

ANTI-CELLULITE EFFECT OF BLACK PEPPER AND ROSEMARY OIL RICH BALM

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Abstract

This study was performed to evaluate the efficacy and satisfaction of anti-cellulite balm containing black pepper and rosemary oil. The product efficacy was tested by 4 weeks using with massage on thighs area of 10 subjects (5 subjects for placebo and 5 subjects for anti-cellulite balm). The thighs circumferences were measured before and after 4 weeks of treatment. The result found that the thighs circumferences were significantly decreased ($p < 0.05$) after 3 weeks of massage with anti-cellulite balm. The skin in treated area was evaluated with visioscan VC 98[®] before and after 4 weeks using. The result found that the smoothness was increased whereas the roughness and wrinkle of the skin were decreased versus baseline in both groups. The subjects reported satisfaction on anti-cellulite balm such as non-irritation, texture, moisture, spreadability, odor, and absorption ability at a high level. In addition, the product preference was tested by 200 participants. The participants were asked about anti-cellulite product use and found that most of them never use anti-cellulite product (84%). The product satisfaction such as easy to use, packaging, texture, spreadability, absorption ability and odor were at a high level. There were 53.5% of participants interested in anti-cellulite balm. However, there were many suggestions such as packaging need to be improved and the product should be added with color and fragrance.

Keywords: anti-cellulite, balm, black pepper oil, cellulite, rosemary oil

Introduction :

Cellulite is aesthetically undesirable for most women and can potentially lead to a decrease in self-perception and reduce the overall physiological quality of life (Roure et al. 2011). Approximately 85% of women over the age of 20 have some degree of cellulite (Rao et al. 2004). It occurs mainly on the lower limbs, pelvic region (gluteal-femoral regions) and abdomen and is characterized by an “orange peel” or “cottage cheese” appearance (Drealos and Marenus 1997). Cellulite representing all shapes and sizes that affect by an estrogen hormone to stimulate lipogenesis and inhibit lipolysis, resulting in adipocyte hypertrophy (Rossi and Vergnanini 2000).

There are various techniques for cellulite treatment such as skin brushing, massage, controlled weight-loss, body wrap, steam and sauna, laser treatment, liposculpture, surgery (Wollina et al. 2008), mesotherapy, liposuction, endermology, injection lipolysis, radio frequency, carboxy therapy, high frequency ultrasound massage and cryolipolysis (Foster 2004; Goldman and Hexels 2010). Among the treatments for cellulite, massage is a cost-effective treatment. Massage is safe, less side effects and easy to apply, although it requires a lot of times and regularly performed for expected result. Cellulite has been treated with massage which decreases tissue edema but it is also likely to have its effects at the cellular level by stimulating fibroblast (and keratinocyte) activity while decreasing adipocyte activity. In addition to massage, effective topical creams with a variety of agents were used to ameliorate the condition (Rawlings 2006). Topical anti-cellulite preparations may be divided

in four major groups according to their mechanism of action. These treatments include agents that increase the microcirculation flow, reduce lipogenesis and promote lipolysis, restore the normal structure of dermis and subcutaneous tissue, and prevent free radical formation or scavenge free radicals. Several pharmacologic agents available for the treatment of cellulite lack scientific evidence of long-term efficacy (Khan et al. 2010).

There are various essential oils suitable for anti-cellulite massage such as lemongrass, thyme, linalool, rosemary, cypress, grapefruit, black pepper, juniper, fennel and eucalyptus. Black pepper (*Piper nigrum*) has long been used in Thai traditional medicine for many health benefits such as aches and pains, congestion, digestion, exhaustion, fatigue, stiffness and stimulating (Worwood 2001). It is a good circulation enhancer, dilating blood vessels in the area in which it is applied and it can also help tone muscles (Foster 2004). It contains major pungent alkaloid, piperine which is known to possess many pharmacological actions such as antioxidant, analgesic and anti-inflammatory activities (Damanhour and Ahmad 2014). The other chemical components of black pepper are limonene, caryophyllene, α -phellandrene, α -pinene and β -pinene (Worwood 2001). Rosemary (*Rosmarinus officinalis*) is well known for fighting the capillary fragility that can cause fluid to leak into the surrounding tissues. It is also antioxidant, anti-inflammatory and detoxifying herb (Foster 2004). Therefore, it is an extremely important anti-cellulite herb which included in many brand of anti-cellulite cream. The main chemical components of rosemary is 1,8-cineole, α -pinene, camphene, α -terpineol and borneol (Touafek et al. 2004). It is also contains polyphenolic compounds such as flavonoids and phenolic acid derivatives (e.g. rosmarinic acid) (Okamura et al. 1994)

There are numerous anti-cellulite products that have been advertised and employed to treat cellulite. In general, most of anti-cellulite products in market are in dosage form of cream, oil and gel. Moreover, there is no research regarding the use of anti-cellulite balm. This study, therefore, aimed to formulate anti-cellulite balm containing black pepper and rosemary oils. Then, the product efficacy and satisfaction were evaluated by volunteers.

Methodology :

Subjects

Subjects in this study consisted of 10 female aged between 19-25 years. Eligible subjects for product efficacy test were required to present of cellulite on their thighs (grades 2; orange peel visible with pinching) according to Curri's classification (Rossi and Vergnanini 2002). Each subject provided informed consent and has a right to privacy. They have no history of allergic reaction of black pepper and rosemary oil. All subjects did not change lifestyle, habitual intake, or physical activity levels during the test period. Other anti-cellulite treatments, cosmetic products and moisturizers are avoided in the studied area. This was a randomized, placebo-controlled study. The subjects were divided into two groups: placebo (n=5) and active (n=5) to assess the product efficacy and product satisfaction of anti-cellulite balm versus a placebo.

Formulation of anti-cellulite balm

For anti-cellulite balm preparation, white beeswax, petrolatum and sweet almond oil were melt on water bath until became clear solution or homogeneously. Black pepper oil, rosemary oil (Payan Bertrand, Indonesia) and vitamin E were added with stirring and pour in container. The control balm was prepared by the same method without black pepper and rosemary oil as shown in the Table 1.

Table 1 Formulation of anti-cellulite and control balm

| Ingredient | Control balm | Anti-cellulite balm |
|------------------|--------------|---------------------|
| Petrolatum | 70.00 | 70.00 |
| Sweet almond oil | 27.50 | 22.30 |
| Rosemary oil | - | 2.50 |
| Black pepper oil | - | 2.50 |
| White beeswax | 2.50 | 2.50 |
| Vitamin E | 0.20 | 0.20 |
| Total | 100.00 | 100.00 |

Anti-cellulite massage procedure

The subjects were massaged with anti-cellulite balm (active) or control balm (placebo) on both sides of thighs 30 minutes every day for 4 weeks by massage therapists. The massage procedure consisted of 6 steps as shown in Figure 1. Each step was modified from Synovitz and Karl (2013).

Step 1: Apply balm in a proper amount on the thighs area and lubricating it around the thighs.

Step 2: Start massaging at the lower thigh and go up toward heart. Then slide hand back down to the lower and repeat the entire “Light long stroking” by use the palm and fingertips of both hands, begin at upper knee and stroke up with light long pressure to the buttock. Pick the hand up and begin again at the same beginning point.

Step 3: Apply “Fan stroking” by placing hands palm-side down and smoothly sliding upwards. The fingers are then fanned out on both sides, slowly releasing pressure movement and finishing at the top of thighs.

Step 4: Performing “Knuckle stroking” by make a loose fist and place it knuckles down with apply moderate pressure, finishing at the upper thighs.

Step 5: Use “Circular pressure” by apply light pressure with the thumbs in a circular motion while gradually increase the pressure.

Step 6: Finish off with some relaxing with “Effleurage”, the hands are placed across the thighs with fingers together and thumbs slightly stretched. The stroke should be smooth, initially without pressure.



Figure 1 Anti-cellulite massage procedure

Thigh circumference measurements

Thigh circumferences were measured using measuring tape while the subjects standing at the upper thighs area close to the fat buttocks (at the top) (Roure et al. 2011) every week for 4 weeks after massage. A baseline was recorded at week 0 before the beginning of the test.

Skin texture measurement

The smoothness, roughness and wrinkle of skin in treating areas were measured with visioscan VC 98[®] before and after treatment for 4 weeks. All measurements were performed by the same researcher under a controlled temperature (between 20-22°C) and relative humidity (between 45%-55%).

Subjects satisfaction tests

After 4 weeks of massage the subjects were asked to evaluate their satisfaction using the questionnaire. The questionnaire consists of 2 parts, (1) information about product appearance and texture; (2) information about the satisfaction after using the anti-cellulite or control balms.

The feeling scores of satisfaction after treatment were calculated as class interval to classify 5 levels of satisfaction: very high (score 4.21-5.00), high (score 3.41-4.20), medium (score 2.61-3.40), low (score 1.81-2.60) and very low (score 1.00-1.80).

Product preference test

The consumer’s preference of anti-cellulite balm was evaluated by 200 females. The participants were asked to try balm and evaluated their satisfaction by answer the questionnaire. The questionnaires consist of 4 parts, which contain general information, anti-cellulite product using information, anti-cellulite balm satisfaction and other suggestions.

Data Analysis

The data were expressed as mean, standard deviation and percentage. Statistical analysis was determined by Paired sample t-test via SPSS version 21 licensed for Mae Fah Luang University.

Results :

Anthropometric body composition measurement

Weight and body fat were measured using electronic body fat scale PT-712. BMI was calculated by the weight in Kilograms divided by the square meters of the body height (Kg/m²). It was found in Table 2 that there was no changed in anthropometric body composition of both groups after 4 weeks when compared with baseline (week 0) because all subjects did not change their lifestyle, habitual intake, or physical activity levels during test period. Therefore, the weight had no major influence on the results of both groups.

Table 2 The anthropometry measurement

| | Group | Number | Week 0 | Week 1 | Week 2 | Week 3 | Week 4 | Change (After-before) |
|--------------------------|---------|--------|------------|------------|------------|------------|------------|-----------------------|
| Weight (Kg) | Control | 5 | 53.28±5.39 | 53.52±6.08 | 53.6±5.75 | 53.5±5.77 | 53.6±6.11 | 0.32±0.72 |
| | Test | 5 | 53.62±6.49 | 54.16±6.24 | 54.06±6.36 | 54.54±6.46 | 54.44±6.63 | 0.82±0.14 |
| BMI (Kg/m ²) | Control | 5 | 19.96±2.11 | 20.08±2.26 | 20.10±2.32 | 20.08±2.31 | 20.04±2.21 | 0.08±0.10 |
| | Test | 5 | 20.96±2.70 | 21.26±2.73 | 21.14±2.70 | 21.38±2.81 | 21.40±2.89 | 0.44±0.19 |
| Body fat (%) | Control | 5 | 20.28±4.30 | 20.02±4.65 | 19.98±4.11 | 19.9±4.27 | 20.08±4.45 | -0.20±0.15 |
| | Test | 5 | 22.46±5.79 | 21.74±5.73 | 21.82±6.00 | 22.06±5.96 | 22.24±5.78 | -0.22±0.01 |

Thigh circumference measurement

Table 3 summarizes the mean circumference measurement differences which were calculated by measuring thigh circumference before and after using anti-cellulite balm or placebo (before-after) every week for 4 weeks. After 3 weeks of massage with anti-cellulite balm the thigh circumferences of both side were significantly decreased from baseline (week 0) whereas in the placebo group the thigh circumferences of both side were significantly increased (p<0.05) in week 2 (right side) and week 4 (left side).

Table 3 Means of the change (before-after) of the thighs circumference measurements after using anti-cellulite balm and placebo

| | Week 1 | Week 2 | Week 3 | Week 4 |
|---------------------|------------|-------------|-------------|-------------|
| Anti-cellulite balm | | | | |
| Left | -0.02±0.13 | 0.20±0.23 | 0.36±0.25* | 0.56±0.32* |
| Right | 0.08±0.23 | 0.28±0.24 | 0.34±0.15* | 0.56±0.22* |
| Placebo | | | | |
| Left | -0.00±0.19 | 0.04±0.15 | -0.12±0.15 | -0.20±0.16* |
| Right | -0.08±0.23 | -0.38±0.18* | -0.36±0.25* | -0.36±0.21* |

*Significant vs. baseline (week 0) (p<0.05)

Skin texture measurement

The results of skin texture measurements with a visioscan VC 98[®] such as smoothness, roughness and wrinkle are shown in Table 4. After using the anti-cellulite balm for 4 weeks, the skin on treated area significantly increased in smoothness on left side (p<0.05), significantly decreased in roughness on both sides (p<0.05) and significantly decreased in wrinkle on left side (p<0.05).

Table 4 Skin texture measurement

| | Placebo | | | | Anti-cellulite balm | | | |
|------------|-------------|-------------|-----------------------|---------|---------------------|------------|-----------------------|---------|
| | Before | After | Change (After-before) | P-value | Before | After | Change (After-before) | P-value |
| Smoothness | | | | | | | | |
| Left | 36.12±13.39 | 48.40±13.40 | +12.28(-5.61,20.5) | 0.061 | 38.47±8.50 | 49.27±2.85 | +10.80(1.56,17.18) | 0.018 |
| Right | 38.99±6.61 | 42.02±11.79 | +3.03(0,16.9) | 0.434 | 49.35±4.16 | 51.58±6.76 | +2.23(-1.65,14.66) | 0.583 |
| Roughness | | | | | | | | |
| Left | 2.18±0.37 | 1.31±0.29 | -0.87(-1.42,-0.57) | 0.005 | 2.54±0.55 | 1.84±0.27 | -0.69(-1.66,-0.32) | 0.047 |
| Right | 2.26±0.60 | 1.46±0.64 | -0.79(-0.79,-0.33) | 0.015 | 3.34±0.85 | 1.94±0.34 | -1.41(-1.49,-0.33) | 0.047 |
| Wrinkle | | | | | | | | |
| Left | 48.45±3.87 | 42.72±2.92 | -5.73(-10.86,0) | 0.059 | 56.49±11.05 | 49.42±8.38 | -7.07(-13.17,0) | 0.029 |
| Right | 44.86±4.92 | 45.64±9.82 | +0.79(-5.75,7.23) | 0.775 | 50.92±8.17 | 46.15±5.44 | -4.79(-14.4,-0.26) | 0.775 |

Satisfaction on the properties of anti-cellulite balm

The subjects in both groups were asked for their satisfaction on general characteristic of anti-cellulite balm. The results are shown in Table 5 that the subjects in tested group satisfied the texture, odor, spreadability, absorption ability, moisture and non-irritation of anti-cellulite balm at high level.

Table 5 Satisfaction on the properties of anti-cellulite balm

| Parameter | Control Group | | Tested Group | |
|----------------|---------------|-----------------------|--------------|-----------------------|
| | Score±SD | Level of Satisfaction | Score±SD | Level of Satisfaction |
| Texture | 3.00±2.24 | Medium | 3.80±1.73 | High |
| Odor | 2.40±1.00 | Low | 3.40±1.22 | High |
| Spreadability | 3.20±1.73 | Medium | 3.60±1.73 | High |
| Absorption | 3.20±1.73 | Medium | 3.40±1.41 | High |
| Moisture | 3.20±1.73 | Medium | 3.60±1.73 | High |
| Non-irritation | 4.40±1.73 | High | 4.60±1.73 | High |

Satisfaction after using anti-cellulite balm

The subjects in both groups were asked for their satisfaction after using anti-cellulite and control balm. The results are shown in Table 6 that subjects in tested group satisfied the reduction of thighs circumference, cellulite reduction, smoothness, tightness and flexibility at

medium level. Moreover, they felt impressive and interested in the anti-cellulite balm at high level.

Table 6 Satisfaction after using anti-cellulite balm

| Parameter | Control Group | | Tested Group | |
|-----------------------------------|-----------------|-----------------------|-----------------|-----------------------|
| | Score \pm SD | Level of satisfaction | Score \pm SD | Level of satisfaction |
| Reduction in Thighs circumference | 2.00 \pm 2.24 | Low | 3.00 \pm 1.41 | Medium |
| Cellulite Reduction | 2.00 \pm 2.24 | Low | 3.20 \pm 1.73 | Medium |
| Smoothness | 2.60 \pm 1.41 | Low | 3.00 \pm 2.24 | Medium |
| Tightness | 2.00 \pm 2.24 | Low | 3.00 \pm 2.24 | Medium |
| Flexibility | 2.60 \pm 1.73 | Medium | 3.20 \pm 1.73 | Medium |
| Impressiveness | 3.40 \pm 1.41 | High | 3.80 \pm 1.73 | High |
| Interestedness | 3.20 \pm 1.73 | Medium | 3.80 \pm 1.73 | High |

Product preference test

The preference of anti-cellulite balm was tested by 200 females with age between 19 - 25 years old. The participants were asked for their anti-cellulite products using information. The result is shown in Table 7 that 168 participants (84%) were never use anti-cellulite product and 32 participants (16%) were used anti-cellulite products. They used products such as cream (16 subjects, 50%), gel (10 subjects, 31.25%) and oil (10 subjects, 31.25%), respectively.

Table 7 Anti-cellulite product using information and types of anti-cellulite products

| Anti-cellulite product using | Frequency | Percentage |
|----------------------------------|-----------|------------|
| Use | 32 | 16.00 |
| Types of anti-cellulite product* | | |
| Cream | 16 | 50.00 |
| Gel | 10 | 31.25 |
| Oil | 10 | 31.25 |
| Never use | 168 | 84.00 |

*More than one answer can be chosen

Product satisfaction on properties of anti-cellulite balm

The participants were asked about their satisfaction on general characteristic of anti-cellulite balm. The result is shown in Table 8 that the participants satisfied anti-cellulite balm at high level for all factors such as easy to use (4.08 \pm 35.22), packaging (3.89 \pm 31.42), texture (3.84 \pm 36.09), spreadability (3.77 \pm 34.33), absorption ability (3.70 \pm 31.62), and odor (3.56 \pm 32.53).

Table 8 Product satisfaction on properties of anti-cellulite balm

| Parameter | Score \pm SD | Level of satisfaction |
|---------------|-----------------|-----------------------|
| Easy to use | 4.08 \pm 0.94 | High |
| Packaging | 3.89 \pm 0.96 | High |
| Texture | 3.84 \pm 0.85 | High |
| Spreadability | 3.77 \pm 0.88 | High |
| Absorption | 3.70 \pm 0.93 | High |
| Odor | 3.56 \pm 0.92 | High |

Interested in anti-cellulite balm

The participants were asked for their interested in anti-cellulite balm. The results found that 107 participants (53.5%) were interested in anti-cellulite balm whereas 93 participants (46.5%) were not interested.

The suggestion for product improvement

The last part of questionnaire composed of the suggestion for product improvement. After test anti-cellulite balm there were many suggestions form participants as shown in Table 9. Most participants (55%) were suggested that odor of anti-cellulite balm should be improved. The anti-cellulite balm should be added with fragrance such as floral or fruit scent (rose, lavender and blueberry) and fresh scent (peppermint). In addition, the participants (26%) suggested that the packaging of product should be more designed and attractive. The packaging should make from plastic and has Thai label. Moreover, 45 participants (22.5%) suggested that the product color should be improved for more attractive, 31 participants (15.5%) suggested that the texture of balm should be improved. However, a few participants (1.5%) suggested that other forms of product such as spray and stick are more easily for use.

Table 9 The suggestions for product improvement (more than one answer can be chosen)

| Suggestion for product improvement | Frequency | Percentage |
|------------------------------------|-----------|------------|
| Odor | 110 | 55.00 |
| Packaging | 52 | 26.00 |
| Color | 45 | 22.50 |
| Texture | 31 | 15.50 |
| Other | 3 | 1.50 |

Discussion and Conclusion :

The anti-cellulite balm had semi-solid texture. It contained petrolatum, beeswax, sweet almond oil, black pepper oil (2.5%) and rosemary oil (2.5%). The products tend to be stable and safe, since the texture, color and odor did not change during use for 1 month. Moreover, there was no irritation developed by 24 hours occlusion in patch testing and after used. The anti-cellulite balm was proved to reduce the thigh circumference and improved the skin texture when compared with baseline (week 0).

The reduction in thigh circumference might be due to the topical treatment with black pepper and rosemary oil. Black pepper and rosemary oils are rich in flavonoids and terpenes (Mohamed and Al-Okbi 2008; Kukreja et al. 2015) which reported to help counteract cellulite by improving circulation, encouraging the elimination of wastes, preventing free radical formation or scavenging free radicals, restoring hormonal balance and inhibiting further fibrosclerosis of fat surrounding collagen matrix (Wilson 2003; Barel 2009). Black pepper oil stimulates circulation and improves muscle tone whereas rosemary oils encourages cellular metabolism and assists in the drainage of lymphatic fluid (Wilson 2003). Rosemary oil also stimulates cell renewal, improves dry and mature skin and can reduce the appearance of broken capillaries and varicose veins by strengthening fragile vessels (Wilson, 2003).

The improvement of skin texture might be due to massage technique. The massage helps stimulate the blood and lymph microcirculation, increase the removal of the extra fluid in the adipose tissue, reduce interstitial excess fluids, improve cell oxygenation and filtration or re-

absorption processes in the capillaries (Sparavigna et al. 2011). Furthermore, massage techniques will retard the further development of fibrosclerosis and the aggregation of fat cells in nodules (Barel 2009). Continued massage should help to reduce the stagnation of the lymph and therefore, stop cellulite getting worse, which leads to the reduction of cellulite (Draelos and Marenus 1997; Foster 2004). Moreover, massage and warmth have been shown to assist in topical medication delivery into the skin and further reduce the appearance of cellulite (Pierard et al. 2000). In addition, both anti-cellulite balm and control balm contain sweet almond oil which also used as massage oil for enhance penetration of essential oil. Sweet almond oil has rich concentration of oleic and linoleic essential fatty acids which provide the moisturizing, restructuring, natural emollient and skin-rejuvenating properties (Kuriyama et al. 2005). It is quite possible that synergies between both massage and anti-cellulite balm may be the intervention to ameliorate the signs of cellulite.

The subject satisfaction on anti-cellulite balm according to questionnaires was high because it was effective, no irritation, easy to use and interesting. Anti-cellulite balm offer the benefit of a safe treatment and visible result was observed after few weeks of application. It appears to be more inexpensive and easy to use than laser treatment (Byun et al. 2015). However, additional large clinical trials and long-term test are required to confirm the efficacy of anti-cellulite balm. In addition, the mechanisms of action need to be investigated. Further research is required to study in percutaneous penetration of the active molecules through the skin to reach the hypodermis. Furthermore, other parts of the body are needed to be tested for more reliable result. Moreover, other essential oils that help combat cellulite include basil, cedarwood, clary sage, cypress, fennel, geranium, juniper, lemon, orange, oregano, patchouli, spruce and thyme might be useful for further studies as aromatherapy blends. Because aetiopathogenesis of cellulite is complex, an effective slimming product should always contain a combination of ingredients acting either in an additive or in a synergistic manner on different metabolic pathways (Terranova et al. 2006).

In conclusion, massage with anti-cellulite balm containing black pepper and rosemary oil possesses significant potential for the treatment of cellulite and found to be safe. Additionally, there were many suggestions for product improvement such as the packaging should be improved and the product should be added with color and fragrance.

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