure control compared with diets without meat and starch as main components. Additionally, engaging in some physical activity for 30 minutes to one hour predicted better blood pressure control[7]. Moreover, A study of 4-month lifestyle modification program found that diet and exercise could lower blood pressure in patients with resistant hypertension[8].

In Thailand, the Ministry of Public Health has established the Lifestyle Medicine Institute, which aims to driving the mission of health promotion and environmental sanitation, covering health promotion and environmental sanitation services, management of health risk factors, and management of environmental sanitation[9]. A study on factors influencing blood pressure control among primary hypertensive patients in Samut Songkhram Province using secondary data indicated that salty food consumption, exercise behavior, smoking habits, and adherence to prescribed medications were statistically significant predictors of blood pressure control[10]. Another study found the significant predictors of hypertension preventive behaviors among pre-hypertension, including female gender, social support, and knowledge[11]. However, the studies mentioned above focused on a wide range of age group (over 18 years old), and the studies focusing on the pre-aging individuals were limited.

Therefore, this study aims to provide foundational information on lifestyle medicine factors associated with blood pressure levels among pre-ageing individuals with hypertension in Thailand. The findings could be used to inform healthcare services and strategic planning for the care of pre-elderly hypertensive patients.

Materials and Methods

Study Design & Study Population

This study employed an analytic cross-sectional design.

Study population consisted of pre-aging individuals with hypertension residing within the Ban Nong Hua Ling Health Promoting Hospital Network of Primary Care Units. This health-promoting hospital network was specifically chosen and covers four subdistricts: Na Hin Lad, Khok Kruat, Nong Saeng, and Ko Wai. This network consists of five health-promoting hospitals: Nong Hua Ling Health Promoting Hospital, Ban Mai Health Promoting Hospital, Ban Phromphet Health Promoting Hospital, Ban Bung Khao Health Promoting Hospital, and Ban Na Mai Health Promoting Hospital.

The research was conducted from September to December 2023.

Inclusion Criteria

1. Aged between 45–59 years (Pre-aging)
2. Diagnosed with hypertension and/or other chronic illnesses by a physician
3. Receiving treatment regularly
4. Able to read or understand spoken Thai
5. Willing to participate in the study after being fully informed

Exclusion Criteria

1. Having Visual or hearing impairments
2. Having Mental health issues or psychiatric disorders

Sample Size Calculation

The sample size was calculated using Yamane's formula[12]. The calculation method is detailed as follows:

$$n = \frac{N}{1 + Ne^2}$$

n = Sample size

N = Population (The total pre-ageing population was 213 persons.)

e^2 = Margin of error (0.05)

$$n = \frac{213}{1 + (213x(0.05)^2)} 0.0025 = 139$$

The total sample size required was 139 participants.

Participants were allocated proportionally by residence (or outpatient status) from five health-promoting hospitals and selected using convenience sampling.

Measures & Procedures

This research included two questionnaires. The first questionnaire collected personal data and contained 10 questions, including gender, age, educational level, occupation, income, weight, height, underlying disease other than hypertension, duration of hypertension diagnosis, and blood pressure level on the survey day. Gender was assessed using the options, male or female. Educational level was assessed using the options primary school, junior high school, high school, or undergraduate and above. Occupation was assessed using options freelancer,

agriculture, housemaid, vendor, government officer, or no occupation. Income was assessed using the options less than 5,000 baht, 5,001–10,000 baht, 10,001–15,000 baht, or more than 15,001 baht. Underlying diseases other than hypertension were assessed using the options diabetes mellitus, dyslipidemia, chronic kidney disease, cancer, asthma, cardiovascular disease, old cerebrovascular accident, gout, and no underlying disease other than hypertension. Blood pressure was measured in a sitting position with the arm positioned at heart level, using digital sphygmomanometer belonging to each health-promoting hospital on the survey day. Participants were recommended to rest for 10–15 minutes before blood pressure measurement. The digital sphygmomanometers were calibrated before use in this study. Avoidance of risky substances, a pillar of lifestyle medicine, included three questions on smoking, alcohol consumption and substance use, which were asked as part of the personal data questionnaire using a "yes" or "no" format.

The second questionnaire, the lifestyle medicine behavior questionnaire, was developed by the researchers based on a review of relevant theories and documents. It contains 36 questions across six parts: (1) Physical activity, four questions; (2) Nutrition, 10 questions; (3) Restorative sleep, six questions; (4) Stress management, five questions; and (5) Social connection, five questions; using a four-point Likert scale, ranging from 1 (Never), 2 (Sometimes), 3 (Often), and 4 (Always). Higher scores indicated more positive lifestyle medicine behaviors. Content validity was examined by three experts in the healthcare field, resulting in an acceptable validity of .90. The questionnaire was pilot tested with 30 participants, yielding an acceptable Cronbach's alpha of .85.

Data Analysis

Nominal data were coded as 0 or 1 for gender (male = 0, female = 1), education level (primary school = 0, junior high school = 1, high school = 2, undergraduate and above = 3), and underlying diseases other than hypertension (no = 0, yes = 1). Other personal data were collected through self-reported participant information. The responses were then grouped and coded into the same categories for occupation (no occupation = 1, government officer = 2, vendor = 3, freelancer = 4, agriculture = 5, housemaid = 6), income (less than 5,000 baht = 1, 5,001–10,000 baht = 2, 10,001–15,000 baht = 3, more than 15,001 baht = 4), body mass index (BMI; <18.5 = 1, 18.5–22.9 = 2, 23.0–24.9 = 3, 25.0–29.9 = 4, ≥30 = 5), duration of hypertension diagnosis (less than 1 year = 1, 1–5 years = 2, 5–10 years = 3, more than 10 years = 4), and blood pressure level (normal = 1, elevated = 2, stage 1 hypertension = 3, stage 2 hypertension = 4, stage 3

hypertension = 5). SPSS version 30 was used to analyze the data, and $p < 0.05$ was considered statistically significant[12].

Results

The characteristics of participants are shown in Table 1. The mean age of the participants was 56.2 years, with a minimum age of 49 years and a maximum age of 59 years. Most participants were females (72.7%). The highest proportion of education attainment was primary school (56.1%). The most common occupation was freelancer (51.8%). Most participants earned less than 5,000 baht per month (48.2%). More than half (56.8%) of the participants had no underlying diseases other than hypertension. Approximately one-third of participants (30.2%) had been diagnosed with hypertension for 2-5 years. Most participants had a normal blood pressure level (40.3%), followed by an elevated level (43.8%), and stage 1 hypertension (25.2%).

Table 1 Characteristics of participants

Variable	n	%
Age (years)		
45-50	22	15.8
51-55	27	19.4
56-59	90	64.7
Gender		
Females	101	72.7
Males	38	27.3
Education Level		
Primary school	78	56.1
Junior high school	32	23.0
High school	23	16.6
Undergraduate and above	6	4.3
Occupation		
Freelancers	72	51.9
Agriculture	26	18.7
Housemaids	16	11.5
Others	25	17.9
Income (baht)		
Less than 5,000	67	48.2
5,001-10,000	55	39.6

Table 1 Characteristics of participants (cont.)

Variable	n	%
10,001–15,000	12	8.6
More than 15,001	5	3.6
BMI (kg/m^2)		
< 18.5	9	6.5
18.5–22.9	30	21.6
23.0–24.9	31	22.3
25.0–29.9	57	41.0
≥ 30	12	8.6
Underlying diseases other than hypertension		
No other underlying diseases	79	56.8
Having other underlying diseases	60	43.2
Duration of diagnosis with hypertension (years)		
Less than 1	23	16.6
1–5	42	30.2
5–10	41	29.5
more than 10	33	23.7
Blood pressure level (mmHg)		
Normal (120–129 /80–84)	56	40.3
Elevated (130–139/85–89)	47	33.8
Stage 1 hypertension (140–159/90–99)	35	25.2
Stage 2 hypertension (160–179/100–109)	1	0.7
Stage 3 hypertension (≥ 180/ ≥ 110)	0	0.0
Smoking		
Yes	6	4.4
No	133	95.6
Alcohol Consumption		
Yes	25	18.0
No	114	82.0
Substance use		
Yes	4	2.9
No	135	97.1

The lifestyle medicine behavior questionnaire highlighted several results in each section (Table 2). When considering items with a mean score of 3 points (often) or higher, the physical activity section included question no. 2 (perform physical activities). In the nutrition section, this

included question no. 6 (consume a variety of vegetables, 4-5 serving spoons per day). In the restorative sleep section, questions no. 15 (sleep and rest for 7–9 hours per day), no. 16 (sleep and rest in a completely dark room), and no. 17 (sleep and rest in a room free from noise disturbance) met this criterion. In the stress management section, question no. 25 (have an optimistic outlook) was identified. In the social connection section, questions no. 26 (have shared activities with family) and no. 29 (participate in various community activities) were identified.

Table 2 Lifestyle Medicine Behavior

Lifestyle Medicine Behavior	$\bar{X}$	SD
Physical activity		
1. Engage in moderate to vigorous exercise such as brisk walking or cycling, and experience a faster breathing rate while exercising but still able to talk, for at least 150 minutes per week (30–45 minutes/session, 3–5 times/week). (+)	2.43	0.89
2. Perform physical activities such as gardening, tending to pets, or doing housework. (+)	3.22	0.75
3. Warm up and cool down before and after exercise. (+)	2.41	0.96
4. Monitor pulse rate during exercise, such as observing fast and heavy breathing or a rapid heartbeat. (+)	2.67	0.84
Nutrition		
5. Consume unrefined rice, flour, and cereals 6-8 serving spoons per day. (+)	2.61	0.85
6. Consume a variety of vegetables 4-5 serving spoons per day. (+)	3.03	0.77
7. Consume whole fruits equivalent to the size of a fist, 4 pieces per day, or bite-sized fruit pieces 6-8 pieces per day. (+)	2.81	0.77
8. Consume meat, 6-12 tablespoons per day. (+)	2.88	0.78
9. Avoid red meat and processed meats such as sausage and ham. (+)	2.71	0.88
10. Consume dried nuts and seeds 4-5 handfuls per week. (+)	2.26	0.75
11. Choose to eat low-fat foods such as steamed fish, chili paste with boiled vegetables. (+)	2.96	0.72
12. Limit sugar consumption, such as sweets and ice cream, to no more than 6 teaspoons per day. (+)	2.65	0.83
13. Limit sodium consumption, such as salt, fish sauce, soy sauce, etc., to no more than 1 teaspoon per day. (+)	2.86	0.77
14. Monitor weight or waist circumference. (+)	2.78	0.83

Table 2 Lifestyle Medicine Behavior (cont.)

Lifestyle Medicine Behavior	$\bar{X}$	SD
Restorative sleep		
15. Sleep and rest 7-9 hours per day. (+)	3.21	0.81
16. Sleep and rest in a completely dark room. (+)	3.17	0.87
17. Sleep and rest in a room free from noise disturbance. (+)	3.29	0.81
18. Wake up in the middle of the night. (-)	2.22	0.91
19. Drink alcoholic beverages to aid sleep. (-)	1.75	1.03
20. Use sleeping pills to aid sleep. (-)	1.63	0.99
Stress management		
21. Engage in relaxing activities during leisure time, such as listening to music, meditating, dancing, or playing games. (+)	2.59	0.84
22. Recall positive experiences or thoughts. (+)	2.80	0.76
23. Practice deep breathing exercises. (+)	2.42	0.88
24. Talk and express feelings to close individuals. (+)	2.89	0.91
25. Have an optimistic outlook (positive thinking). (+)	3.13	0.70
Social connection		
26. Have shared activities with family, such as watching TV or eating meals together. (+)	3.14	0.76
27. Communicate and maintain contact with people in the community. (+)	2.91	0.69
28. Participate in activities with groups sharing similar interests. (+)	2.72	0.81
29. Participate in various community activities, such as traditional events and merit-making ceremonies. (+)	3.04	0.83
30. Use social media like Line or Facebook to communicate with close individuals. (+)	2.60	1.01

The results of the multiple regression analysis of participant characteristics are shown in Table 3. No characteristics were significantly associated with blood pressure levels.

Table 3 Association between characteristics of subjects and blood pressure

Variable	Beta	t	Sig.
Age	.044	.517	.606
Gender	-.052	-.609	.544
Educational level	.013	.151	.880
Occupation	-.003	-.038	.970
Income	-.064	-.745	.457
BMI	.142	1.682	.095
Underlying diseases other than hypertension	-.061	-.710	.479
Duration of diagnosis with hypertension	.124	1.459	.147

There were seven lifestyle medicine behaviors related to blood pressure levels, as shown in Table 4. In the physical activity section, moderate to vigorous exercise for at least 150 minutes per week, warming up and cooling down before and after exercise, and monitoring pulse rate during exercise were related to blood pressure levels. In the nutrition section, consuming whole fruits equivalent to the size of a fist (4 pieces per day) or bite-sized fruit pieces (6-8 pieces per day), consuming dried nuts and seeds (4-5 handfuls per week), and monitoring weight or waist circumference were related to blood pressure levels. In the sleeping section, drinking alcoholic beverages to aid sleep was related to blood pressure levels.

Table 4 Association between lifestyle medicine behavior and blood pressure (items showing significant relationship were shown)

Question No.	Beta	t	Sig.
1. moderate to vigorous exercise for at least 150 minutes per week	-.174	-2.062	.041
3. warm up and cool down before and after exercise	-.268	-3.260	.001
4. monitor pulse rate during exercise	-.325	-4.023	<.001
7. consume whole fruits equivalent to the size of a fist 4 pieces per day, or bite-sized fruit pieces 6-8 pieces per day	-.171	-2.028	.044
10. consume dried nuts and seeds 4-5 handfuls per week	-.210	-2.516	.013
14. monitor weight or waist circumference	-.212	-2.539	.012
19. drink alcoholic beverages to aid sleep	-.227	-2.730	.007

Discussion

This study showed no relationship between personal factors and blood pressure control, which is inconsistent with the study of Yang et al.[14], who reported that sex and comorbidity are associated with successful blood pressure control. The study by Onsrinoi et al.[11] also noted that being female is linked to hypertensive prevention behavior. Additionally, a study by Emefa Modey Amoah et al.[7] presented that age, sex, presence of comorbidity, the number of pills taken, history of smoking, time since diagnosis of hypertension, and duration of exercise were significantly associated with blood pressure control. In this study, data collected from a narrow range of age that represented pre-aging individuals (45-59 years old) were used. These differences may arise from variations in population and context in the studies.

Following the six pillars of lifestyle medicine, this study identified seven key questions under three pillars related to blood pressure levels. Exercise behaviors, including moderate to vigorous exercise for at least 150 minutes per week, warming up and cooling down before and after exercise, and monitor pulse rate during exercise, were found to be associated with blood pressure levels. This is consistent with the findings of Yang et al.[14], who reported that increased physical activity leads to more effective blood pressure control, and that regular and consistent physical activity mitigates the negative effects of a sedentary lifestyle. The benefits of physical activity become even more pronounced with ongoing and regular engagement in moderate to vigorous physical activity[15]. These results indicate that both exercise and leisure-time physical activity can reduce and prevent the risk of high blood pressure levels[16]. This underscores the crucial role of physical activity in controlling blood pressure levels.

In the nutrition section, the consumption of whole fruits equivalent to the size of a fist (4 pieces per day), or bite-sized fruit pieces (6-8 pieces per day), as well as the intake of dried nuts and seeds (4-5 handfuls per week) were found to be related to blood pressure levels. These findings are consistent with a study examining the association between lifestyle characteristics and blood pressure control among urban adults in Ghana[6], which highlighted a significant relationship between fruit and vegetable intake and blood pressure control. Moreover, these results align with the "Dietary Approaches to Stop Hypertension (DASH)" eating plan, which recommends 4-5 servings of fruits and 4-5 servings of nuts, seeds, dry beans, and peas daily[17]. This underscores the importance of dietary intake among pre-aging individuals with hypertension. Furthermore, monitoring weight or waist circumference was also significantly

correlated with blood pressure levels. This may increase awareness among hypertensive pre-aging individuals and serve as a reminder for them to take care of their health.

Restorative sleep, including drinking alcoholic beverages to aid sleep was also found to be associated with blood pressure levels in this study. Alcohol disrupts normal sleep patterns, leading to lighter, less restorative rest and more frequent awakenings[18]. These can be linked to the American College of Lifestyle Medicine[19], which recommends striving for seven or more hours of sleep per night and minimizing interruptions during sleep to achieve optimal health. Furthermore, another study discovered that individuals with seven hours of daily sleep have a lower risk of hypertension[20].

On the other hand, our findings indicate that there was no significant association between stress management, social connection, and the avoidance of risky substances. This is consistent with a study in Ghana that found no relationship between alcohol, smoking, and blood pressure control[7]. This lack of association may be attributed to the diversity in stress management practices, social connections, and risky substances used among the participants. Moreover, the highest proportion of participants were freelancers (51.8%), which may contribute to a lack of social connection.

Lifestyle medicine behaviors have a significant impact on improving hypertension[8,14], brain health and improvement in neurocognitive impairment[21], including the prevention and management of risk factors such as type 2 diabetesm[22] and other chronic diseases[6]. A study by Emefa Modey Amoah et al.[7] demonstrated that lifestyle-modifying factors play a key role in complementing pharmacotherapy for hypertension control. It can be asserted that the six pillars of lifestyle medicine can improve blood pressure levels, as claimed by the American College of Lifestyle Medicine[15], which states that lifestyle medicine is a medical specialty that uses therapeutic lifestyle interventions as a primary modality to treat chronic conditions.

This study showed that seven lifestyle medicine behaviors were associated with blood pressure levels, which highlighted the importance of lifestyle medicine on blood pressure management among pre-aging individuals with hypertension in a network of primary care units. The result of this study can be utilized to create a lifestyle medicine promotion program aimed at reducing the risk of hypertension and preventing its complications at the primary care level. Additionally, at the policy level, these findings can be served as a foundation for health policy development to promote good health for all.

Nevertheless, there are limitations in this study. Data were collected from a network of primary care units comprising five health-promoting hospitals, which may only represent the characteristics of pre-aging individuals with hypertension in that specific area. This study focused solely on hypertension; therefore, further research on the details of lifestyle medicine is necessary to develop appropriate programs that prevent not only hypertension but also other non-communicable diseases.

Conclusion

Seven lifestyle medicine behaviors were associated with blood pressure levels among pre-aging individuals with hypertension in a network of primary care units in Thailand. These behaviors included engaging in moderate to vigorous exercise for at least 150 minutes per week, warming up and cooling down before and after exercise, monitoring pulse rate during exercise, consuming whole fruits equivalent to the size of a fist (4 pieces per day) or bite-sized fruit pieces (6-8 pieces per day), consuming dried nuts and seeds (4-5 handfuls per week), monitoring weight or waist circumference, and drinking alcoholic beverages to aid sleep. These factors could be useful for the care of pre-aging individuals with hypertension.

Ethical Approval Statement

This study was approved by the Ethical Review Committee for Research in Human Subjects of Nakhon Nayok Provincial Health Office on 26 August 2023 (Protocol No. NPHO 2023-020). Informed consents were obtained from all participants.

Author Contributions

NN designed the study and the instrument and authored the original manuscript. NN, RS, SYT and JT contacted participants and collected data. RS, SYT and JT reviewed and edited the manuscript. All authors read and approved the manuscript prior to submission for publication.

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Conflicts of Interest

The authors declare that there are no conflicts of interest.

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