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The analgesic and disability improvement effects of trigger points electroacupuncture on chronic low back pain patients: an uncontrolled before-and-after study

Quan Hoang Minh Le[1], Thanh Tran Van Nguyen[1], Nhi Thi Yen Bui[2], and Oanh Thi Kim Ngo[1,*]

[1]*Faculty of Traditional Medicine, University of Medicine and Pharmacy at Ho Chi Minh City, Ho Chi Minh City, Vietnam*
[2]*University of Medical Center, Ho Chi Minh City, Vietnam*

Abstract

Introduction: Low back pain (LBP) is the most common cause of disability in patients aged 45 to 65. Traditional medicine plays an important role in the treatment of this disease. Especially, electroacupuncture at 100 Hz is effective in the improvement of pain and symptoms. In addition, clinical and research evidence shows that trigger points acupuncture is effective in LBP treatment. However, these studies have small sample sizes, so their reliability is not high. Thus, our study aims to evaluate the effect of trigger points electroacupuncture (TrP-EA) at 100 Hz on chronic LBP patients with larger sample sizes.

Methods: 37 patients diagnosed with chronic LBP received TrP-EA at 100 Hz for 4 weeks. Outcome measures were the visual analogue scale (VAS), roland morris questionnaire (RMQ), and Oswestry low back pain disability index (ODI).

Results: Compared with the pre-treatment baseline, VAS, RMQ, and ODI improved dramatically after 1 week of treatment ($p<0.01$), 2 weeks of treatment ($p<0.01$), 3 weeks of treatment ($p<0.01$) and 4 weeks of treatment ($p<0.01$).

Conclusions: The results suggest that TrP-EA at 100 Hz had analgesic efficacy and may have the potential to improve disability in patients with chronic LBP.

Keywords: trigger points; low back pain; electroacupuncture; disability evaluation; visual analogue scale

1. INTRODUCTION

Low back pain (LBP) is a considerable health problem today [1]. Approximately 70%–85% of the population experiences LBP at least once in their lifetime. Annually, an estimated 5%–10% of employees miss work within 7 days due to LBP [2]. About 2%–7% of people with acute LBP develop chronic LBP. Chronic LBP that persists for more than 3 months affects an estimated 15%–45% of the population. This is the most common cause of disability in patients aged 45 to 65 [1].

However, conventional current methods provide few improvements in LBP symptoms, so there are ongoing searches for standard or alternative methods. Modern medical treatments for chronic LBP include analgesics, muscle relaxants, non-steroidal anti-inflammatory drugs (NSAIDs), surgery,

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*Corresponding author: Oanh Thi Kim Ngo. Faculty of Traditional Medicine, University of Medicine and Pharmacy at Ho Chi Minh City, Ho Chi Minh City, Vietnam. E-mail: ntkoanh@ump.edu.vn

etc. Among these treatments, NSAIDs are commonly used in pain management, but NSAIDs also increase the risk of cardiovascular events, gastrointestinal effects and reduce the body's tolerance [3].

Traditional medicine plays an important role in LBP treatment. Especially electroacupuncture is effective in pain relief and symptoms improvement [3]. In the study of Dieu Thuong Trinh Thi and Hong Nhung Thi Le, the authors compare the effect of high-frequency electroacupuncture (100 Hz – intervention group) with low-frequency electroacupuncture (2 Hz – control group) in patients with LBP. 87% of patients in the intervention group and 45% of patients in the control group had pain relief of ≥70%. This study shows that 100 Hz electroacupuncture is more effective in pain relief than 2 Hz [4]. In addition, trigger points have been used in pain management for many years. In 2004, Kazunori Itoh and his partners researched the effect of trigger points and criteria points acupuncture in chronic LBP treatment. The results suggest that trigger points acupuncture is more effective in LPB treatment than standard acupuncture. However, this study has a small sample size (35 patients divided into 3 groups), so the reliability is not high [2]. Therefore, we need studies with larger sample sizes to increase reliability. Based on the foregoing, our study was performed on 37 patients to evaluate the effect of trigger point electroacupuncture (TrP-EA) at 100 Hz in chronic LBP treatment.

This study aimed to evaluate pain intensity and disability according to visual analogue scale (VAS), roland morris questionnaire (RMQ), and Oswestry low back pain disability index (ODI) to test the hypothesis that 100 Hz TrP-EA can reduce pain and improve disability in patients with chronic LBP.

2. METHODS

2.1. Study design and participants

An uncontrolled before-and-after study was performed on 37 University of Medical Center Ho Chi Minh City – Branch no. 3 patients from February 2021 to February 2023.

Inclusion criteria: (1) patients aged 45 or older who consented to participate in the study; (2) individuals experiencing LBP persisting for more than 3 months with an average VAS score of 5 cm or over; (3) patients displaying trigger points in back and legs; (4) Additional criteria could include symptoms such as pain, numbness down the legs.

Exclusion criteria: (1) major trauma or systemic disease such as rheumatoid arthritis, ankylosing spondylitis, psoriatic arthritis, Scheuermann disease; (2) systemic symptoms such as weight loss, fever of unknown origin, anorexia, personal history of malignancy, diffuse pain and joint stiffness; (3) symptoms of infection such as fever, meningeal irritation signs, photophobia; (4) symptoms of central motor neuron damage such as Hoffmann sign, Babinski sign, hyperreflexia, spasticity, incontinence, sexual dysfunction; (5) symptoms of serious acute diseases such as myocardial infarction (chest pain, sweating, shortness of breath), arterial dissections (tearing sensation, headache, blurred vision); (6) Conditions unsuitable for acupuncture such as inflammation of skin in need of acupuncture, weak or exhausted patients, severe comorbidities; (7) being treated with other methods.

Elimination criteria: (1) patients experiencing adverse events from the intervention leading to their discomfort and withdrawal from the study; (2) patients with unfavorable comorbidities necessitating alternative treatment approaches during the study period; (3) individuals not experiencing pain relief after three days of treatment (shifted to the hospital's treatment plan); (4) patients failing to adhere to the study's treatment regimen, discontinuing the intervention more than twice.

2.2. Study setting

Using convenience sampling, all patients with chronic LBP at the University of Medical Center Ho Chi Minh City – Branch no. 3 would be invited to participate in the study. Among these patients, those who met the inclusion criteria would receive the intervention. All patients were treated at trigger points following the International Consensus on Diagnostic Criteria and Clinical Considerations of Myofascial Trigger Points in 2018. The diagnosis of trigger points is confirmed when at least 2 of the following criteria are present: (1) A taut band: The investigator presses gently along the muscle fibers, feeling a small nodule at trigger points and a fibrous band like a rope extending from this nodule

to the distal attachment of the stretched muscle fibers; (2) A hypersensitive spot: The investigator presses along the stretched muscle band would reveal a small nodule with a well-localized characteristic and very painful to press; (3) Referred pain: Referred pain is pain that begins at trigger points and spreads to other positions [5]. Qualified patients were treated with TrP-EA at 100 Hz for 4 weeks. Electroacupuncture was performed once a day and 5 days per week (taking Saturday and Sunday off each week) continuously for 4 weeks, the duration of electroacupuncture is 20 minutes in each session. Acupuncture needles (disposable acupuncture needles 0.30×25 mm, Khanh Phong brand, Vietnam) were inserted into the skin at a depth of 1.5–4 cm. Acupuncture was manipulated by traditional medicine doctors who have practicing certificates. The acupuncturist stimulated the needles until the patients reached a feeling of 'de qi' sensation (the patients felt moderately tense, heavy, and painless in the areas where acupuncture needles were inserted) and then stimulated points with an electrical acupuncture device. The frequency was adjusted to 100 Hz and the intensity was gradually increased from 1 to 100 μA (depending on the patient's tolerance level).

In addition to TrP-EA, patients were guided to engage in self-care practices, maintain proper posture, and perform active lumbar spine mobility exercises during the first week. Over the following 3 weeks, patients continued active lumbar movement exercises at the hospital once a week, under the supervision of researchers, and performed these exercises at home for the remainder of the time. These exercises comprised various activities, including lumbar spine range of movement exercises, lumbar muscle stretching exercises, lumbar muscle strength training, and muscle relaxation. Each exercise session lasted for 15 minutes, performed twice daily, continuously for 4 weeks.

Furthermore, the researchers emphasized the importance of avoiding poor posture during daily activities, such as bending over, lifting heavy objects, and making sudden movements, to prevent direct trauma to the lower back.

2.3. Outcome measurements

VAS is a 10 cm long horizontal line, the two ends of which are depicted corresponding to the two extremes of pain: the left end (0 cm) of the scale is "no pain" and the right end of the scale (10 cm) is "worst imaginable pain". Patients were required to manually position their pain intensity over the past 24 hours on VAS. The distance (mm) from where the patient locates to 0 is the VAS point [6].

RMQ consists of 24 questions covering limitations of daily activities due to LBP such as walking, caring for someone, sitting, lying down, dressing, sleeping, self-care, and daily living. Each item is 1 point, score ranges from 0 points (no disability) to 24 points (max disability). RMQ is also used to assess clinical improvement as a percentage based on score reduction after treatment [7].

ODI has 10 sections that deal with the daily activities of life disrupted by LBP. Each item is answered on a Likert scale from 0 (no problem at all) to 5 (not possible). The total score ranges from 0 to 50 [8].

VAS, RMQ, and ODI were assessed at the time of pre-treatment, after 1 week, 2 weeks, 3 weeks, and 4 weeks of treatment.

Adverse events were assessed throughout the study including pain, swellings, bleeding, infection at the needle positions, nausea, dizziness, cold sweat, cold hands and feet, and low blood pressure.

2.4. Statistical analysis

Data were imported and managed by Microsoft Excel. Statistical analysis was performed by R version 4.3.1. The qualitative data were reported as frequency with a percentage (%). The quantitative data were reported as mean with SD and 95% confidence of interval for mean (95%CI). When the quantitative variables were normally distributed, one-way ANOVA was used to compare the difference between mean values from the baseline to the fourth week of treatment. If the F-ratio in ANOVA was statistically significant, Turkey HSD test would be used to compare between each week and the previous consecutive week. When the quantitative variables were not normally distributed, we applied logarithmic transformation to normalize the distribution. If the normalizing transformation was unsuccessful, Kruskal-wallis test and Dunn-Bonferroni test would be used instead. The difference

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was statistically significant when $p<0.05$.

3. RESULTS

3.1. Baseline characteristics

From February 2021 to February 2023, a total of 37 participants were recruited. There were no missing data in 37 participants, none of the participants withdrew due to adverse events. The baseline features of the patients are presented in Table 1. Participants in the study ranged in age from 45 to 86 years old, the average age was 59.78±11.15 years. Males accounted for 43.24% and females accounted for 56.76%. The average number of trigger points (corresponding to the number of needles) was 5.51±1.02, the minimum number of trigger points was 4 and the maximum was 7.

Table 1. Baseline characteristics

Characteristics	Value	Min	Max
Age (years)[1)]	59.78±11.15	45.00	86.00
Gender[2)]			
Male	16 (43.24)		
Female	21 (56.76)		
Profession[2)]			
Light workloard	20 (54.05)		
Medium workloard	14 (37.84)		
Heavy workloard	3 (8.11)		
BMI[2)]			
Underweight	1 (2.70)		
Normal range	20 (54.05)		
Overweight	12 (32.43)		
Obese class I	4 (10.81)		
Obese class II	0 (0.00)		
Obese class III	0 (0.00)		
Duration of low back pain[2)]			
3–6 months	19 (51.35)		
>6 months	18 (48.65)		
Spread [2)]			
Yes	20 (54.05)		
No	17 (45.95)		
Pretreatment[2)]			
Yes	34 (91.89)		
No	3 (8.11)		
Relapse[2)]			
Yes	35 (94.59)		
No	2 (5.41)		
The number of Trigger points[1)]	5.51±1.02	4.00	7.00

[1)] Data were presented as mean±SD.
[2)] Data were presented as frequency (%).
BMI, body Mass Index; VAS, visual analogue scale; RMQ, roland morris questionnaire; ODI, Oswestry low back pain disability index.

3.2. Changes in visual analog scale (VAS), roland morris questionnaire (RMQ), and Oswestry low back pain disability index (ODI) scores during 4 weeks of treatment

According to Table 2 and Fig. 1, the results show that the VAS, RMQ, and ODI scores decreased dramatically after 1 week of treatment and continued decreasing after every week during the intervention (all $p<0.01$). The lowest VAS, RMQ, and ODI scores were recorded after the last treatment session. Specifically, after 4 weeks of treatment, the VAS score was reduced from 6.22±0.92 (95%CI: 5.91–6.52) mm at baseline to 1.51±0.99 (95%CI: 1.18–1.84) mm, the RMQ score was reduced from 8.81±1.51 (95%CI: 8.31–9.31) points at baseline to 1.92±1.16 (95%CI: 1.53–2.31) points and the ODI score decreased from 14.65±2.89 (95%CI: 13.69–15.61) points at baseline to 5.97±2.18 (95%CI: 5.25–6.70) points. All indices of VAS, RMQ, and ODI showed a statistically significant decrease even when comparing each week with the previous consecutive week.

The results showed that the average improvement percentage after 1 week of treatment was 21.71±10.77 (%) and continued to increase after each week for the next three weeks. The average improvement percentage after 2 weeks, 3 weeks, and 4 weeks of treatment was statistically significantly different from the time after 1 week of treatment ($p<0.01$). This index also showed a statistically significant increase even when comparing each week with the previous consecutive week (Table 3).

3.3. Adverse effect

During the study, 3 (8.00%) patients experienced slight bleeding at the needle positions. However, the bleeding was minor and ceased immediately upon the application of sterile cotton to the needle positions. No other adverse events (pain,

Table 2. Changes in VAS, RMQ and ODI scores during 4 weeks of treatment

	Mean±SD	95%CI		ANOVA		p-value in Turkey HSD test*
		Lower bound	Upper bound	F-ratio	p-value	
VAS						
Baseline	6.22±0.92	5.91	6.52	106.60	<0.01	
After 1 week	4.89±0.91	4.59	5.19			<0.01
After 2 weeks	3.97±1.01	3.64	4.31			0.03
After 3 weeks	2.73±1.19	2.33	3.13			<0.01
After 4 weeks	1.51±0.99	1.18	1.84			<0.01
RMQ						
Baseline	8.81±1.51	8.31	9.31	92.59	<0.01	
After 1 week	6.95±1.70	6.38	7.51			0.05
After 2 weeks	5.00±1.81	4.40	5.60			<0.01
After 3 weeks	3.38±1.53	2.87	3.89			<0.01
After 4 weeks	1.92±1.16	1.53	2.31			<0.01
ODI						
Baseline	14.65±2.89	13.69	15.61	81.18	<0.01	
After 1 week	12.30±2.25	11.55	13.05			<0.01
After 2 weeks	10.16±2.38	9.37	10.95			<0.01
After 3 weeks	7.86±0.23	7.26	8.47			<0.01
After 4 weeks	5.97±2.18	5.25	6.70			<0.01

* Significant differences in comparison between each week and the previous consecutive week by Tukey HSD test.
VAS, visual analogue scale; RMQ, roland morris questionnaire; ODI, Oswestry low back pain disability index; IQR, interquartile range; CI, confidence interval.

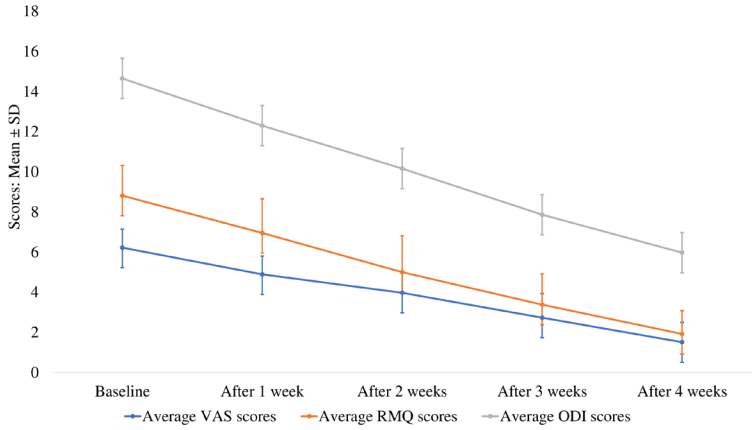

Fig. 1. VAS, RMQ and ODI scores after each week of the intervention. VAS, visual analogue scale; RMQ, roland morris questionnaire; ODI, Oswestry low back pain disability index.

Table 3. Improvement percentage according to RMQ

Time	Mean±SD (%)	95%CI (%)	p-value in Kruskal-wallis test	p-value in Dunn-Bonferroni test*
After 1 week	21.71±10.77	18.11-25.30	<0.01	
After 2 weeks	43.95±17.10	38.25-49.65		<0.01
After 3 weeks	62.27±15.06	57.25-67.30		0.02
After 4 weeks	78.52±10.73	74.94-82.09		0.01

* Significant differences in comparison between each week and the previous consecutive week by Dunn-Bonferroni test.
RMQ, roland morris questionnaire; CI, confidence interval

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swellings, infection at the needle positions, nausea, dizziness, cold sweat, cold hands, and feet, low blood pressure, etc.) occurred during the intervention period. None of the participants discontinued due to adverse events (Table 4).

4. DISCUSSION

4.1. Evaluation of the analgesic effect

Compared with the pre-treatment baseline, the study results showed a statistically significant decrease in VAS score right after one week of treatment, and this score continued to decrease significantly each week during 4 weeks of intervention. The VAS score achieved the lowest index at the final assessment time (after 4 weeks of treatment). These results supported the hypothesis that 100 Hz TrP-EA can reduce pain in patients with chronic LBP. With the aim of pain relief in patients with moderate chronic LBP, this evidence suggests that each course of TrP-EA should last at least 4 weeks to achieve optimal pain relief.

Our study results are consistent with previous studies on trigger points acupuncture: Research by Kazunori Itoh and his partners shows that trigger points acupuncture has better pain relief than standard acupuncture [2]; research by Emİne Handan Tüzü and research by Mario Téllez-García showed that trigger points acupuncture helps to reduce pain, the number of trigger points, the sensitivity of the trigger points in patients with LPB [9],[10]. Our study, with a larger sample size and comparable assessment tools, strengthens the claim regarding the pain-relieving impact of trigger points acupuncture. A novel aspect of our study is the incorporation of electroacupuncture at a frequency of 100 Hz during trigger point acupuncture. However, our study design has no manual acupuncture group, so we could not compare the analgesic effect between manual acupuncture and electroacupuncture at trigger points.

Table 4. Adverse events

Adverse events	Frequency (%)
Bleeding at needle positions	3 (8.00)
None	34 (91.89)

4.2. Evaluation of improving disability effect

Compared with the pre-treatment baseline, the study results showed a statistically significant decrease in RMQ and ODI scores each week during 4 weeks of treatment. These scores achieved the lowest index after four weeks of treatment. During 4 weeks of treatment, the RMQ and ODI scores between 2 consecutive weeks of treatment were also significantly different. These results supported the hypothesis that TrP-EA at 100 Hz may effectively improve disability in patients with LBP. Because RMQ and ODI have different sensitivities depending on the patient's disability, using both these questionnaires in the study could increase the accuracy of the disability assessment in patients with chronic LBP, thereby increasing the reliability of the study [11].

Compared with previous studies, our study results are consistent with Kazinori Itoh's and Mario Téllez-García's study on the improving disability effect of trigger points acupuncture [2],[10]. However, in our study, patients were also taught self-care, correct posture, and active lumbar spine exercises, so the improving disability effect of TrP-EA is still unclear. Our study results can be the basis for conducting new studies in the future to confirm more clearly the improving disability effect of TrP-EA.

4.3. Evaluation of improvement percentage according to roland morris questionnaire (RMQ)

One of the differences between RMQ and ODI is that RMQ does not categorize disability. However, RMQ can estimate the rehabilitation effect of a treatment as a percentage through the reduction in RMQ score after treatment. The study results showed that the improvement percentage after 2 weeks of treatment was over 40% and significantly increased compared with 1 week before. The improvement percentage was over 50% after 3 weeks of treatment and over 70% after 4 weeks of treatment. This index was also significantly different between 2 consecutive weeks during four weeks of treatment. These results show that TrP-EA at 100 Hz is the method that brings relatively high rehabilitation efficiency in the treatment of chronic LBP.

4.4. Advantages of electroacupuncture at trigger points compared with standard acupuncture

The study results showed that the number of trigger points on the objects of the study was 5.51±1.02. It means that each patient may only need to acupuncture 5 to 6 points in each session to achieve relatively high therapeutic effects. The number of needles for TrP-EA is less than standard acupuncture (acupuncture in 9 points), which is the advantage of TrP-EA [2].

Our study did not have the control group treated with the standard acupuncture, so we could not compare the treatment effect between this method and TrP-EA. Further randomized controlled clinical trial studies are needed to be performed to investigate other advantages of electroacupuncture at trigger points.

4.5. Adverse events

The results showed that there were 3 (8.00%) cases of bleeding at the needle positions, but these cases only had slight bleeding and stopped bleeding immediately after using sterile cotton to press the needle positions. This result is consistent with previous studies on the adverse events of acupuncture: The studies of Witt Claudia M in 2009, Enblom Anna in 2017, Wang Carol C in 2019, etc. These authors concluded that most of the adverse events of acupuncture were mild [12]–[14]. In addition, we did not record any other adverse effects during the study. These results help to confirm that TrP-EA is a relatively safe treatment method.

4.6. Strength and limitation

With larger sample sizes than previous studies, our results confirm more strongly the positive effect on pain relief of trigger points acupuncture in patients with chronic LBP. The novelty of our study is the addition of 100 Hz electroacupuncture in trigger points acupuncture. The research shows that this is a potential treatment to help patients with chronic LBP shorten treatment time and reduce the use of pain relievers. We compared the results between 2 consecutive weeks, which helps prognosis treatment time in patients with chronic LBP. In addition, we used both RMQ and ODI in the study, which helps to increase the accuracy of the disability assessment in patients with chronic LBP and can also assess the improvement percentage of TrP-EA at 100 Hz.

The limitation of our study is having no control group to compare the therapeutic effect of 100 Hz electroacupuncture at trigger points with manual acupuncture at these points. Besides, this study applied convenience sampling, so the results have reduced reliability in reflecting treatment effectiveness in the general population. In addition to 100 Hz TrP-EA, patients in our study were also taught self-care, correct posture, and active lumbar spine exercises. For this reason, the improving disability effect of this treatment still has not been demonstrated clearly. Another drawback of our study is that the survey only lasted 4 weeks after the intervention, so our study did not evaluate the pain relief and improving disability effectiveness of the method from 5 weeks onwards after the intervention, as well as the duration of effect maintenance after stopping the intervention. However, our study results can be the basis for randomized controlled trial studies in the future to assert the efficacy of TrP-EA more strongly.

5. CONCLUSION

The results suggest that TrP-EA at 100 Hz had analgesic efficacy in patients with chronic LBP. This treatment method may have the potential to improve disability in patients with chronic LBP. In this study, the evidence for a disability improvement effect of TrP-EA in patients with chronic LBP was still unclear. However, our study results can be the basis for conducting new studies in the future to confirm more clearly the improving disability effect of TrP-EA. In summary, TrP-EA is a potential treatment to help patients with chronic LBP shorten treatment time and reduce the use of pain relievers.

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Conflict of interest

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ORCID

Quan Hoang Minh Le
https://orcid.org/0009-0000-0918-6399
Thanh Tran Van Nguyen
https://orcid.org/0009-0007-5375-1157
Nhi Thi Yen Bui
https://orcid.org/0009-0007-9200-2765
Oanh Thi Kim Ngo
https://orcid.org/0000-0001-5729-153X

Authors' contributions

Conceptualization: QHM Le, OTK Ngo.
Data curation: QHM Le, TTV Nguyen.
Formal analysis: TTV Nguyen.
Methodology: OTK Ngo.
Software: TTV Nguyen.
Validation: OTK Ngo.
Investigation: QHM Le, NTY Bui, OTK Ngo.
Writing - original draft: TTV Nguyen.
Writing - review & editing: QHM Le, TTV Nguyen, NTY Bui, OTK Ngo.

Availability of data and material

Upon reasonable request, the datasets of this study can be available from the corresponding author.

Ethics Approval

This study was approved by the Ethics Council of the University of Medicine and Pharmacy Ho Chi Minh City according to Decision No. 471/HĐĐĐ-ĐHYD on September 20, 2021. The study was performed only on subjects informed about the research purpose and process, then signed a consent form to participate voluntarily. All information related to the research subjects would be encrypted, completely confidential, and used for research purposes only. Interventional instruments were guaranteed to be sterile for the safety of study subjects. This research is only to protect and improve community health and not for any other purpose.

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