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Research article

# Development of an Herbal Oil Formula for the Relief of Upper Back Pain in Office Syndrome

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**Abstract**

**Background and Purpose:** Office syndrome is characterized by persistent pain in the same muscles. However, herbal oils used to treat office syndrome have an undesirable gooey consistency and leave yellow stains. This study aimed to use a cold extraction method to develop herbal oil in the form of coconut oil with extracts of the herbs *Zingiber purpureum* Roscoe, *Z. officinale* Roscoe, and *Curcuma zedoaria* (Christm.) Roscoe. **Methods:** This single-blind randomized clinical trial included 40 participants with upper back pain. Participants were divided equally into the intervention group who applied herbal oil twice daily on the painful areas for 1 week, and the control group who applied placebo oil. Outcome assessments included the general information, visual analog scale (VAS) for pain, trigger point pain assessed with an algometer, cervical range of motion (ROM), and satisfaction scores. **Results:** After 1 week of intervention and at 1 week after intervention cessation, the mean VAS for pain was significantly lower in the intervention group than the control group, and was significantly lower in the intervention group compared with baseline. The mean trigger point pain level was significantly lower in the intervention group than the control group after the intervention. In the intervention group, the mean lateral flexion ROMs were significantly better after 1 week of intervention compared with baseline. The overall satisfaction with the herbal oil was moderate. **Conclusions:** Using the cold extraction method created a coconut oil with herbal extracts that relieved pain but requires development to improve the consistency and staining.

**Keywords:** Herbal Oil, Office Syndrome, Upper Back Pain

## Introduction

Office syndrome is characterized by repetitive pain in the same muscle over a long period, including numbness in the arm or hand owing to nerve compression and pain when moving[1]. The pain is most common in the upper back, followed by the lower back, and the wrists and arms, and is caused by individuals staying in the same sitting position for a long time and having poor posture[2]. The Division of Occupational and Environmental Diseases, Department of Disease Control,

Ministry of Public Health, Thailand (2016) reported that the number of patients with musculoskeletal disease increased from 72,486 (121.9 per 100,000 population) in 2015 to 81,226 (135.3 per 100,000 population) in 2016[3]. Current treatments for office syndrome include stretching, shortwave diathermy, shockwave therapy, exercise, acupuncture, medication, physiotherapy, and Thai massage[4]. Additionally, herbal medicines used to relieve pain include Plai (*Zingiber purpureum*), which is used to relieve sprains and reduce inflammation and body aches[5]. Previous research indicates that the curcuminoids in *Curcuma zedoaria* have a potent analgesic effect in rats, as the rhizome of C. *zedoaria* reduces inflammation by inhibiting the activity of the enzymes COX-2 and nitric oxide synthase[6]. Another recent study showed that fresh ginger and heat-treated ginger help relieve exercise-induced muscle inflammation by inhibiting the production of nitric oxide, a substance that causes inflammation[7]. Bunpean et al.[8] found that massage with Plai (*Z. purpureum*) oil reduces pain because it contains terpenoids that reduce muscle pain and have an anti-inflammatory effect[9]. However, as the essential substances were extracted from *Z. purpureum* through palm oil frying, the resulting Plai oil was sticky and left yellow stains on clothes[8]. Therefore, the cold extraction method was used to create a coconut oil with extracts of the herbs *Z. purpureum*, *Z. officinale*, and *C. zedoaria*. The present study evaluated the efficacy of this cold-extracted herbal oil in reducing muscle pain and inflammation associated with office syndrome and evaluated the satisfaction of the herbal oil formula users.

## Methods

**Research design:** This single-blind randomized clinical trial included 40 participants with upper back pain. The inclusion criteria were: (i) age 18–30 years; (ii) pain score ≥ 4; (iii) willingness to participate in the study[8]. The exclusion criteria were: (i) pain in the neck, shoulder, or shoulder muscles caused by an accident or brain disorder; (ii) history of allergy to Plai and/or coconut oil; (iii) numbness due to nerve compression; (iv) any disease that prohibited the study intervention, including severe asthma, epilepsy, acute infection, and severe osteoporosis; (v) fever above 38.5°C, high blood pressure (160/100 mmHg), fainting, palpitations, headaches, or nausea and vomiting; (vi) pathological conditions in the neck and shoulder that prevented the individual from performing the study intervention, including fracture, fracture non-union, and cancer; (vii) open wounds, chronic wounds, contagious skin lesions, surgical wounds within 1 month prior to the study procedure, or inflamed veins; (viii) having received treatment that affects shoulder pain not more than 7 days before participating in the study or during the study period (e.g., topical drugs, oral medicines, analgesic injections, massage, application of compresses, acupuncture, physical therapy); (ix) unable to participate throughout the entire study period or loss of contact before study completion[8].

**Sample size:** The sample size was calculated based on the research method of a previous study[10]. The mean score for shoulder muscle pain was taken as 5.43 ± 0.94[10]. It was estimated that the study intervention would reduce the pain score by 40%, which gives a decrease of 2.82 points, and the standard deviation was estimated to be 8.46 (about three times the reduction). With a type I error of 0.05, power of 0.08, and two-sided a of 0.05 and b of 0.2, the calculated sample size was 30 (calculations were made using Open Epi, version 3, open-source calculator --SSMean). Allowing for a dropout rate of 30%, the sample size was increased to 30/(1 - 0.3), which was 43 participants. Therefore, 40 participants who met the eligibility criteria were included in this study. The participants were divided into two groups of 20 each (intervention and control) using simple randomization. The participants were blinded to the grouping, with the control group receiving the intervention after the end of the study.

**Ethical considerations:** This study was approved by the Human Research Ethics Committee, Walailak University, License No. WUEC-22-081-01. The information was kept confidential in the form of encrypted, anonymous, or unidentifiable information linking personal information and was destroyed at the end of the research. This information will be used for academic and general purposes only.

**Preparation of the herbal oil formula:** The herbs were fresh herbs grown in the Thung Song District of Nakhon Si Thammarat Province, Thailand. The herbal oil formulation for pain relief was created using the following steps[11]. (I) Fresh *Z. cassumunar* rhizomes were peeled, cut into small pieces (1 kg), blended with water in a ratio of 1:1, and then filtered through a white cloth, mixed with coconut milk (5 kg mature coconut meat), and kept for 1–2 hours to allow the *Z. purpureum* and coconut milk to separate into layers. (II) The substance was refrigerated at 4°C, left for 12 hours, and then melted at 80°C for 1–2 hours and centrifuged. (iii) After centrifugation, the three parts (oil, cream, and water) were separated by extracting only the oil part and melting the cream at 80°C; this was repeated until all the oil was extracted. (iv) The extracted oil was filtered until coconut oil containing *Z. purpureum* extract was obtained. *Z. officinale* and *C. zedoaria* were extracted using the same extraction method. The herbal analgesic oil was created by mixing oil extracted from *Z. purpureum* (32%), *Z. officinale* (27%), *C. zedoaria* (10%), methyl salicylate (10%), eucalyptus oil (12%), menthol (3%), camphor (3%), and borneol (3%) and was packaged in spray form. The placebo oil for the control group consisted of 83.98% coconut oil, 16% eucalyptus oil, and 0.02% yellow food coloring packaged in spray form.

**Data collection:** 1) An information collection form was used to record each participant's age, occupation, weight, height, and hours spent sitting at work per day. 2) The satisfaction forms included five topics (gooeyness, smell, skin absorption, hot feeling, and yellow stains) rated as a score from 1–5, with 5 indicating the highest degree of satisfaction and 1 indicating dissatisfaction. 3) The visual analog scale (VAS) was used to indicate the pain score from 1–10, with 1 indicating no pain, 1–3 indicating mild pain, 4–6 indicating moderate pain, and 7–10 indicating severe pain. 4) An algometer was used to measure the level of trigger point pain using a manual pressure gauge (Algometer model NK-200 force gauge, Wenzhou, China)[12] with a probe size of 1 $cm^2$. 5) A goniometer was used to measure the cervical range of motion (ROM) consisting of flexion, extension, left lateral flexion, and right lateral flexion.

**Procedure:** Participants were assessed before the study (general information, VAS, algometer measurements, and goniometer measurements) and after 1 week of intervention (satisfaction score, VAS, algometer measurements, and goniometer measurements) as shown in Figure 1. Additional VAS assessments were also completed on day 3 and at 1 week after the cessation of the intervention.

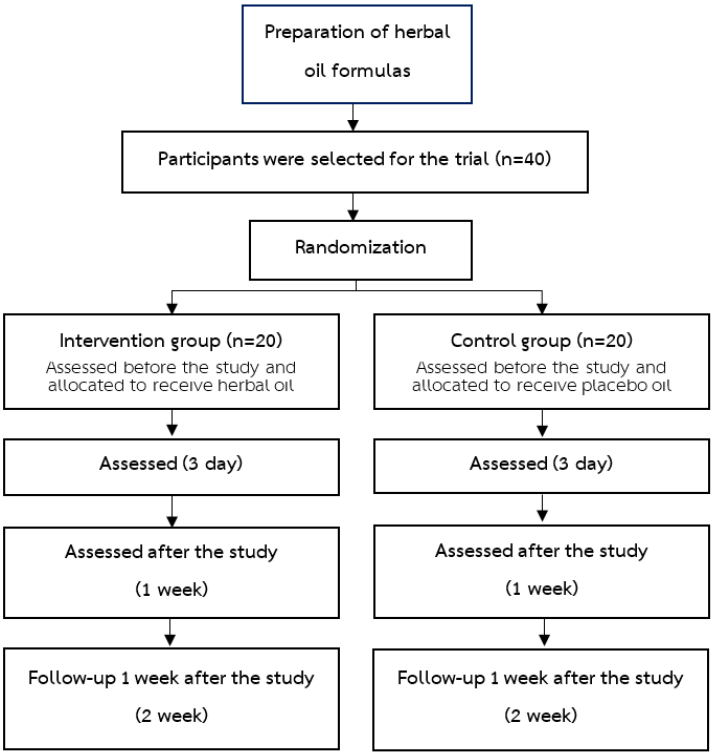


**Figure 1.** Flow diagram of the study.

**Intervention:** All participants underwent allergy testing prior to the experiment by applying a 1-inch strip of herbal oil on both inner arms for 5 minutes. If an allergic reaction occurred, the participant was excluded from the study. The intervention and control groups were given the herbal oil spray and the placebo oil spray, respectively, and instructed to spray the oil on the painful area (by pressing the spray nozzle down twice and rubbing in the oil) twice daily (morning and bedtime) for 1 week.

**Data analysis:** Information collection forms and satisfaction forms were analyzed with descriptive statistics using the frequency distribution and means. Data from the assessments and physical examinations were compared (before versus after intervention) with the paired t-test, and were compared between groups with the independent t-test using Microsoft Excel 2016.

## Results

**Participant characteristics:** The baseline characteristics are summarized in Table 1. All participants were aged 18–26 years and had a normal body mass index (BMI). The two groups had a similar mean age and BMI. Most participants in both groups had a daily sitting time of 4–6 hours per day at work.

**Table 1.** Characteristics of the participants at baseline

| Participant characteristics | Intervention group (n = 20) | Control group (n = 20) | Statistics value | *P value* |
|---|---|---|---|---|
| Age (years), mean ± SD | 21.60 ± 1.50 | 21.95 ± 1.63 | -0.705[a] | 0.242 |
| BMI (kg/m$^2$), mean ± SD | 23.62 ± 6.73 | 24.43 ± 5.80 | -0.406[a] | 0.343 |
| Duration of sitting at work, n (% within group) | 3 (15) | 3 (15) | 0.000[b] | 1.000 |
| 1–3 hours/day | 12 (60) | 11 (55) | 0.320[b] | 0.749 |
| 4–6 hours/day | 5 (25) | 3 (15) | 0.790[b] | 0.429 |
| 7–9 hours/day | 0 (0) | 3 (15) | -1.801[b] | 1.928 |
| 10 or more hours/day | | | | |

a = independent t-test, b = z-test for proportion difference

**Participant satisfaction:** The mean scores of almost all items were similar in both groups, except that the hot feeling was significantly greater in the intervention group than the control group ($p < 0.05$) (Table 2).

**Table 2.** Comparison of satisfaction scores between the intervention and control groups

| Satisfaction scores Mean ± SD | Intervention group (n = 20) | Control group (n = 20) | t | *P value* |
|---|---|---|---|---|
| Gooeyness | 1.90 ± 0.55 | 1.70 ± 0.80 | 0.919 | 0.182 |
| Smell | 3.45 ± 0.60 | 3.45 ± 0.89 | 0.000 | 0.500 |
| Skin absorption | 3.90 ± 0.55 | 3.60 ± 0.75 | 1.435 | 0.080 |
| Feeling hot | 3.05 ± 0.22 | 1.65 ± 0.49 | 11.637 | 0.000* |
| Yellow stains | 2.30 ± 0.73 | 1.95 ± 0.76 | 1.484 | 0.073 |

*Significant difference between groups ($p < 0.05$)

**Pain score:** There were no significant differences in the mean VAS pain scores between the two groups at baseline (intervention group = 5.45 ± 1.27, control group = 5.20 ± 1.10) and on day 3 (intervention group = 3.90 ± 1.55, control group = 4.55 ± 1.27). However, the mean VAS pain score was significantly lower in the intervention group than the control group after 1 week of intervention (intervention group = 2.95 ± 1.46, control group = 4.25 ± 1.44) and at week 2 of follow-up (intervention group = 2.15 ± 1.66, control group = 4.20 ± 1.19) (Figure 2). Both the intervention and control groups had significantly lower mean VAS pain scores after 1 week of intervention and at week 2 of follow-up compared with baseline (Figure 2).

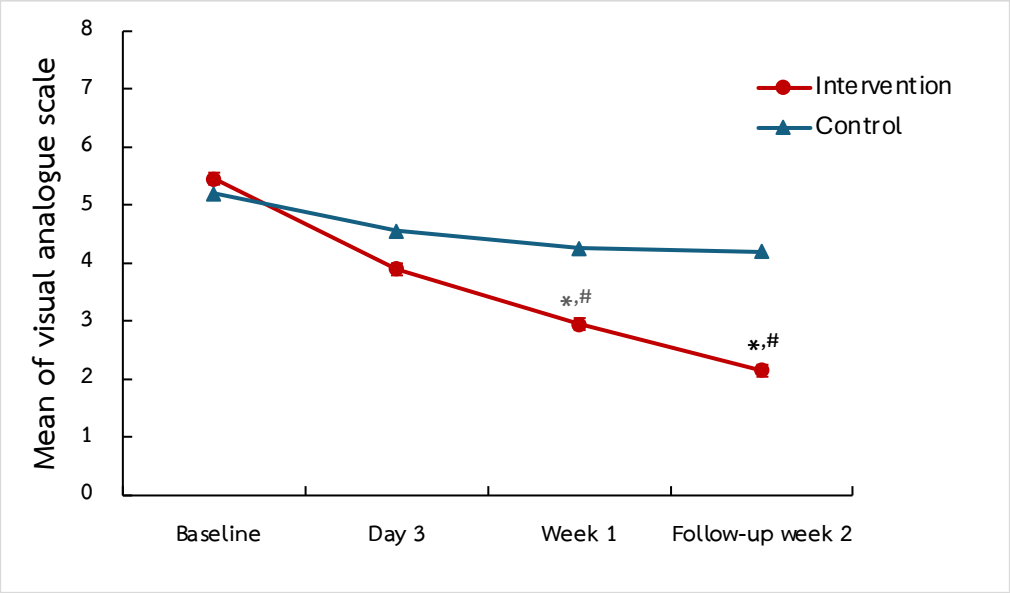


**Figure 2.** Comparisons of the mean VAS pain scores

*Significant difference between groups ($p < 0.05$)

#Significant difference compared with baseline ($p < 0.05$)

**Trigger point pain:** The trigger point pain did not significantly differ between groups at baseline (Table 3). After 1 week of intervention, the level of trigger point pain was significantly greater in the intervention group compared with the control group, and was significantly greater compared with baseline within the intervention group (Table 3).

**Table 3.** Comparison of the mean trigger point pain level between and within groups

| Trigger Point (kg.m/s2) Mean ± SD | Intervention group (n = 20) | Control group (n = 20) | t | *P* value |
|---|---|---|---|---|
| Baseline | 41.85 ± 12.70 | 42.20 ± 8.26 | -0.103 | 0.459 |
| Day 3 | 46.55 ± 16.57 | 42.00 ± 9.91 | 1.053 | 0.150 |
| Week 1 | 53.70 ± 17.85# | 44.15 ± 8.31 | 2.168 | 0.019* |

*Significant difference between groups ($p < 0.05$)

#Significant difference compared with baseline ($p < 0.05$)

**Cervical ROM:** The mean cervical ROM across all movements did not significantly differ between groups at baseline, on day 3 of the intervention, and after 1 week of intervention (Table 4). However, within the intervention group, the left and right lateral flexion ROMs were significantly greater after 1 week of intervention compared with baseline (Table 4).

**Table 4.** Comparison of the mean cervical ROM in the intervention and control groups

| Cervical ROM (degrees) Mean ± SD | Intervention group (n = 20) | Control group (n = 20) | t | *P* value |
|---|---|---|---|---|
| **Flexion** | | | | |
| Baseline | 48.45 ± 11.41 | 46.00 ± 16.07 | 0.556 | 0.291 |
| Day 3 | 40.60 ± 16.52 | 39.30 ± 11.60 | 0.288 | 0.388 |
| Week 1 | 44.40 ± 15.50 | 41.00 ± 14.75 | 0.711 | 0.240 |
| **Extension** | | | | |
| Baseline | 88.80 ± 7.50 | 87.00 ± 8.68 | 0.702 | 0.244 |
| Day 3 | 91.45 ± 7.19 | 89.40 ± 8.51 | 0.823 | 0.208 |
| Week 1 | 87.90 ± 7.82 | 87.40 ± 9.15 | 0.186 | 0.427 |
| **Left lateral flexion** | | | | |
| Baseline | 39.70 ± 8.03 | 43.05 ± 7.37 | -1.374 | 0.089 |
| Day 3 | 44.35 ± 6.70 | 41.25 ± 8.21 | 1.309 | 0.099 |
| Week 1 | 49.00 ± 9.04* | 46.10 ± 8.87 | 1.024 | 0.156 |
| **Right lateral flexion** | | | | |
| Baseline | 39.35 ± 7.73 | 39.95 ± 4.38 | -0.302 | 0.382 |
| Day 3 | 39.90 ± 6.06 | 40.45 ± 5.55 | -0.299 | 0.383 |
| Week 1 | 45.50 ± 7.96* | 42.00 ± 7.90 | 1.395 | 0.086 |

*Significant difference compared with baseline ($p < 0.05$)

## Discussion

In the present study, there were no significant differences in age and BMI between the intervention and control groups. Furthermore, using the method reported by Pongvivat et al.[13], we found that the two groups had similar levels of trigger point pain at baseline. Most of the participants in both groups were in a sitting posture at work for 4–6 hours per day, and such static posture periods are associated with upper back pain[14].

A comparison of the satisfaction in both groups revealed that the control group reported less of a hot feeling than the intervention group because there was no herbal component in the placebo; however, the smell and skin absorption were rated as similar in both groups. The gooeyness of the oil and the creation of yellow stains on clothes were also less satisfactory in the intervention group than the control group, which is consistent with a previous study that reported that herbal extracts in oil are considered gooey[8].

The mean VAS for pain was significantly lower in the intervention group than the control group after 1 week of intervention and at 1 week after the cessation of the intervention. This analgesic effect of the herbal oil is consistent with previous studies that reported that herbal wraps provide significant pain relief[15], and that Plai (*Z. purpureum*) oil relieves pain in myofascial pain syndrome[16]. Furthermore, the curcuminoids in *C. zedoaria* have an anti-inflammatory effect by inhibiting the activity of COX-2 and nitric oxide synthase[6], and *Z. officinale* has been shown to relieve muscle inflammation[17] by inhibiting the production of nitric oxide, which causes inflammation[7]. Another study reported that massage with Plai (*Z. purpureum*) oil reduces pain due to the presence of terpenoids that reduce muscle pain and have an important anti-inflammatory effect[8,9].

The mean trigger point values were significantly higher in the intervention group than the control group at 1 week after the cessation of the intervention, which is consistent with the findings of a study that reported

that Plai oil massage is better in relieving myofascial pain syndrome than a control intervention[16]. The reduction in muscle pain might be due to the inhibition of cyclooxygenase and lipoxygenase, the enzymes involved in the synthesis of prostaglandin, which reduces the inflammatory process.[18]

There was a significant increase in the mean ROMs of left and right lateral flexion after 1 week of intervention in the intervention group compared with baseline because the ROM in these directions is directly related to the contractile line of the upper back muscles[19]. The ROM increases due to decreased muscle pain[20], which is consistent with a study that showed that thorn apple oil massage improves the left and right lateral flexion with reduced muscle stiffness and pain in individuals with neck and shoulder pain from office syndrome[21]. The increase in mean cervical ROM in the control group was consistent with a previous study in which the control group showed an increase in the degree of neck movement compared with baseline[16], possibly due to some participants having pain but still being able to move their necks normally.

## Conclusion

Using the cold extraction method to create an herbal formula comprising coconut oil with herbal extracts relieved the upper back pain and increased the lateral flexion of the cervical spine ROM of individuals with office syndrome. However, the participants were not satisfied with the gooey consistency of the herbal oil and the yellow stains it left on clothes. Therefore, further development of the herbal formulation is needed.


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## Citation

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