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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 $\lambda_{\text{max}} = 415 \text{ nm}$	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.

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