# Evaluation of quality and satisfaction on Thai balm made from Bang Chang chili oil, Thailand

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## Abstract

This study evaluates the quality, effectiveness, and user satisfaction of a Thai balm from Bang Chang chili (*Capsicum annuum var. acuminatum)* oil. It's a local chili pepper of Samut Songkhram in Thailand. The balm's effectiveness was assessed in four key areas: product features, usability, pain relief, and overall product evaluation. A total of 35 volunteers participated in the study. Results indicated high satisfaction levels, with the highest rating of 4.70 for usability followed by pain relief effectiveness (4.64), overall product evaluation (4.62), and product features (4.58), respectively. The balm was safety product, easy to use, and effectively absorbed into the skin. The pain-relieving properties confirmed through experimental trials which a specifically reduce the painemonstrating a significant reduction in pain intensity compared morethan a placebo. These findings highlight the potential of Bang Chang chili balm as a multifunctional product for pain relief, skin care, and general wellness, with high user satisfaction.

**Keywords:** ***Bang Chang chili, balm, quality***

## 1. Introduction

Chili peppers (*Capsicum* spp.) are a significant crop in many Asian. These include Bangladesh, China, India, Indonesia, Thailand, and Vietnam. They are indispensable in Asian cuisines, both as spices and for economic reasons. Thailand's temperature and geography vary by region, with mountains, river plains, and coastal areas all having an impact on chili pepper growing. These peppers come in a variety of flavors, hues, sizes, and levels of spiciness.) (Al-snafi AE,2015)

The nutritional content of chili peppers varies. (per 100g): They contain 40-50 kcal, 8-9g carbohydrates, 2-3g dietary fiber, 1-2g protein, less than 1g fat, and 250-400mg potassium. Chili peppers are also rich in vitamin C and vitamin A (beta-carotene). The bioactive compounds capsaicin and capsaicinoids are responsible for their spiciness, measured in Scoville Heat Units (SHU). Chili peppers are key ingredients in popular Thai dishes like "Tom Yum Goong" (spicy shrimp soup) and "Som Tum" (green papaya salad). Large amounts of chili peppers are also exported to countries with strong culinary traditions in various forms such as sauces, pastes, and dried products. (Ahmad N, Mukhtar H,1999)

The health benefits of capsaicin in chili peppers are numerous. These benefits include pain relief, boosting fat metabolism, aiding digestion, improving blood circulation, reducing

 

cholesterol, and providing antioxidant effects. Research shows capsaicin can inhibit enzymes like TRPV1 (involved in pain perception), metabolic enzymes, and inflammatory enzymes. It also affects lipase enzymes, reducing fat absorption, which may help with weight management and metabolic health. Capsaicin is also used in skincare products because it can inhibit enzymes like tyrosinase and elastase, helping to reduce skin pigmentation and improve skin elasticity. (Rashid MH, Inoue M, Bakoshi S, Ueda H,2003)

The "Bang Chang chili pepper" (C. annuum var. acuminatum) is a Thai cultivar originally from the Bang Chang subdistrict in Samut Songkhram. The capsaicin in these peppers helps reduce pain by blocking pain signals, stimulates blood circulation, and has anti-inflammatory effects. Therefore, people commonly use chili-based balms to alleviate muscle and joint pain. This study aims to evaluate the quality and satisfaction of a balm made from "Bang Chang" peppers, with the goal of providing insights for using this variety in healthcare.

## 1.1 Materials and Methods

The "Bang Chang" chili pepper (*C. annuum* var. acuminatum) seeds were provided by the Tropical Vegetable Research Center at Kasetsart University, Kamphaeng Saen Campus, Nakhon Pathom, Thailand. The seeds were planted at the Samut Songkhram Campus of Suan Sunandha Rajabhat University, Thailand, from November 2022 to February 2023. Plant identification has been confirmed by previous studies.

### Chili Pepper Oil and Ethanol Extract Preparation

### Harvesting the Ripe Red Chili Peppers

The ripe red chili peppers are harvested from the plants when they are fully mature and ready for processing.

### Sun-Drying

The chili peppers are sun-dried until their moisture content is less than 1%. This drying process helps reduce the moisture in the peppers, making them suitable for storage and extraction.

### Removing the Pedicels

After drying, the pedicels (stems) are removed from the chili peppers, leaving only the dried fruit.

### Grinding the Chili Peppers into Powder

The dried chili fruits are ground into a fine powder to prepare them for the extraction process.

### Oil Extraction with Rice Bran Oil (RBO)

1 liter of rice bran oil (RBO) is mixed with 500g of chili powder. This mixture is left to macerate for 3 days, allowing the active compounds from the chili peppers to be extracted into the oil.

**Ethanol Extraction**

A similar process is used to extract with ethanol, using the same chili powder-to-ethanol ratio as in the oil extraction.

The chili powder and ethanol mixture is left to macerate in the same manner as the RBO extraction.

**Filtration to Remove Impurities**

Both the oil and ethanol extracts are filtered to remove impurities and unwanted particles.

**Evaporation to Constant Weight**

After filtration, the solvent is evaporated until the extracts reach a constant weight, leaving behind the concentrated extracts.

**Storage of Extracts**

The resulting extracts are stored in amber glass bottles to protect them from light and maintain their quality. The extracts are kept at a temperature of 4°C for long-term storage.

Allergy Warning: Testing of skin irritation and allergic reactions on human skin before full use to check for irritation or allergic reactions to capsaicin. (Kakatum N, et al., 2021).

Adjusting Intensity: To make the balm hotter, you can increase the amount of chili oil, but be cautious not to make it too concentrated to avoid irritation**.**

### 1.2 Research Objective

1. To evaluate the quality of Thai balm made from Bang Chang chili oil.

2. To study user satisfaction with the Thai balm made from Bang Chang chili oil.

**Analysis Test Report Thai balm**

| Analysis | Unit | LOD | LOQ (LOR) | Result | Method | Testing Location |
|---|---|---|---|---|---|---|
| **Metals Testing** | | | | | | |
| Arsenic | Mg/kg | 0.005 | 0.10 | Not Detected | In-house method, STM No. 05-040 based on AOAC(2019) 2011.19 | Bangkok |
| Cadmium | Mg/kg | 0.004 | 0.03 | Not Detected | In-house method, STM No. 05-040 based on AOAC(2019) 2011.19 | Bangkok |
| Lead | Mg/kg | 0.01 | 0.10 | Not Detected | In-house method, STM No. 05-040 based on AOAC(2019) 2011.19 | Bangkok |
| Mercury | Mg/kg | 0.001 | 0.005 | Not Detected | In-house method, STM No. 05-045 based on United States Environmental Protection Agency ZEPAX,2007,Method 7473 | Bangkok |
| **Microbiological Testing** | | | | | | |
| Clostridium spp. | In 1 g | - | - | Not Detected | BP (2021), Appendix XVI B | Bangkok |
| Pseudomonas | In 1 g | - | - | Not | BP (2021), Appendix XVI B | Bangkok |

| Analysis | Unit | LOD | LOQ (LOR) | Result | Method | Testing Location |
|---|---|---|---|---|---|---|
| **Metals Testing** | | | | | | |
| aeruginosa | | | | Detected | | |
| Staphylococcus aureus | In 1 g | - | - | Not Detected | BP (2021), Appendix XVI B | Bangkok |
| Total Aerobic Microbial Count | CFU/g | - | - | <10 | BP (2021), Appendix XVI F | Bangkok |
| Yeast and mod | CFU/g | - | - | <10 | BP (2021), Appendix XVI F | Bangkok |

Remark: - LOD : Uimit of Detection

- "<" : Lower than LOQ (Limit of Quantitation) / LOR (Limit of Reporting)

## 2. Results And Discussion

Physical characteristics of balm Thai balm made from Bang Chang chili oil

Bang Chang chili blam is translucent yellow to light yellow, smooth, slippery texture

**This table summarizes the tests for anti-tyrosinase, anti-elastase, and anti-lipase activities, including the solvents used, concentration ranges, test methods, measurement methods, and positive controls**

| Test | Solvent (10% DMSO) | Concentration Range | Test Method | Measurement Method | Positive Control |
|---|---|---|---|---|---|
| **Anti-Tyrosinase** | 10% DMSO | 0.001, 0.01, 0.1, 1, 10 mg/mL | Dopachrome technique to measure anti-tyrosinase activity | Micro-titer plate reader measures reduction in dopachrome absorbance | Kojic acid |
| **Anti-Elastase** | 10% DMSO | 0.001, 0.01, 0.1, 1, 10 mg/mL | Micro-titer plate reader to measure elastase enzyme inhibition | Measures reduction in absorbance from hydrolysis of p-nitroanilide | Epigallocatechin gallate (EGCG) |

| Test | Solvent (10% DMSO) | Concentration Range | Test Method | Measurement Method | Positive Control |
|---|---|---|---|---|---|
| **Anti-Lipase** | 10% DMSO | 0.001, 0.01, 0.1, 1, 10 mg/mL | Measurement of pancreatic lipase inhibition from absorbance of p-nitrophenol produced by hydrolysis of p-nitrophenyl butyrate | Absorbance measured at λmax = 415 nm | Orlistat |

**Assessment of the Pain-Relieving Effects of Chili Oil: Experimental Design and Methodology**

| Step | Description |
|---|---|
| **Pain Assessment** | Pain intensity is measured both **before and after** the application of chili oil balm. A standardized pain scale such as the **Visual Analog Scale (VAS)** or **Numeric Rating Scale (NRS)** is used to assess the level of pain experienced by the participants. |
| **Control Group** | A **placebo group** is included where participants use a balm without chili oil. This allows for comparison of the chili oil balm's effectiveness against a non-active treatment. |
| **Duration of Experiment** | Pain assessments are conducted at **set intervals** (e.g., **30 minutes, 1 hour, and 2 hours**) post-application to track the **time-dependent effects** of the balm. |
| **Results Recording** | Data on **pain relief** is recorded, including the percentage of reduction in pain and changes in pain intensity scores. The results are compared across **chili oil** and **placebo** groups. |
| **Expected Results** | It is anticipated that chili oil, due to its **capsaicin** content, will offer **pain relief** by stimulating sensory receptors and producing a **warming sensation** that reduces pain signals. The comparison with the placebo group will reveal whether chili oil significantly relieves pain. |

**Satisfaction and Effectiveness Levels of Bangchang Chili Balm in Four Aspects of 35 volunteers.**

*Table 1, It was found that the volunteers expressed the highest satisfaction with the usability of the Bangchang Chili Balm at 4.70. This was followed by satisfaction with its pain-relieving effectiveness at 4.64, the overall product evaluation at 4.62, and the product features at 4.58, respectively.*

| Satisfaction and Effectiveness Criteria | Average | S.D | Level |
|---|---|---|---|
| **1. Product Features** | 4.58 | | 5 |
| 1.1 Product Aesthetics | 4.60 | 0.55 | 5 |
| 1.2 Fragrance | 4.66 | 0.54 | 5 |
| 1.3 Balm Color | 4.63 | 0.55 | 5 |
| 1.4 Texture of the Balm | 4.69 | 0.53 | 5 |
| 1.5 Product Size | 4.46 | 0.74 | 4 |
| 1.6 Product Stability | 4.43 | 0.74 | 4 |
| **2. Usability** | 4.70 | | 5 |
| 2.1 Product Form Easy to Use | 4.60 | 0.55 | 5 |
| 2.2 Safety (e.g., no allergic reaction, irritation) | 4.97 | 0.17 | 5 |
| 2.3 Absorption into the Skin | 4.51 | 0.61 | 5 |
| **3. Effectiveness in Pain Relief** | 4.64 | | 5 |
| 3.1 Ability to Relieve Pain | 4.69 | 0.47 | 5 |
| 3.2 Duration of Effectiveness | 4.60 | 0.55 | 5 |
| **4. Overall Product Evaluation** | 4.62 | | 5 |
| 4.1 Overall Satisfaction with the Product | 4.63 | 0.55 | 5 |
| 4.2 Willingness to Use the Product for Pain | 4.63 | 0.49 | 5 |
| 4.3 Willingness to Recommend the Product | 4.60 | 0.50 | 5 |

## 3. Conclusion

Capsaicin exerts significant therapeutic effects, such as antioxidant, anti-obesity, and anti-cancer properties. However, there is no evidence to prove the actual mechanism of capsaicin that presents these functions. Thus, more in-vivo, in-vitro, and clinical studies are required to understand the working mechanisms of capsaicin further. It's important to be more careful when taking certain drugs, like cephalexin, pitavastatin, and cyclosporin (CyA), with foods that contain capsaicin, because these drugs have a small therapeutic window and could make patients sick. Furthermore, novel encapsulation technologies have the potential to address the low solubility and bioavailability of capsaicin. The effectiveness of chili oil as a pain-relieving balm will be determined based on the changes in pain scores before and after application. If the chili oil balm is more effective than the placebo, it may be recommended for use in relieving pain associated with muscle soreness, joint discomfort, or minor aches.

 

## References


Ahmad N, Mukhtar H. *Antioxidants in peppers*. J Agric Food Chem1999;47(8):3138-3146.

Al-snafi AE. The pharmacological importance of Capsicum species (Capsicum annuum and Capsicum frutescens) grown in Iraq. J Pharm Biol. 2015;5(3):124-142.

Cheng BH, Yang RY. *Global chili pepper (Capsicum spp.)* germplasm resources: A review. Asian J of Agric Biol 2017;5(2):44-51.

Cui L, Wang H, Ji Y, Yang J, Xu S, Huang Y, et al. *Capsaicin: Current understanding of its mechanisms and therapy of pain and other pre-clinical and clinical uses*. Molecules 2016; 21(7):844

Fattori V, Hohmann M, Rossaneis A, Pinho-Ribeiro F, Verri W. *Capsaicin: current understanding of its mechanisms and therapy of pain and other pre-clinical and clinical uses*. Molecules. 2016;21(7):844.

Kakatum, N., Fakkam, S., Donbandranchokea, M., Anuchona, J., and Supatsaraphokin, N., (2021) Development of Innovative Gel Sunscreen Products from Momordica cochinchinensis(Lour.) Spreng. Extract. *Journal of Pharmaceutical Research International* Vol. 33(60A), pp 484-490,

Kanyapat Petcharaporn, Kanittada Thongkaol, Pimporn Thongmuang, Yuttana Sudjaroenl,

Kim EJ, Kim MK, Jin XJ, et al. *Curcumin inhibits skin inflammation and angiogenesis in vivo*. Arch Pharm Res 2008;31(11):1436-1443.

Kitahara K, Kawai S. Cyclosporine and tacrolimus for the treatment of rheumatoid arthritis. Curr Opin Mal J Med Health Sci 16(SUPP6): 216-224, Aug 2020 224 Rheumatol. 2007;19(3):238-245

Lee SH, Choi SY, Kim H, et al. *Capsaicin Inhibits Dimethylbenz[a] anthracene-Induced Skin Tumor Formation via Antiinflammation*. Cancer Prev Res (Phila) 2010;3(11):1354-1365.

Nutritional Composition, Capsaicin Content and Enzyme Inhibitory Activities from ‘Bang chang’ Thai Cultivar Chili Pepper (Capsicum annuum Var. acuminatum) after Drying Prodess,Available Online:25 September,2023.

Rashid MH, Inoue M, Bakoshi S, Ueda H. *Increased expressionof vanilloid receptor 1 on myelinated primary afferent neurons contributes to the anti-hyperalgesic effect of capsaicin cream in diabetic neuropathic pain in mice*. J Pharmacol Experiment Therap. 2003;306(2):709-717.

Russo VM. *Peppers: botany, production and uses*. Wallingford, Oxfordshire: CABI; 2012

Smutzer G, Devassy RK. Integrating TRPV1 receptor function with capsaicin psychophysics. Adv Pharmacol Sci. 2016;2016.

Sridith K, Ratanapanone N. *The hot Thai chili pepper industry and the Thai farmers’ risk attitude toward production*. Int J of Dev Sustain 2018;7(2):1047-1059.

Sudjaroen Y. *Evaluation for nutritive values and antioxidant activities of Bang Chang 's Cayenne pepper (Capsicum annuum var. acuminatum)* Sci Res Essays 2014;9(19):844-850.

Thiele R, Mueller-Seitz E, Petz M. *Chili pepper fruits: presumed precursors of fatty acids characteristic for capsaicinoids*. J Agric Food Chem. 2008;56(11):4219-4224.

Wang DH, Kuo CH, Kuo YH, Lee JS, Chang TC. *Carnosic acid and capsaicin from neuroprotective and bioactive properties of dried chili in rotenone-induced oxidative stress and apoptosis*. Neurol Sci 2009;30(6):1111-1120.

Yoon JY, Kwon HH, Min S, et al. *Supplementing with dietary astaxanthin combined with collagen hydrolysate improves facial elasticity and decreases matrix metalloproteinase-1 and -12 expression: a comparative study with placebo*. J Med Food 2014;17(7):810-816.

Yuttana Sudjaroenl, Tanunchanok Pitaksilp, Kampol Ruchiwit, Kanittada Thongkaol, Pimporn Thongmuang, Kowit Suwannahong, Association of CYP2D6 (G1934A) gene and hematological disturbances in chronic pesticide exposures, Journal of Applied Pharmaceutical Science Vol. 10(09), pp 065-071, September, 2020.