Antimicrobial Activity of *Garcinia mangostana* Extract for Anti-Acne Therapy

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ABSTRACT

The present study aims to evaluate the antimicrobial activity of the ethanolic extract of Garcinia mangostana peel on acne treatment. The alpha-mangostin content in G. mangostana peel was determined by an HPLC method. The minimum inhibitory concentration was utilized to measure the antimicrobial activity of the extract against Staphylococcus aureus, Bacillus subtilis, Escherichia coli, Salmonella and Propionibacterium acnes, with the resulting minimum inhibitory concentrations being 0.0098, 0.0098, 0.0195, 0.0195 and 1.25 mg/mL, respectively. The in vivo analysis of the extract was performed on female volunteers with acne-prone skin. The results showed a significant decrease in acne lesions including comedones, microcysts, papules and pustules of 47.44%, with 83% of the volunteers reporting satisfaction and 9% intolerance sensations after 28 days of treatment. This result demonstrates that Garcinia mangostana peel extract has therapeutic potential as a treatment for acne lesions and therefore is an effective natural alternative ingredient for use in an anti-acne gel for ecological cosmetics.

INTRODUCTION

Garcinia mangostana is a queen of the tropical fruits with a sweet and sour taste. It is widely cultivated in Indochina countries including Thailand and can only be found once a year during the rainy season. It has been traditionally known among Thais that the peel of *Garcinia mangostana* has astringent, wound-healing, anti-inflammatory, odour-inhibiting and skin-lightening properties as well as an antimicrobial effect on oral bacteria. Studies have shown that the ethanolic extract from pericarp of *Garcinia mangostana* consists of xanthones, mangostin, polyphenol and flavone. This study aims to evaluate the efficacy of the ethanolic extract of *Garcinia mangostana* peel on the antimicrobial activities and the inhibitory effect of the extract against facial acne in female volunteers in order to find a natural substitute for synthetic acne treatment.

EXPERIMENTAL

Plant material and equipment

The *Garcinia mangostana* were collected from the Chantaburi province in the east of Thailand. The peel was cleaned and dried at 50 + 2 °C for 48 h. The dried peel was ground to a fine powder and passed through a sieve (40 mesh).

The materials and equipment required for the experiment were:

- 3000 mL closed system extraction tank (P.K.T. Engineering Supply, Samut prakarn, Thailand)
- Whatman No.1 filter paper (Whatman International, Kent, England)
- Rotary vacuum evaporator (Buchi Labortechnik AG, Flawil, Switzerland)
- High performance liquid chromatography (HPLC) (Agilent Technologies, Santa Clara, CA, USA)
- Cosmosil C-18 column (4.6 x 250 mm, 5 micrometer size) (Nacalai, San Diego, CA, USA)
- Mueller-Hinton agar plate (MHA)

(Merck, Darmstadt, Germany)
- Autoclave (Hirayama Inctech Metrological, Saitama, Japan)
- Vortex mixer (Scientific Industries, Bohemia, NY, USA)
- Laminar flow (Dwyer Instruments, Michigan City, IN, USA
- Incubator (Memmert, Büchenbach, Germany)
- Micropipette (Merck, Darmstadt, Germany)
- Paper discs (Whatman International, Kent, England)
- Blood agar base No.2 (Merck, Darmstadt, Germany)
- Mueller-Hinton agar (Merck, Darmstadt, Germany)

Preparation of the extract

The fine powder sample (200 g) was extracted twice with 2000 mL of 95% ethanol with agitation for 24 h. The extract was filtered through a Whatman No.1 filter paper and concentrated on a rotary vacuum evaporator to remove the residual ethanol. The concentrated extract was stored at 4 °C.

Determination of the α–mangostin content by HPLC

The content of α–mangostin in the *Garcinia mangostana* peel extract was analyzed by high performance liquid chromatography (HPLC). The HPLC method was performed on a Agilent 1100 Series HPLC system equipped with a model LC-10AD pump, UV-Vis detector SPD-10A, Rheodyne injector fitted with a 20 µL loop and auto injector SIL-10A. A Cosmosil C-18 column (4.6 × 250 mm, 5 µm size) with a C-18 guard column was used. The elution was carried out with gradient solvent systems with a flow rate of 1.3 mL min-1 at ambient temperature (25-28 °C). The mobile phase consisted of ortho-phosphoric acid pH 3 (solvent A) and acetonitrile (solvent B). The mobile phase was prepared daily, filtered through a 0.45 µm and sonicated before use. Total running time was 30 min. The sample injection volume was 5 µL, while the wavelength of the UV-Vis detector was set at 243 nm. The compounds were quantified using CLASS VP software.

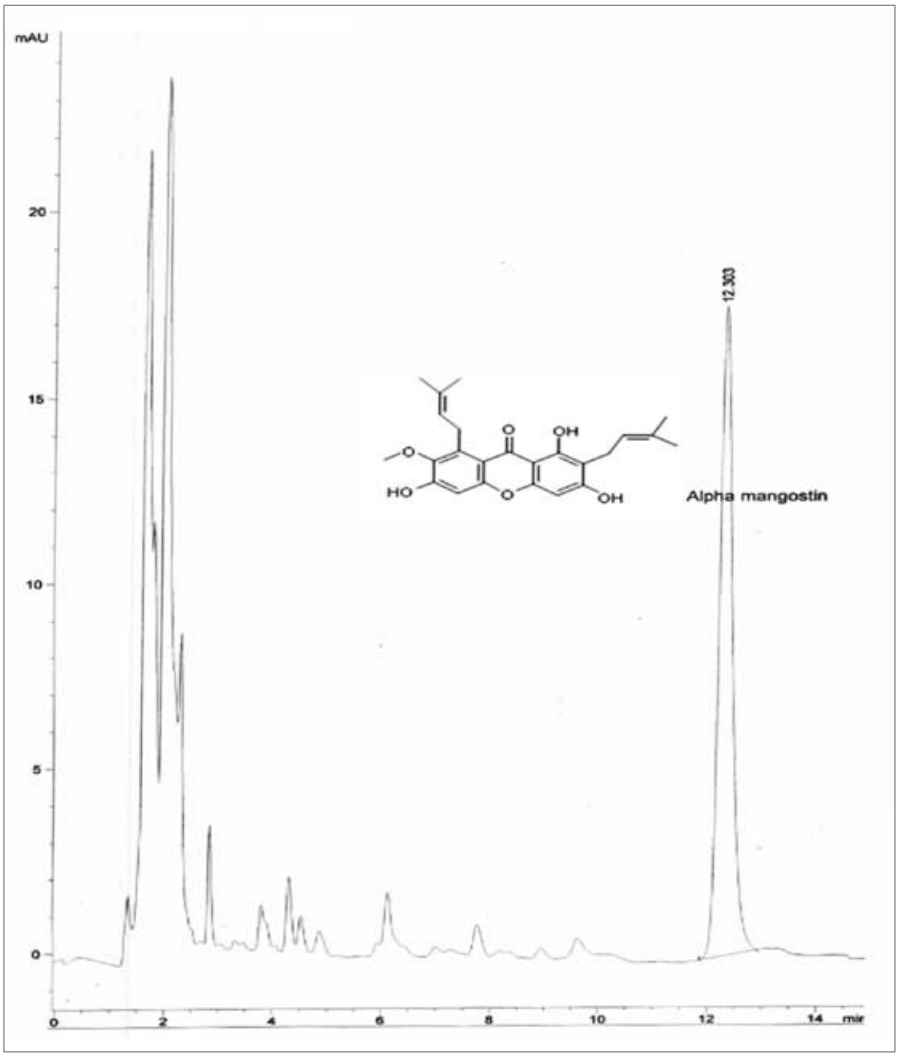

Fig. 1 HPLC chromatogram of the alpha-mangostin in *Garcinia mangostana* extract

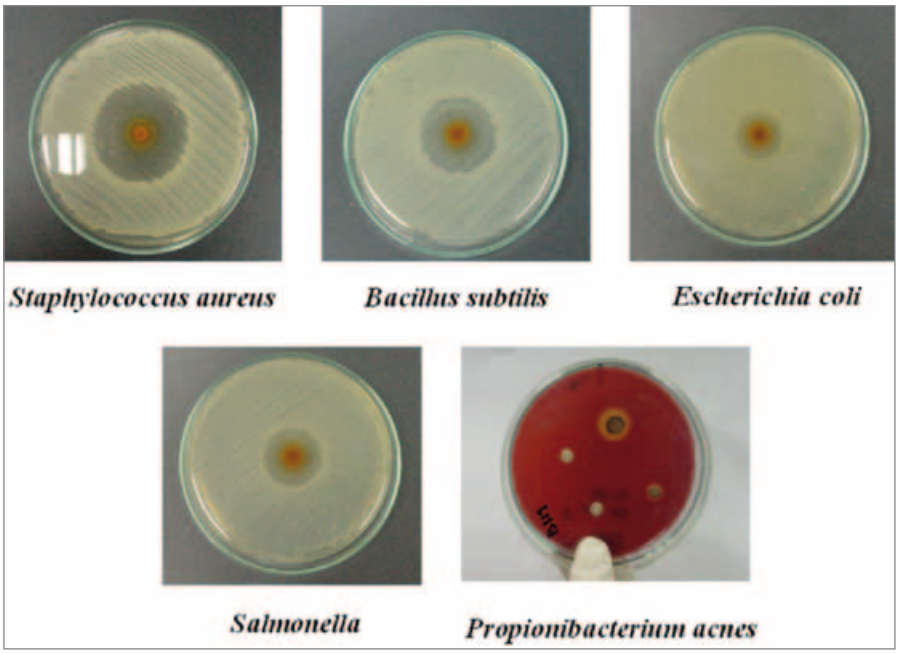

Fig. 2 Inhibition Zone of the *Garcinia mangostana* extract for various microorganisms

Disc diffusion method

The antibacterial activity was tested using the disc method. The surface of a Mueller Hinton agar plate (MHA) was inoculated with *S. aureus*, *B. subtilis*, *E. coli*, and *Salmonella*, and chocolate agar was inoculated with *P. acnes* suspension (McFaland No.0.5). Sterile, six mm-diameter paper discs were placed on the inoculated agar plate and *Garcinia mangostana* extracts were put on the discs. Plates were incubated at 37 °C for 24 h and *P. acnes* was incubated in an anaerobic jar. Afterwards the antibacterial activity was evaluated by measuring the inhibition zone diameters.

Analysis of the minimum inhibitory concentration

The minimum inhibitory concentration (MIC) was determined by agar dilution. The extract was prepared in liquid form and then diluted using serial two-fold dilutions to achieve final concentrations of 0.0195-2.50 mg/mL. The MIC was identified as the lowest concentration of the sample that can prevent growth of the microorganism.

Clinical evaluation of acne treatment

Twenty-two Asian female volunteers with oily facial skin took part in the clinical study. The volunteers were treated with a gel base containing 3% G. mangostana twice daily for 28 days. A dermatologist evaluated the number and type of acne lesions on Day 0 and after 28 days of treatment.

RESULTS AND DISCUSSION

Content of α–mangostin in the extract

The α–mangostin content in the ethanolic extract of *Garcinia mangostana* peel determined by HPLC was 17.89 + 0.26 % w/w; its structure is shown in **Fig 1**.

Disc diffusion method

The *Garcinia mangostana* peel extract was tested for an antimicrobial effect against *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli*, *Salmonella* and *Propionibacterium acnes*. The results showed a positive inhibitory effect against the micro-organisms **(Fig. 2)**.

Table 1 Minimum Inhibitory Concentration of *Garcinia mangostana* extract against *S. aureus, B. subtilis, E. coli, Salmonella* and *P. acnes*

Microbial Strains	Minimum inhibitory concentration of Garcinia mangostana peel extract (mg/mL)
Staphylococcus aureus	0.0098
Bacillus sublitis	0.0098
Escherichia coli	0.0195
Salmonella	0.0195
Propionibacterium acnes	1.2500

Minimum inhibitory concentration analysis

The *Garcinia mangostana* peel extract was tested for an antimicrobial effect against *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli*, *Salmonella* and *Propionibacterium acnes*. The results demonstrated a strong inhibitory effect against the microorganisms. The minimum inhi-bitory concentration (MIC) for *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli*, *Salmonella* and *Propionibacterium acnes* was 0.0098, 0.0098, 0.0195, 0.0195 and 1.25 mg/mL, respectively **(Table 1)**.

Clinical evaluation of the extract for acne treatment

The clinical evaluation of acne lesions was conducted by counting the number of retentional lesions on the facial area (except the nasal pyramid) at Day 0 and Day 28. The variation (Δ) in the total number of acne lesions from Day 0 to Day 28 was calculated as -11.1, which was equivalent to 47.44% of the totel acne lesions. The average numbers for the decrease in comedones, microcysts, papules, pustules and total number of acne lesions are shown in **Fig. 3**. There was a significant decrease in the number of acne lesions from Day 0 to Day 28 with twice daily treatment,

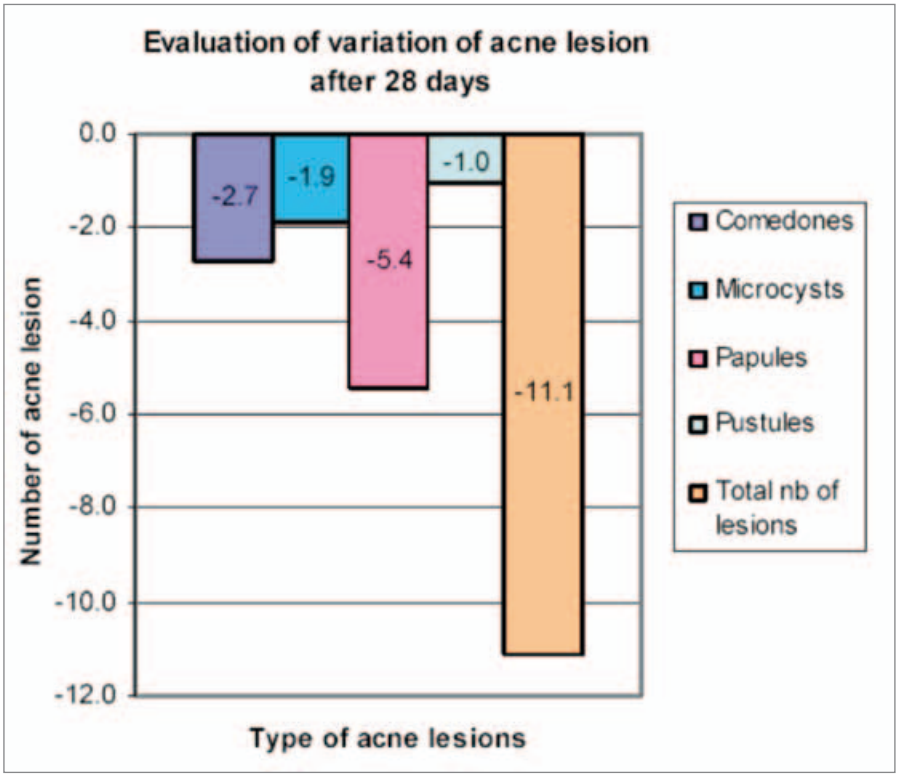

Fig. 3 Clinical evaluation of the extract for acne treatment

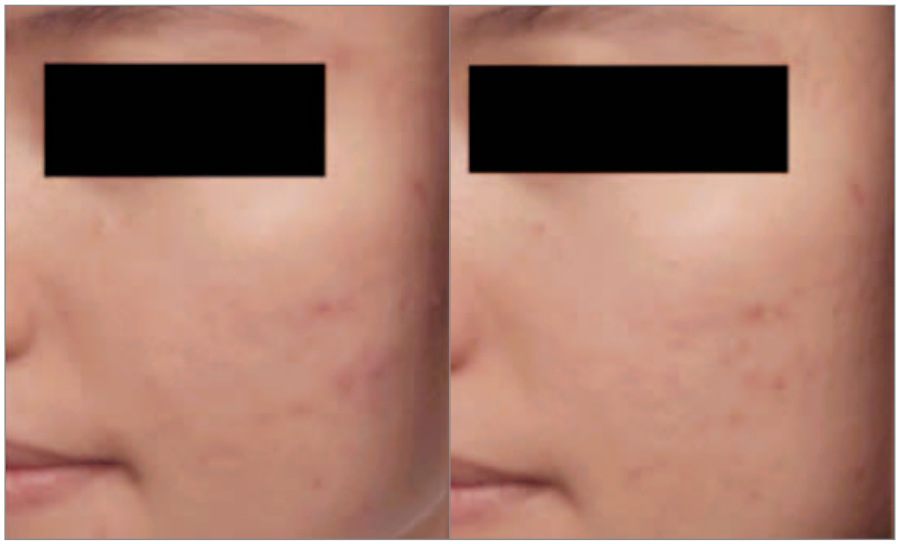

Fig. 4 Number of acne lesions at D0 and D28

particularly in the number of papules. Moreover, the subjective evaluation questionnaire revealed 83% reporting satisfaction, 9% intolerance sensations and no withdrawals due to severe irritation **(Fig. 4)**. The results therefore show that the G. mangostena extract has effective antibacterial properties and can be utilized in acne therapy.

CONCLUSION

Several synthetic antibacterial agents, which may cause side effects and irritation, have been widely used in cosmetics products. Natural ingre-dients with an antibacterial effect have therefore been investigated as an alternative.

This study was carried out to demonstrate the antibacterial properties of the ethanolic extract from *Garcinia mangostana* peel and perform an *in vivo* analysis of the inhibitory effect on the facial acne of female volunteers. HPLC measurements showed the ethanolic extract of G. mangostana peel to have an alpha-mangostin content of 17.89 + 0.26% w/w. The extract has antibacterial properties against *S. aureus*, *B. subtilis*, *E. Colli*, *Salmonella* and *propionibacterium acne* with the MIC values of 0.0098, 0.0098, 0.0195, 0.0195 and 1.25 mg/mL, respectively.

The *in vivo* analysis on Asian female subjects with acne-prone skin showed an inhibitory effect of *Garcinia mangostana* extract against comedones, microcysts, papules and pustules after 28 days of use. There was a significant decrease in total acne lesions of 47.44%, with 83% of the volunteers reporting satisfaction and 9% intolerance sensations after 28 days of treatment.

These results demonstrate that *Garcinia mangostana* peel extract has therapeutic potential as a treatment for acne lesions and is therefore an effective natural alternative ingredient for use in an anti-acne gel for ecological cosmetics.

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