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APPENDICES

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Appendix I

Individual melanin and erythema values in guinea pigs for

Propylene glycol (negative control)

3% Kojic acid (positives control)

3% Haadnun extract

5% Haadnun extract

0.5% Puag-Haad

1.0% Puag-Haad

Skin color was evaluated on guinea pig skin with mexameter MX 16 described in methods.



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Table 1 Skin measurement before and after applying propylene glycol (negative control) in guinea pigs (n = 10 measurements/ guinea pig). The data show average values (SD in parenthesis).

| Guinea pig | Melanin values | | | | Erythema values | | | |
|------------|----------------|---------|--------|--------|-----------------|---------|--------|---------|
| | Before UVB | Week 0* | Week 2 | Week 4 | Before UVB | Week 0* | Week 2 | Week 4 |
| 1 | 635.00 | 640.00 | 655.60 | 631.00 | 560.00 | 550.60 | 543.40 | 557.70 |
| (SD) | (13.50) | (18.28) | (5.89) | (3.89) | (9.78) | (12.07) | (7.65) | (3.30) |
| 2 | 642.00 | 658.00 | 649.50 | 635.30 | 565.00 | 551.50 | 548.60 | 559.90 |
| | (8.25) | (9.90) | (7.78) | (2.83) | (4.22) | (4.86) | (5.56) | (4.01) |
| 3 | 649.00 | 663.30 | 632.00 | 632.90 | 566.00 | 563.80 | 541.00 | 552.00 |
| | (9.54) | (14.80) | (8.47) | (7.11) | (5.19) | (8.42) | (7.38) | (5.89) |
| 4 | 630.50 | 646.20 | 645.60 | 630.30 | 562.10 | 554.50 | 557.20 | 553.60 |
| | (5.12) | (6.27) | (6.15) | (7.50) | (8.74) | (7.23) | (7.96) | (14.00) |
| 5 | 634.80 | 659.10 | 649.20 | 634.80 | 575.50 | 565.60 | 568.80 | 570.30 |
| | (6.25) | (6.19) | (8.24) | (6.39) | (4.98) | (5.17) | (4.24) | (5.96) |
| 6 | 636.00 | 657.40 | 655.70 | 631.20 | 557.00 | 553.60 | 553.60 | 559.40 |
| | (8.26) | (7.07) | (3.92) | (9.99) | (5.46) | (5.06) | (5.30) | (5.68) |

* The value at week 0 = initial value measured immediately before application of propylene glycol. Application was started on the 18th day following 3-day UVB exposure.

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Table 2 Skin measurement before and after applying 3% kojic acid (Positive control) in guinea pigs (n = 10 measurements/ guinea pig). The data show average values (SD in parenthesis).

| Guinea pig | Melanin values | | | | Erythema values | | | |
|------------|----------------|---------|--------|--------|-----------------|---------|---------|---------|
| | Before UVB | Week 0* | Week 2 | Week 4 | Before UVB | Week 0* | Week 2 | Week 4 |
| 1 | 623.4 | 678.00 | 630.70 | 641.50 | 570.60 | 558.20 | 550.90 | 575.30 |
| (SD) | (15.21) | (17.80) | (4.62) | (5.95) | (8.99) | (12.99) | (9.02) | (7.56) |
| 2 | 607 | 656.20 | 626.20 | 628.70 | 551.20 | 546.60 | 551.70 | 555.90 |
| | (8.53) | (3.85) | (7.77) | (5.31) | (15.00) | (18.02) | (11.17) | (12.00) |
| 3 | 626 | 666.80 | 623.00 | 625.00 | 574.00 | 551.40 | 540.40 | 557.00 |
| | (4.44) | (10.97) | (9.44) | (3.13) | (4.29) | (6.20) | (8.68) | (4.48) |
| 4 | 614.8 | 654.20 | 639.10 | 635.00 | 567.90 | 558.10 | 547.10 | 554.70 |
| | (5.23) | (4.52) | (9.60) | (4.29) | (7.77) | (9.48) | (8.56) | (15.58) |
| 5 | 650.5 | 662.30 | 635.00 | 619.00 | 566.00 | 554.50 | 563.60 | 554.20 |
| | (6.13) | (5.17) | (6.18) | (6.13) | (9.57) | (10.05) | (3.34) | (7.52) |
| 6 | 640.7 | 668.70 | 638.80 | 622.20 | 568.10 | 556.00 | 551.30 | 540.90 |
| | (4.58) | (6.33) | (4.69) | (3.79) | (5.92) | (5.16) | (7.30) | (7.99) |

* The value at week 0 = initial value measured immediately before application of kojic acid. Application was started on the 18th day following 3-day UVB exposure.

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Table 3 Skin measurement before and after applying 3% Haadnun extract in guinea pigs (n = 10 measurements/ guinea pig). The data show average values (SD in parenthesis).

| Guinea pig | Melanin values | | | | Erythema values | | | |
|------------|----------------|---------|---------|--------|-----------------|---------|---------|---------|
| | Before UVB | Week 0* | Week 2 | Week 4 | Before UVB | Week 0* | Week 2 | Week 4 |
| 1 | 645 | 656.80 | 623.70 | 606.20 | 556.00 | 552.20 | 538.90 | 532.40 |
| (SD) | (13.94) | (12.87) | (6.18) | (6.34) | (5.85) | (8.75) | (6.82) | (3.47) |
| 2 | 646.7 | 657.30 | 632.10 | 631.10 | 549.20 | 552.60 | 540.40 | 553.70 |
| | (9.31) | (9.46) | (8.39) | (5.07) | (3.80) | (9.91) | (5.50) | (4.22) |
| 3 | 614 | 658.80 | 611.50 | 612.70 | 559.30 | 549.90 | 537.90 | 556.70 |
| | (11.94) | (19.65) | (5.91) | (3.97) | (5.89) | (7.45) | (4.53) | (17.04) |
| 4 | 636.4 | 666.00 | 663.20 | 646.10 | 576.80 | 566.70 | 547.50 | 565.30 |
| | (7.12) | (5.19) | (7.74) | (7.17) | (5.45) | (10.23) | (16.43) | (8.49) |
| 5 | 628 | 663.40 | 647.10 | 632.70 | 564.10 | 556.90 | 567.80 | 556.00 |
| | (6.09) | (4.99) | (10.67) | (5.96) | (17.10) | (20.84) | (5.31) | (6.48) |
| 6 | 625.6 | 652.00 | 656.10 | 617.50 | 553.40 | 548.10 | 553.20 | 588.00 |
| | (7.78) | (6.27) | (16.25) | (3.78) | (3.83) | (5.67) | (5.94) | (37.09) |

* The value at week 0 = initial value measured immediately before application of 3% Haadnun extract. Application was started on the 18th day following 3-day UVB exposure.

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Table 4 Skin measurement before and after applying 5% Haadnun extract in guinea pigs (n = 10 measurements/ guinea pig). The data show average values (SD in parenthesis).

| Guinea pig | Melanin values | | | | Erythema values | | | |
|------------|----------------|---------|---------|--------|-----------------|---------|---------|---------|
| | Before UVB | Week 0* | Week 2 | Week 4 | Before UVB | Week 0* | Week 2 | Week 4 |
| 1 | 645 | 656.80 | 635.60 | 621.30 | 556.00 | 552.20 | 553.20 | 549.80 |
| (SD) | (13.94) | (12.87) | (11.67) | (6.99) | (5.85) | (8.75) | (3.77) | (4.08) |
| 2 | 646.7 | 657.30 | 628.50 | 623.00 | 549.20 | 552.60 | 540.70 | 545.60 |
| | (9.31) | (9.46) | (7.62) | (3.33) | (3.80) | (9.91) | (5.50) | (3.72) |
| 3 | 614 | 658.80 | 630.30 | 616.70 | 559.30 | 549.90 | 539.40 | 544.30 |
| | (11.94) | (19.65) | (11.59) | (5.60) | (5.89) | (7.45) | (13.43) | (7.50) |
| 4 | 636.4 | 666.00 | 658.70 | 643.00 | 576.80 | 566.70 | 563.50 | 572.60 |
| | (7.12) | (5.19) | (6.38) | (5.75) | (5.45) | (10.23) | (17.96) | (5.99) |
| 5 | 628 | 663.40 | 643.10 | 624.50 | 564.10 | 556.90 | 579.10 | 568.00 |
| | (6.09) | (4.99) | (8.35) | (6.98) | (17.10) | (20.84) | (18.11) | (13.54) |
| 6 | 625.6 | 652.00 | 639.00 | 615.90 | 553.40 | 548.10 | 545.10 | 554.10 |
| | (7.78) | (6.27) | (9.58) | (6.49) | (3.83) | (5.67) | (2.88) | (12.41) |

* The value at week 0 = initial value measured immediately before application of 5% Haadnun extract. Application was started on the 18th day following 3-day UVB exposure.

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Table 5 Skin measurement before and after applying 0.5% Puag-Haad in guinea pigs (n = 10 measurements/ guinea pig). The data show average values (SD in parenthesis).

| Guinea pig | Melanin values | | | | Erythema values | | | |
|------------|----------------|---------|---------|--------|-----------------|---------|---------|---------|
| | Before UVB | Week 0* | Week 2 | Week 4 | Before UVB | Week 0* | Week 2 | Week 4 |
| 1 | 626.00 | 672.70 | 646.40 | 620.60 | 533.40 | 550.30 | 558.30 | 569.40 |
| (SD) | (8.24) | (8.56) | (7.69) | (8.91) | (5.55) | (6.27) | (18.71) | (8.64) |
| 2 | 635.70 | 659.00 | 619.30 | 622.10 | 557.00 | 552.70 | 546.50 | 573.50 |
| | (7.22) | (12.91) | (11.24) | (5.36) | (7.22) | (4.22) | (9.16) | (11.71) |
| 3 | 659.80 | 673.10 | 625.60 | 625.60 | 565.00 | 552.40 | 555.10 | 570.30 |
| | (10.45) | (11.65) | (4.95) | (4.30) | (5.61) | (4.62) | (13.41) | (7.69) |
| 4 | 636.30 | 670.40 | 625.60 | 601.90 | 567.20 | 552.90 | 555.10 | 540.30 |
| | (6.99) | (11.50) | (4.95) | (7.11) | (6.66) | (4.12) | (13.41) | (3.86) |
| 5 | 634.90 | 669.80 | 634.00 | 618.60 | 556.00 | 551.80 | 542.60 | 553.40 |
| | (6.00) | (5.14) | (10.83) | (6.75) | (8.15) | (8.74) | (6.06) | (6.40) |
| 6 | 635.00 | 663.30 | 651.70 | 617.20 | 561.60 | 546.70 | 554.90 | 556.10 |
| | (5.19) | (5.54) | (5.27) | (3.01) | (6.94) | (3.92) | (5.70) | (4.65) |
| 7 | 634.10 | 664.40 | 644.50 | 611.90 | 571.40 | 562.70 | 548.00 | 556.60 |
| | (5.06) | (5.04) | (8.42) | (3.54) | (6.11) | (3.71) | (11.58) | (14.62) |

* The value at week 0 = initial value measured immediately before application of 0.5% Puag-Haad. Application was started on the 18th day following 3-day UVB exposure.

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Table 6 Skin measurement before and after applying 1.0% Puag-Haad in guinea pigs (n = 10 measurements/ guinea pig). The data show average values (SD in parenthesis).

| Guinea pig | Melanin values | | | | Erythema values | | | |
|------------|----------------|---------|---------|--------|-----------------|---------|---------|---------|
| | Before UVB | Week 0* | Week 2 | Week 4 | Before UVB | Week 0* | Week 2 | Week 4 |
| 1 | 626.00 | 672.70 | 658.20 | 636.00 | 533.40 | 550.30 | 559.80 | 564.40 |
| (SD) | (8.24) | (8.56) | (10.43) | (6.07) | (5.55) | (6.27) | (5.01) | (6.69) |
| 2 | 635.70 | 659.00 | 634.90 | 621.70 | 557.00 | 552.70 | 551.10 | 584.00 |
| | (7.22) | (12.91) | (7.48) | (8.94) | (7.22) | (4.22) | (13.61) | (5.08) |
| 3 | 659.80 | 673.10 | 648.20 | 643.40 | 565.00 | 552.40 | 537.10 | 586.00 |
| | (10.45) | (11.65) | (19.45) | (4.03) | (5.61) | (4.62) | (8.05) | (7.54) |
| 4 | 636.30 | 670.40 | 626.40 | 615.80 | 567.20 | 552.90 | 568.20 | 547.00 |
| | (6.99) | (11.50) | (5.91) | (3.16) | (6.66) | (4.12) | (6.66) | (3.02) |
| 5 | 634.90 | 669.80 | 654.60 | 622.20 | 556.00 | 551.80 | 555.80 | 546.10 |
| | (6.00) | (5.14) | (5.99) | (8.26) | (8.15) | (8.74) | (12.03) | (10.51) |
| 6 | 635.00 | 663.30 | 654.50 | 623.10 | 561.60 | 546.70 | 568.60 | 557.00 |
| | (5.19) | (5.54) | (8.17) | (5.78) | (6.94) | (3.92) | (14.23) | (6.38) |
| 7 | 634.10 | 664.40 | 655.80 | 615.50 | 571.40 | 562.70 | 578.20 | 561.00 |
| | (5.06) | (5.04) | (4.49) | (5.25) | (6.11) | (3.71) | (13.29) | (6.27) |

* The value at week 0 = initial value measured immediately before application of 1.0% Puag-Haad. Application was started on the 18th day following 3-day UVB exposure.

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Appendix IIa

Individual baseline melanin values in female volunteers

0.50% Puag-Haad (group A)

0.25% Puag-Haad (group B)

0.25 % Licorice extract (group C)

3.00% Kojic acid (group D)

Skin color was evaluated on outside areas of upper arms with Mexameter MX 16 described in methods.



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Table 1 Individual baseline melanin values of subjects in group A

| Volunteer No. | Left arm | | | Right arm | | |
|---------------|----------|---------|---------|-----------|---------|---------|
| | Week -2 | Week -2 | Week -1 | Week -2 | Week -2 | Week -1 |
| A1 | 482.60 | 490.80 | 490.20 | 485.00 | 492.40 | 486.00 |
| A2 | 498.80 | 498.80 | 494.00 | 492.20 | 497.20 | 486.80 |
| A3 | 505.20 | 515.40 | 499.00 | 499.00 | 508.80 | 504.80 |
| A4 | 512.20 | 519.80 | 519.00 | 513.00 | 514.20 | 509.40 |
| A5 | 531.00 | 525.40 | 530.20 | 523.40 | 526.80 | 519.40 |
| A6 | 531.60 | 539.20 | 537.80 | 533.60 | 540.80 | 537.40 |
| A7 | 545.40 | 545.60 | 536.60 | 535.60 | 534.00 | 534.40 |
| A8 | 481.00 | 487.20 | 472.40 | 477.40 | 483.20 | 471.60 |
| A9 | 485.00 | 480.00 | 477.50 | 488.87 | 477.52 | 478.58 |
| A10 | 516.20 | 510.80 | 507.00 | 510.60 | 498.40 | 493.80 |
| A11 | 517.40 | 512.60 | 517.40 | 516.00 | 516.00 | 515.60 |
| A12 | 515.40 | 511.20 | 507.40 | 530.60 | 523.00 | 501.40 |
| A13 | 545.00 | 545.00 | 522.00 | 526.40 | 526.40 | 526.00 |
| A14 | 502.80 | 502.20 | 501.60 | 503.40 | 508.20 | 494.60 |
| A15 | 510.40 | 511.20 | 515.20 | 506.80 | 514.40 | 512.00 |
| A16 | 521.60 | 526.20 | 521.00 | 524.60 | 528.00 | 528.60 |
| A17 | 532.80 | 533.40 | 519.80 | 535.20 | 541.00 | 528.40 |
| A18 | 524.20 | 522.14 | 520.25 | 528.25 | 521.27 | 515.08 |
| A19 | 526.80 | 523.60 | 528.80 | 528.00 | 523.00 | 524.80 |
| A20 | 532.05 | 525.61 | 521.00 | 528.09 | 524.13 | 525.45 |
| Average | 515.87 | 516.31 | 511.91 | 514.30 | 514.94 | 509.71 |
| (SD) | (19.01) | (18.18) | (18.13) | (18.09) | (17.77) | (19.29) |

Table 2 Individual baseline melanin values of subjects in group B

| Volunteer No. | Left arm | | | Right arm | | |
|---------------|----------|---------|---------|-----------|---------|---------|
| | Week -2 | Week -1 | Week 0 | Week -2 | Week -1 | Week 0 |
| B1 | 487.00 | 490.60 | 482.80 | 489.00 | 489.20 | 480.00 |
| B2 | 495.80 | 500.80 | 495.20 | 498.80 | 493.80 | 494.00 |
| B3 | 504.20 | 505.00 | 495.40 | 502.60 | 508.80 | 497.40 |
| B4 | 516.60 | 509.80 | 510.00 | 515.20 | 515.80 | 511.00 |
| B5 | 519.20 | 523.40 | 526.80 | 521.60 | 528.80 | 526.20 |
| B6 | 535.20 | 536.60 | 536.00 | 535.80 | 539.40 | 538.40 |
| B7 | 543.60 | 537.20 | 546.80 | 544.40 | 541.00 | 542.80 |
| B8 | 482.80 | 491.00 | 481.80 | 484.60 | 486.60 | 484.80 |
| B9 | 494.00 | 494.60 | 491.40 | 504.00 | 495.80 | 496.20 |
| B10 | 504.00 | 507.20 | 502.00 | 503.20 | 513.80 | 500.80 |
| B11 | 515.40 | 516.20 | 518.40 | 513.60 | 519.20 | 513.20 |
| B12 | 520.40 | 519.00 | 510.60 | 541.40 | 539.20 | 530.80 |
| B13 | 535.60 | 534.40 | 535.80 | 536.40 | 537.20 | 536.00 |
| B14 | 498.20 | 498.00 | 491.80 | 498.60 | 501.40 | 491.60 |
| B15 | 506.40 | 507.00 | 503.20 | 516.00 | 507.20 | 506.80 |
| B16 | 510.00 | 517.40 | 504.60 | 517.60 | 519.60 | 508.00 |
| B17 | 529.40 | 527.40 | 530.00 | 530.60 | 532.40 | 529.80 |
| B18 | 505.20 | 507.20 | 508.40 | 512.60 | 510.60 | 511.80 |
| B19 | 523.20 | 523.60 | 519.40 | 532.80 | 533.20 | 522.00 |
| B20 | 496.60 | 501.00 | 495.20 | 499.60 | 513.80 | 496.60 |
| Average | 511.14 | 512.37 | 509.28 | 514.92 | 516.34 | 510.91 |
| (SD) | (16.80) | (14.70) | (18.54) | (17.55) | (17.43) | (18.56) |

Table 3 Individual baseline melanin values of subjects in group C

| Volunteer No. | Left arm | | | Right arm | | |
|---------------|----------|---------|---------|-----------|---------|---------|
| | Week -2 | Week -1 | Week 0 | Week -2 | Week -1 | Week 0 |
| C1 | 481.20 | 480.40 | 478.20 | 483.00 | 492.80 | 479.20 |
| C2 | 497.00 | 498.00 | 492.40 | 498.00 | 500.60 | 499.80 |
| C3 | 505.40 | 510.80 | 507.00 | 504.40 | 501.60 | 503.20 |
| C4 | 516.20 | 514.80 | 512.40 | 514.20 | 516.40 | 518.20 |
| C5 | 523.40 | 520.20 | 527.60 | 535.20 | 531.80 | 538.80 |
| C6 | 529.40 | 537.20 | 521.60 | 527.40 | 533.40 | 522.80 |
| C7 | 542.20 | 542.20 | 533.60 | 539.40 | 539.40 | 539.00 |
| C8 | 483.40 | 487.80 | 479.00 | 487.80 | 492.80 | 486.60 |
| C9 | 491.80 | 495.40 | 490.00 | 489.00 | 493.40 | 493.40 |
| C10 | 501.80 | 499.40 | 495.00 | 503.60 | 503.80 | 494.40 |
| C11 | 504.20 | 509.80 | 499.40 | 514.40 | 513.40 | 508.40 |
| C12 | 535.20 | 527.20 | 528.80 | 523.20 | 530.00 | 524.20 |
| C13 | 535.00 | 532.40 | 525.60 | 530.00 | 532.00 | 528.80 |
| C14 | 488.40 | 492.40 | 487.80 | 489.60 | 493.00 | 496.00 |
| C15 | 512.40 | 509.40 | 502.40 | 508.00 | 505.00 | 498.80 |
| C16 | 520.80 | 519.20 | 519.80 | 518.80 | 520.00 | 517.00 |
| C17 | 509.60 | 520.00 | 518.20 | 529.00 | 528.60 | 538.20 |
| C18 | 507.20 | 519.00 | 509.80 | 509.00 | 509.80 | 503.20 |
| C19 | 516.20 | 521.80 | 513.80 | 526.20 | 523.80 | 519.00 |
| C20 | 503.40 | 507.00 | 499.80 | 501.20 | 508.60 | 496.40 |
| Average | 510.21 | 512.22 | 507.11 | 511.57 | 513.51 | 510.27 |
| (SD) | (17.36) | (16.49) | (16.70) | (16.93) | (15.55) | (17.92) |

Table 4 Individual baseline melanin values of subjects in group D

| Volunteer No. | Left arm | | | Right arm | | |
|---------------|----------|---------|---------|-----------|---------|---------|
| | Week -2 | Week -1 | Week 0 | Week -2 | Week -1 | Week 0 |
| D1 | 491.60 | 488.40 | 480.60 | 485.20 | 487.40 | 480.80 |
| D2 | 499.20 | 499.00 | 494.00 | 500.00 | 494.60 | 492.80 |
| D3 | 510.80 | 508.60 | 509.80 | 508.00 | 513.00 | 507.80 |
| D4 | 515.80 | 515.20 | 510.00 | 510.20 | 519.80 | 515.60 |
| D5 | 512.60 | 522.60 | 512.00 | 523.60 | 520.80 | 519.20 |
| D6 | 536.20 | 537.80 | 530.20 | 535.40 | 531.60 | 534.20 |
| D7 | 501.00 | 502.00 | 498.00 | 495.80 | 493.80 | 488.80 |
| D8 | 502.80 | 509.60 | 501.20 | 505.20 | 511.60 | 503.60 |
| D9 | 515.40 | 521.60 | 512.20 | 518.60 | 523.20 | 525.60 |
| D10 | 524.40 | 520.00 | 522.40 | 524.80 | 524.40 | 526.20 |
| D11 | 530.40 | 538.80 | 531.80 | 524.80 | 536.40 | 529.20 |
| D12 | 496.60 | 501.00 | 500.40 | 502.20 | 507.40 | 500.20 |
| D13 | 552.80 | 541.80 | 542.80 | 539.20 | 535.40 | 529.20 |
| D14 | 526.60 | 525.60 | 523.60 | 521.20 | 526.40 | 522.20 |
| D15 | 524.69 | 525.10 | 527.21 | 541.12 | 535.89 | 533.11 |
| D16 | 504.80 | 504.80 | 501.40 | 508.80 | 512.80 | 507.40 |
| D17 | 506.20 | 528.60 | 510.40 | 512.40 | 530.00 | 510.40 |
| D18 | 509.80 | 509.20 | 497.60 | 505.20 | 504.60 | 503.60 |
| D19 | 529.60 | 525.20 | 527.20 | 534.60 | 529.00 | 535.40 |
| D20 | 506.00 | 502.40 | 501.40 | 502.80 | 509.20 | 498.40 |
| Average | 514.86 | 516.37 | 511.71 | 514.96 | 517.36 | 513.19 |
| (SD) | (15.29) | (14.68) | (15.52) | (15.37) | (14.66) | (16.21) |

Appendix IIb

Individual melanin (M) and erythema (E) values in female volunteers for
0.50% Puag-Haad (group A)
0.25% Puag-Haad (group B)
0.25 % Licorice extract (group C)
3.00% Kojic acid (group D)

Skin color was evaluated on outside areas of upper arms with Mexameter MX 16 described in methods.

ศูนย์วิทยทรัพยากร
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Table 5 Skin measurement before and after applying propylene glycol (control) in volunteers group A. The data show average values (n = 5 measurements).

| Volunteer No. | Control group (left arm) | | | | | | | | | | | | | | | | | |
|---------------|--------------------------|---------|--------|---------|--------|--------|--------|--------|--------|---------|---------|---------|---------|--------|--|--|--|--|
| | Week 0 | | Week 2 | | Week 4 | | Week 6 | | Week 8 | | Week 10 | | Week 12 | | | | | |
| | M | E | M | E | M | E | M | E | M | E | M | E | M | E | | | | |
| A1 | 490.20 | 588.80 | 485.00 | 608.60 | 486.20 | 575.40 | 487.60 | 591.80 | 492.60 | 591.80 | 492.00 | 583.60 | 487.20 | 575.00 | | | | |
| (SD) | (1.64) | (5.26) | (1.87) | (5.90) | (1.79) | (6.23) | (1.52) | (5.85) | (2.19) | (7.63) | (4.06) | (9.18) | (1.92) | (6.20) | | | | |
| A2 | 494.00 | 586.20 | 495.80 | 566.00 | 495.60 | 570.60 | 495.20 | 577.80 | 495.00 | 574.60 | 501.60 | 575.40 | 501.40 | 576.80 | | | | |
| (SD) | (1.00) | (4.32) | (1.79) | (4.30) | (2.88) | (3.85) | (1.64) | (4.55) | (2.00) | (6.39) | (1.67) | (5.22) | (1.14) | (4.97) | | | | |
| A3 | 499.00 | 589.80 | 497.60 | 571.60 | 500.40 | 571.40 | 500.80 | 586.80 | 500.20 | 581.60 | 501.00 | 570.60 | 500.60 | 580.20 | | | | |
| (SD) | (2.45) | (2.86) | (1.82) | (3.78) | (2.51) | (4.39) | (2.39) | (5.67) | (1.64) | (6.58) | (0.71) | (1.14) | (1.52) | (7.89) | | | | |
| A4 | 519.00 | 607.20 | 512.00 | 590.80 | 502.60 | 580.60 | 504.80 | 594.80 | 508.40 | 594.00 | 510.60 | 591.00 | 510.40 | 598.20 | | | | |
| (SD) | (1.73) | (6.69) | (1.58) | (4.09) | (2.41) | (5.13) | (3.27) | (6.69) | (1.67) | (6.56) | (2.30) | (6.44) | (1.34) | (3.03) | | | | |
| A5 | 530.20 | 609.80 | 528.80 | 598.40 | 527.80 | 603.80 | 521.60 | 591.00 | 523.00 | 585.40 | 522.20 | 583.40 | 520.60 | 596.60 | | | | |
| (SD) | (3.11) | (6.83) | (3.27) | (8.29) | (4.60) | (5.63) | (5.77) | (6.82) | (3.00) | (3.65) | (2.05) | (7.89) | (2.07) | (6.58) | | | | |
| A6 | 537.80 | 611.60 | 535.20 | 609.20 | 532.80 | 598.40 | 531.40 | 603.60 | 533.00 | 587.80 | 534.40 | 599.00 | 532.40 | 598.00 | | | | |
| (SD) | (1.10) | (3.65) | (1.10) | (10.89) | (1.48) | (2.61) | (0.89) | (7.27) | (2.92) | (11.19) | (1.95) | (3.24) | (2.19) | (4.30) | | | | |
| A7 | 536.60 | 610.20 | 546.00 | 610.80 | 543.00 | 611.60 | 542.80 | 613.40 | 542.60 | 606.60 | 544.00 | 608.60 | 545.20 | 610.00 | | | | |
| (SD) | (1.14) | (8.87) | (4.00) | (5.50) | (5.05) | (8.32) | (3.56) | (4.10) | (1.67) | (4.51) | (1.22) | (2.61) | (3.56) | (8.15) | | | | |
| A8 | 472.40 | 556.20 | 477.80 | 558.80 | 479.60 | 551.20 | 481.80 | 558.20 | 478.40 | 558.60 | 480.60 | 546.00 | 481.00 | 548.80 | | | | |
| (SD) | (3.13) | (7.22) | (1.30) | (3.63) | (1.52) | (2.95) | (3.11) | (4.32) | (1.67) | (5.86) | (3.36) | (2.00) | (3.32) | (8.26) | | | | |
| A10 | 507.00 | 614.60 | 510.40 | 612.60 | 495.40 | 594.80 | 493.40 | 604.40 | 491.80 | 597.40 | 495.60 | 587.60 | 494.40 | 594.60 | | | | |
| (SD) | (2.35) | (14.52) | (2.70) | (7.23) | (8.32) | (3.70) | (5.94) | (6.80) | (4.21) | (4.72) | (4.39) | (10.16) | (1.95) | (3.58) | | | | |

Table 5 Skin measurement before and after applying propylene glycol (control) in volunteers group A. The data show average values (n = 5 measurements).

| Volunteer | Control group (righth arm) | | | | | | | | | | | | | | | | | |
|-----------|----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|--------|---------|--------|--|--|--|--|
| | Week 0 | | Week 2 | | Week 4 | | Week 6 | | Week 8 | | Week 10 | | Week 12 | | | | | |
| | M | E | M | E | M | E | M | E | M | E | M | E | M | E | | | | |
| A11 | 515.6 | 617.8 | 511.2 | 610.2 | 507.2 | 600.2 | 502.8 | 617.2 | 507.2 | 608.4 | 506.4 | 605.0 | 508.0 | 610.0 | | | | |
| (SD) | (1.82) | (3.03) | (3.49) | (4.09) | (2.05) | (7.66) | (2.28) | (3.03) | (1.64) | (10.50) | (1.52) | (2.92) | (0.71) | (6.20) | | | | |
| A12 | 501.4 | 607.2 | 503.4 | 595.0 | 506.4 | 591.6 | 504.0 | 609.0 | 503.0 | 594.0 | 506.2 | 588.4 | 507.0 | 592.0 | | | | |
| | (1.82) | (5.07) | (2.41) | (5.83) | (2.30) | (8.79) | (3.81) | (8.94) | (1.00) | (5.10) | (2.59) | (4.34) | (1.58) | (3.46) | | | | |
| A13 | 526.0 | 621.6 | 521.2 | 606.2 | 523.8 | 615.8 | 521.6 | 622.4 | 524.8 | 609.6 | 523.6 | 605.8 | 516.6 | 597.6 | | | | |
| | (1.00) | (6.80) | (2.17) | (8.20) | (1.79) | (5.67) | (2.88) | (5.08) | (1.79) | (10.53) | (1.67) | (5.93) | (1.52) | (8.08) | | | | |
| A14 | 494.6 | 606.6 | 495.8 | 590.6 | 494.2 | 594.0 | 497.2 | 602.8 | 496.8 | 591.4 | 499.2 | 581.0 | 498.0 | 589.6 | | | | |
| | (1.14) | (2.61) | (0.84) | (7.96) | (3.11) | (8.72) | (1.79) | (8.98) | (1.92) | (4.45) | (0.84) | (5.70) | (1.87) | (6.27) | | | | |
| A15 | 512.0 | 620.0 | 503.6 | 596.4 | 510.4 | 609.8 | 502.4 | 620.0 | 504.6 | 596.4 | 504.2 | 591.6 | 504.2 | 597.8 | | | | |
| | (2.35) | (2.68) | (1.67) | (3.36) | (3.21) | (6.06) | (3.21) | (2.95) | (2.07) | (6.47) | (2.77) | (8.71) | (1.64) | (6.06) | | | | |
| A16 | 528.6 | 604.6 | 518.2 | 589.2 | 520.2 | 591.6 | 514.4 | 593.2 | 518.2 | 591.4 | 515.2 | 594.8 | 516.2 | 586.4 | | | | |
| | (1.52) | (4.10) | (1.92) | (5.89) | (1.48) | (1.34) | (2.19) | (3.03) | (0.45) | (3.85) | (6.87) | (6.30) | (1.10) | (5.73) | | | | |
| A17 | 528.4 | 617.2 | 536.2 | 603.0 | 533.8 | 607.8 | 531.8 | 606.0 | 530.2 | 600.4 | 531.4 | 603.0 | 531.4 | 602.0 | | | | |
| | (1.67) | (7.26) | (2.59) | (4.12) | (1.79) | (5.93) | (3.63) | (3.94) | (1.79) | (2.61) | (1.34) | (6.24) | (0.89) | (3.16) | | | | |
| A19 | 524.8 | 615.4 | 516.4 | 599.8 | 522.0 | 592.6 | 522.0 | 608.0 | 521.2 | 587.0 | 521.2 | 587.0 | 512.6 | 586.4 | | | | |
| | (6.50) | (3.29) | (2.07) | (1.30) | (2.35) | (5.46) | (3.08) | (4.58) | (1.30) | (2.24) | (1.30) | (2.24) | (2.61) | (6.73) | | | | |

Table 6 Skin measurement before and after applying 0.5 % w/v Puag-Haad in volunteers group A. The data show average values (n = 5 measurements).

| Volunteer | | 0.5 % w/v Puag-Haad group (right arm) | | | | | | | | | | | | | | |
|-----------|------|---------------------------------------|--------|--------|---------|--------|--------|--------|---------|--------|---------|---------|---------|---------|---------|--|
| | | Week 0 | | Week 2 | | Week 4 | | Week 6 | | Week 8 | | Week 10 | | Week 12 | | |
| No. | | M | E | M | E | M | E | M | E | M | E | M | E | M | E | |
| A1 | | 486.0 | 588.8 | 481.4 | 607.6 | 485.4 | 582.2 | 482.6 | 584.6 | 483.2 | 585.2 | 490.0 | 570.8 | 484.4 | 576.6 | |
| | (SD) | (1.00) | (4.09) | (2.19) | (4.16) | (1.82) | (6.14) | (1.95) | (12.68) | (1.30) | (13.14) | (2.00) | (7.01) | (0.89) | (9.10) | |
| A2 | | 486.8 | 574.0 | 495.4 | 572.8 | 489.0 | 575.2 | 488.0 | 567.2 | 494.2 | 568.4 | 491.0 | 569.6 | 490.2 | 562.0 | |
| | | (1.92) | (4.80) | (2.70) | (3.96) | (3.74) | (5.36) | (0.71) | (5.12) | (2.28) | (5.86) | (1.73) | (8.17) | (0.84) | (6.75) | |
| A3 | | 504.8 | 588.0 | 499.2 | 582.8 | 501.8 | 576.2 | 494.2 | 582.8 | 496.2 | 577.0 | 500.2 | 571.0 | 498.2 | 576.4 | |
| | | (2.95) | (4.12) | (2.28) | (4.76) | (2.77) | (3.83) | (1.30) | (7.69) | (1.30) | (6.20) | (1.30) | (4.64) | (0.45) | (5.46) | |
| A4 | | 509.4 | 595.6 | 507.2 | 597.2 | 502.4 | 585.8 | 500.4 | 581.0 | 500.4 | 598.0 | 498.0 | 570.6 | 497.4 | 577.2 | |
| | | (3.51) | (4.93) | (1.30) | (10.33) | (1.14) | (4.32) | (0.89) | (10.32) | (0.89) | (9.41) | (2.45) | (7.50) | (1.82) | (5.26) | |
| A5 | | 519.4 | 590.6 | 520.8 | 587.0 | 515.2 | 591.4 | 519.0 | 588.8 | 524.6 | 587.2 | 514.0 | 568.0 | 515.6 | 584.6 | |
| | | (2.79) | (6.73) | (2.39) | (3.67) | (2.39) | (7.20) | (1.87) | (5.81) | (2.30) | (7.36) | (1.41) | (3.74) | (2.30) | (3.65) | |
| A6 | | 537.4 | 612.4 | 536.0 | 610.2 | 527.6 | 597.4 | 523.6 | 602.4 | 523.2 | 581.0 | 524.0 | 583.0 | 522.2 | 590.2 | |
| | | (1.34) | (9.81) | (2.35) | (3.96) | (1.14) | (3.44) | (1.52) | (4.28) | (3.27) | (6.63) | (1.22) | (10.49) | (3.03) | (6.94) | |
| A7 | | 534.4 | 604.8 | 531.2 | 597.0 | 530.2 | 593.6 | 526.2 | 595.0 | 533.0 | 596.2 | 520.6 | 585.4 | 520.2 | 582.2 | |
| | | (4.04) | (7.05) | (1.92) | (4.30) | (2.59) | (4.93) | (3.63) | (6.24) | (1.87) | (8.07) | (3.21) | (8.26) | (1.48) | (10.76) | |
| A8 | | 471.6 | 557.0 | 477.2 | 564.2 | 475.2 | 554.4 | 469.0 | 551.2 | 475.8 | 545.4 | 475.2 | 547.2 | 474.0 | 547.4 | |
| | | (0.55) | (3.81) | (1.10) | (3.49) | (2.86) | (2.30) | (2.00) | (3.11) | (1.48) | (9.99) | (1.48) | (7.53) | (4.58) | (4.04) | |
| A10 | | 493.8 | 591.2 | 497.8 | 602.2 | 488.4 | 580.4 | 481.4 | 595.2 | 488.6 | 580.8 | 490.2 | 582.6 | 488.0 | 581.8 | |
| | | (1.30) | (5.07) | (2.95) | (5.81) | (1.34) | (7.73) | (2.70) | (6.26) | (0.55) | (6.76) | (4.60) | (12.62) | (3.00) | (1.64) | |

Table 6 Skin measurement before and after applying 0.5 % w/v Puag-Haad in volunteers group A. The data show average values (n = 5 measurements).

| Volunteer No. | 0.5 % w/v Puag-Haad group (left arm) | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------|--------------------------------------|-------|--------|-------|--------|-------|--------|-------|--------|-------|---------|-------|---------|-------|--------|---------|--------|--------|--------|--------|--------|--------|--------|---------|--------|---------|--------|--------|
| | Week 0 | | Week 2 | | Week 4 | | Week 6 | | Week 8 | | Week 10 | | Week 12 | | | | | | | | | | | | | | | |
| | M | E | M | E | M | E | M | E | M | E | M | E | M | E | M | E | | | | | | | | | | | | |
| A11 | 517.4 | 617.2 | 516.0 | 627.0 | 507.2 | 601.2 | 504.4 | 616.4 | 500.0 | 605.2 | 503.0 | 597.8 | 503.8 | 612.0 | (2.97) | (4.09) | (2.55) | (4.85) | (4.15) | (8.04) | (2.07) | (4.83) | (3.39) | (5.22) | (1.00) | (3.96) | (1.92) | (3.74) |
| A12 | 507.4 | 616.0 | 500.0 | 592.4 | 503.6 | 600.2 | 498.2 | 592.2 | 494.0 | 581.4 | 496.2 | 587.6 | 493.8 | 601.0 | (3.05) | (7.31) | (1.00) | (5.73) | (1.14) | (2.59) | (2.39) | (9.88) | (0.71) | (10.04) | (3.42) | (11.87) | (3.42) | (9.77) |
| A13 | 522.0 | 612.8 | 520.6 | 600.8 | 521.8 | 603.2 | 517.0 | 611.6 | 516.8 | 597.4 | 514.4 | 592.2 | 510.0 | 591.0 | (2.45) | (4.15) | (2.30) | (2.77) | (3.77) | (7.05) | (1.00) | (7.99) | (1.64) | (6.91) | (1.52) | (11.10) | (2.74) | (5.43) |
| A14 | 501.6 | 614.0 | 500.0 | 589.6 | 502.8 | 607.4 | 503.2 | 608.4 | 497.8 | 586.6 | 498.2 | 579.0 | 492.8 | 590.6 | (2.51) | (10.56) | (0.71) | (4.22) | (0.84) | (4.62) | (2.05) | (6.11) | (1.79) | (3.21) | (1.30) | (6.28) | (3.42) | (6.84) |
| A15 | 515.2 | 614.4 | 516.0 | 609.0 | 511.6 | 609.8 | 505.6 | 600.2 | 504.0 | 594.6 | 496.4 | 587.4 | 494.0 | 591.0 | (1.30) | (5.50) | (2.00) | (3.67) | (2.61) | (4.71) | (2.30) | (4.32) | (1.41) | (6.62) | (3.36) | (11.44) | (3.16) | (5.66) |
| A16 | 521.0 | 603.2 | 523.6 | 600.8 | 518.4 | 593.2 | 515.0 | 594.0 | 509.6 | 585.0 | 506.8 | 596.0 | 497.4 | 575.8 | (1.87) | (3.90) | (5.13) | (3.27) | (2.51) | (3.27) | (1.87) | (4.06) | (3.65) | (3.08) | (0.45) | (7.78) | (2.88) | (5.07) |
| A17 | 519.8 | 607.2 | 528.8 | 595.4 | 530.0 | 603.0 | 524.4 | 604.6 | 529.2 | 594.4 | 526.0 | 602.8 | 523.6 | 591.6 | (2.95) | (3.63) | (1.79) | (5.18) | (2.65) | (4.00) | (4.22) | (6.50) | (0.84) | (3.91) | (1.58) | (8.14) | (2.30) | (4.04) |
| A19 | 528.8 | 621.6 | 520.4 | 599.8 | 522.4 | 605.8 | 518.6 | 608.2 | 519.0 | 584.8 | 519.0 | 584.8 | 516.4 | 586.0 | (2.95) | (5.77) | (1.82) | (5.81) | (2.07) | (3.63) | (2.19) | (4.38) | (1.58) | (6.30) | (1.58) | (6.30) | (1.95) | (7.71) |

Table 7 Skin measurement before and after applying propylene glycol (control) in volunteers group B. The data show average values (n = 5 measurements).

| Volunteer No. | Control group (left arm) | | | | | | | | | | | | | |
|---------------|--------------------------|--------|--------|--------|--------|--------|--------|---------|--------|--------|---------|---------|---------|---------|
| | Week 0 | | Week 2 | | Week 4 | | Week 6 | | Week 8 | | Week 10 | | Week 12 | |
| | M | E | M | E | M | E | M | E | M | E | M | E | M | E |
| B 1 | 482.8 | 573.2 | 481.2 | 570.2 | 488.0 | 563.4 | 482.6 | 583.0 | 482.2 | 574.8 | 484.2 | 569.0 | 483.6 | 569.2 |
| (SD) | (2.17) | (9.71) | (0.84) | (3.35) | (1.22) | (3.29) | (2.30) | (6.52) | (3.03) | (7.60) | (1.79) | (3.08) | (1.52) | (11.58) |
| B 2 | 495.2 | 582.4 | 495.8 | 576.0 | 488.2 | 572.0 | 486.2 | 588.4 | 488.2 | 585.8 | 486.6 | 567.2 | 488.8 | 555.8 |
| | (1.64) | (9.13) | (0.84) | (3.39) | (1.92) | (5.34) | (2.95) | (12.05) | (1.48) | (4.21) | (1.67) | (8.81) | (2.39) | (9.68) |
| B 3 | 495.4 | 585.0 | 496.6 | 599.6 | 495.2 | 585.2 | 494.8 | 575.2 | 496.8 | 573.8 | 496.4 | 578.2 | 496.0 | 580.6 |
| | (0.89) | (1.87) | (2.07) | (2.97) | (2.86) | (4.09) | (2.95) | (9.01) | (1.10) | (5.63) | (2.19) | (4.44) | (1.41) | (3.05) |
| B 4 | 510.0 | 588.4 | 511.8 | 595.4 | 504.4 | 578.0 | 506.8 | 577.4 | 507.8 | 579.8 | 507.8 | 578.6 | 506.8 | 576.8 |
| | (1.22) | (1.95) | (1.10) | (5.68) | (1.14) | (4.30) | (3.11) | (3.65) | (0.84) | (6.98) | (2.28) | (5.86) | (2.17) | (9.20) |
| B 5 | 526.8 | 621.8 | 522.2 | 608.4 | 517.4 | 608.6 | 512.2 | 602.2 | 515.0 | 589.6 | 513.6 | 602.8 | 512.0 | 590.4 |
| | (3.19) | (1.79) | (0.84) | (3.78) | (2.51) | (7.92) | (2.59) | (3.70) | (2.65) | (1.67) | (2.70) | (3.56) | (1.00) | (4.93) |
| B 6 | 536.0 | 627.8 | 529.8 | 621.0 | 530.2 | 617.2 | 526.8 | 607.4 | 527.6 | 609.8 | 524.4 | 615.2 | 523.8 | 621.8 |
| | (1.87) | (4.27) | (2.28) | (5.15) | (1.92) | (7.98) | (1.92) | (7.06) | (0.89) | (3.96) | (1.95) | (8.90) | (1.92) | (3.63) |
| B 7 | 546.8 | 624.6 | 539.0 | 605.2 | 535.2 | 596.2 | 528.4 | 597.0 | 537.0 | 598.6 | 532.6 | 601.6 | 530.8 | 600.2 |
| | (2.28) | (5.59) | (2.92) | (4.66) | (2.17) | (3.90) | (1.14) | (5.61) | (1.22) | (5.64) | (1.67) | (3.05) | (2.59) | (4.97) |
| B 8 | 481.8 | 573.6 | 483.0 | 557.8 | 478.2 | 564.2 | 484.0 | 572.6 | 482.0 | 567.2 | 485.2 | 561.8 | 484.2 | 576.6 |
| | (1.64) | (2.61) | (2.83) | (5.07) | (3.83) | (4.82) | (8.60) | (8.11) | (1.58) | (6.72) | (2.28) | (11.17) | (1.79) | (4.93) |
| B 9 | 491.4 | 596.6 | 492.4 | 586.2 | 495.2 | 594.6 | 494.2 | 584.4 | 494.0 | 587.0 | 496.6 | 581.8 | 496.0 | 580.8 |
| | (1.14) | (4.83) | (1.14) | (1.92) | (2.59) | (6.27) | (1.92) | (6.39) | (1.22) | (5.66) | (1.67) | (7.53) | (1.87) | (9.55) |
| B 10 | 502.0 | 580.6 | 510.6 | 586.8 | 509.0 | 592.4 | 506.4 | 598.0 | 505.8 | 589.6 | 506.6 | 591.4 | 504.4 | 581.8 |
| | (1.00) | (5.94) | (1.52) | (7.89) | (2.55) | (9.76) | (1.52) | (5.29) | (1.30) | (5.27) | (2.41) | (9.63) | (3.21) | (4.32) |

Table 7 Skin measurement before and after applying propylene glycol (control) in volunteers group 8. The data show average values ($n = 5$ measurements).

| Volunteer No. | Control group (righth arm) | | | | | | | | | | | | | | | | | | | | | | | |
|---------------|----------------------------|------------------|-----------------|------------------|-----------------|-----------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|---|---|--|--|--|--|--|--|--|--|
| | Week 0 | | Week 2 | | Week 4 | | Week 6 | | Week 8 | | Week 10 | | Week 12 | | | | | | | | | | | |
| | M | E | M | E | M | E | M | E | M | E | M | E | M | E | M | E | | | | | | | | |
| B11 (SD) | 513.2 (0.84) | 601.8 (2.28) | 505.6 (2.19) | 599.6 (3.91) | 509.6 (2.79) | 591.4 (7.23) | 509.2 (3.63) | 599.8 (3.90) | 508.6 (2.07) | 586.6 (5.41) | 510.0 (1.41) | 598.4 (2.51) | 510.6 (1.14) | 601.4 (11.63) | | | | | | | | | | |
| B12 | 530.8 (5.54) | 617.4 (5.86) | 539.4 (1.52) | 612.0 (6.20) | 537.2 (4.32) | 614.8 (7.01) | 538.0 (1.87) | 606.4 (8.29) | 535.6 (1.34) | 606.2 (3.70) | 533.2 (4.49) | 606.8 (6.18) | 531.4 (2.30) | 602.6 (6.11) | | | | | | | | | | |
| B13 | 536.0 (2.55) | 609.4 (9.37) | 536.8 (2.05) | 613.6 (8.08) | 532.2 (4.38) | 606.8 (8.84) | 529.2 (6.02) | 614.0 (8.00) | 522.4 (4.16) | 596.8 (4.15) | 530.0 (5.20) | 601.6 (6.58) | 531.0 (0.71) | 598.8 (2.17) | | | | | | | | | | |
| B14 | 491.6 (2.30) | 593.6 (5.03) | 494.0 (2.00) | 594.4 (1.67) | 492.0 (1.87) | 580.6 (5.77) | 488.0 (1.00) | 581.4 (5.08) | 484.0 (1.22) | 560.0 (10.17) | 483.2 (1.92) | 573.2 (8.76) | 484.0 (3.08) | 584.0 (3.61) | | | | | | | | | | |
| B15 | 506.8 (1.64) | 594.4 (5.22) | 508.8 (1.10) | 585.2 (3.96) | 512.0 (3.24) | 596.8 (5.97) | 497.8 (1.48) | 585.6 (5.81) | 501.6 (2.41) | 580.4 (9.74) | 503.8 (1.79) | 584.0 (10.98) | 501.2 (1.92) | 583.6 (2.70) | | | | | | | | | | |
| B16 | 508.0 (1.00) | 612.6 (4.98) | 504.6 (2.30) | 626.0 (5.79) | 511.2 (0.45) | 625.4 (2.70) | 504.2 (2.59) | 621.0 (10.68) | 501.8 (2.17) | 617.2 (9.93) | 509.0 (3.24) | 641.6 (7.33) | 507.2 (1.79) | 624.8 (10.73) | | | | | | | | | | |
| B17 | 529.8 (1.30) | 612.4 (3.71) | 525.0 (3.39) | 613.4 (5.13) | 526.2 (1.64) | 610.2 (7.60) | 525.4 (3.51) | 615.4 (6.88) | 525.8 (1.10) | 619.8 (4.76) | 523.6 (2.88) | 606.0 (4.64) | 521.6 (1.52) | 602.0 (6.20) | | | | | | | | | | |
| B18 | 511.8 (3.35) | 611.0 (10.05) | 506.2 (3.90) | 598.0 (12.71) | 511.0 (1.58) | 596.6 (3.91) | 509.8 (0.45) | 611.4 (6.88) | 509.2 (1.30) | 604.8 (6.57) | 511.8 (1.92) | 608.2 (5.67) | 509.6 (1.52) | 600.6 (13.22) | | | | | | | | | | |
| B19 | 522.0 (2.30) | 632.4 (4.28) | 528.0 (5.20) | 628.6 (10.57) | 521.4 (4.56) | 623.0 (6.00) | 522.0 (2.55) | 615.0 (9.38) | 525.0 (3.67) | 611.8 (12.26) | 520.8 (2.39) | 623.6 (5.73) | 520.8 (1.30) | 614.8 (5.89) | | | | | | | | | | |
| B20 | 496.6 (1.67) | 580.4 (3.05) | 502.4 (2.70) | 569.4 (4.10) | 501.6 (2.70) | 576.8 (2.39) | 497.2 (2.95) | 575.4 (2.97) | 494.6 (3.85) | 568.2 (9.68) | 502.6 (1.95) | 574.2 (3.56) | 502.4 (1.34) | 576.0 (7.75) | | | | | | | | | | |

Table 8 Skin measurement before and after applying 0.25 % w/v Puag-Haad in volunteers group B. The data show average values (n = 5 measurements).

| Volunteer No. | 0.25 % w/v Puag-Haad group (right arm) | | | | | | | | | | | | | |
|---------------|--|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|-----------------|-----------------|------------------|
| | Week 0 | | Week 2 | | Week 4 | | Week 6 | | Week 8 | | Week 10 | | Week 12 | |
| | M | E | M | E | M | E | M | E | M | E | M | E | M | E |
| B 1 (SD) | 480.0 (2.00) | 566.2 (4.92) | 481.4 (2.07) | 577.0 (5.24) | 481.4 (1.52) | 562.0 (6.63) | 475.8 (1.30) | 571.4 (5.18) | 473.8 (0.84) | 570.6 (6.58) | 476.0 (0.71) | 565.6 (9.02) | 474.2 (0.45) | 556.0 (4.42) |
| B 2 | 494.0 (1.00) | 572.8 (9.18) | 493.0 (3.08) | 576.4 (7.16) | 483.2 (2.77) | 567.6 (6.07) | 484.6 (1.14) | 589.6 (9.84) | 484.6 (0.55) | 560.4 (9.24) | 484.6 (0.55) | 576.8 (6.57) | 483.0 (2.55) | 562.4 (7.60) |
| B 3 | 497.4 (1.14) | 586.2 (5.31) | 497.6 (1.34) | 589.2 (1.92) | 494.4 (1.82) | 575.8 (4.76) | 493.6 (1.52) | 574.4 (7.50) | 487.6 (1.67) | 564.6 (4.51) | 491.8 (1.92) | 566.4 (9.15) | 488.2 (2.17) | 573.6 (3.51) |
| B 4 | 511.0 (0.71) | 583.2 (1.48) | 512.4 (2.07) | 584.2 (4.27) | 508.4 (2.19) | 595.4 (10.14) | 508.0 (0.00) | 573.8 (5.54) | 508.8 (0.84) | 575.6 (6.54) | 504.2 (1.92) | 580.8 (7.92) | 505.4 (1.14) | 577.4 (8.17) |
| B 5 | 526.2 (3.27) | 630.2 (5.63) | 522.2 (1.64) | 609.4 (4.83) | 518.2 (1.79) | 610.2 (9.50) | 507.8 (4.44) | 605.2 (11.12) | 506.8 (1.10) | 580.4 (8.62) | 506.0 (2.83) | 592.0 (9.19) | 505.4 (2.97) | 581.4 (7.16) |
| B 6 | 538.4 (2.41) | 626.2 (4.66) | 535.4 (2.07) | 629.8 (1.64) | 522.4 (6.58) | 603.6 (9.24) | 522.0 (2.35) | 610.8 (4.49) | 518.0 (1.41) | 611.4 (3.85) | 509.2 (1.30) | 604.2 (3.77) | 507.6 (1.14) | 601.2 (11.73) |
| B 7 | 542.8 (2.59) | 625.8 (5.67) | 537.0 (3.16) | 598.8 (3.42) | 538.0 (2.45) | 598.6 (2.07) | 531.8 (2.39) | 610.0 (4.58) | 530.0 (1.41) | 587.2 (4.49) | 525.6 (0.55) | 590.6 (2.07) | 524.0 (2.12) | 596.8 (4.44) |
| B 8 | 484.8 (4.49) | 589.4 (11.44) | 485.8 (5.67) | 580.8 (15.96) | 476.6 (2.41) | 567.4 (8.96) | 475.6 (2.07) | 566.8 (9.23) | 472.0 (1.00) | 558.8 (5.81) | 475.6 (2.07) | 557.4 (9.26) | 471.8 (1.79) | 567.4 (11.93) |
| B 9 | 496.2 (0.84) | 610.6 (6.43) | 497.0 (1.58) | 593.2 (5.97) | 494.0 (1.87) | 588.2 (6.26) | 492.2 (1.92) | 594.4 (4.39) | 492.4 (0.89) | 582.0 (10.51) | 497.4 (3.29) | 590.8 (8.87) | 492.6 (1.67) | 587.0 (7.68) |
| B 10 | 500.8 (1.10) | 592.0 (4.06) | 503.2 (1.30) | 581.4 (4.98) | 502.8 (3.11) | 593.0 (4.18) | 501.4 (1.95) | 585.6 (5.03) | 503.6 (2.07) | 578.8 (10.18) | 498.8 (2.59) | 577.4 (3.65) | 499.0 (2.92) | 581.2 (6.26) |

Table 8 Skin measurement before and after applying 0.25 % w/v Puag-Haad in volunteers group B. The data show average values (n = 5 measurements).

| Volunteer No. | 0.25 % w/v Puag-Haad group (left arm) | | | | | | | | | | | | | |
|---------------|---------------------------------------|-----------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| | Week 0 | | Week 2 | | Week 4 | | Week 6 | | Week 8 | | Week 10 | | Week 12 | |
| | M | E | M | E | M | E | M | E | M | E | M | E | M | E |
| B11 (SD) | 518.4 (2.61) | 606.2 (3.70) | 516.4 (1.34) | 607.0 (4.53) | 510.4 (2.97) | 601.8 (10.50) | 504.4 (2.41) | 593.0 (2.55) | 503.4 (0.89) | 589.0 (5.57) | 503.0 (1.00) | 602.2 (5.76) | 498.4 (3.05) | 585.2 (9.07) |
| B12 | 510.6 (1.14) | 606.2 (6.34) | 515.0 (2.00) | 591.2 (2.28) | 512.2 (0.84) | 597.0 (5.43) | 504.4 (3.36) | 587.0 (5.79) | 506.2 (5.45) | 593.0 (6.96) | 503.8 (3.27) | 576.4 (11.01) | 502.8 (1.10) | 573.6 (5.13) |
| B13 | 535.8 (1.10) | 621.2 (4.76) | 531.8 (3.11) | 608.4 (9.34) | 527.4 (3.21) | 606.8 (4.60) | 521.2 (3.49) | 612.6 (1.14) | 516.8 (3.42) | 587.6 (7.30) | 519.2 (1.30) | 587.2 (9.73) | 514.6 (2.51) | 585.6 (7.99) |
| B14 | 491.8 (3.27) | 580.4 (3.21) | 484.2 (2.17) | 575.8 (10.13) | 490.2 (1.10) | 570.8 (4.44) | 483.4 (2.88) | 575.4 (5.13) | 483.2 (0.84) | 562.6 (5.55) | 482.8 (0.45) | 566.8 (1.92) | 473.8 (2.59) | 576.2 (6.06) |
| B15 | 503.2 (1.64) | 604.4 (2.07) | 504.4 (1.82) | 586.0 (3.67) | 506.0 (1.58) | 594.0 (4.69) | 495.6 (2.88) | 577.0 (4.53) | 494.6 (0.55) | 564.4 (10.83) | 492.2 (1.10) | 579.0 (5.05) | 490.4 (2.07) | 561.2 (8.56) |
| B16 | 504.6 (2.07) | 617.2 (3.49) | 503.6 (1.52) | 610.6 (5.94) | 505.0 (2.55) | 628.6 (8.47) | 495.2 (1.79) | 611.2 (13.59) | 491.4 (1.14) | 618.0 (6.08) | 492.6 (3.91) | 604.4 (3.85) | 492.8 (0.84) | 604.4 (8.23) |
| B17 | 530.0 (2.00) | 617.2 (3.35) | 521.4 (1.82) | 610.8 (4.32) | 523.4 (2.70) | 600.6 (6.35) | 520.2 (3.35) | 604.0 (12.08) | 519.8 (1.30) | 601.2 (9.52) | 515.8 (1.64) | 602.4 (3.65) | 512.8 (1.79) | 591.8 (5.07) |
| B18 | 508.4 (1.34) | 599.6 (2.97) | 509.0 (2.24) | 588.0 (5.70) | 502.0 (2.00) | 603.2 (5.02) | 496.6 (2.07) | 603.6 (9.15) | 493.8 (0.84) | 586.6 (7.64) | 494.4 (1.67) | 598.2 (10.33) | 494.0 (1.22) | 587.8 (4.49) |
| B19 | 519.4 (2.88) | 637.0 (1.73) | 525.2 (3.35) | 626.6 (5.13) | 504.2 (4.66) | 619.6 (14.60) | 507.4 (1.67) | 609.8 (11.21) | 503.2 (0.84) | 602.0 (3.54) | 490.4 (4.83) | 590.0 (6.56) | 489.6 (2.30) | 615.4 (8.29) |
| B20 | 495.2 (1.79) | 577.2 (2.49) | 493.4 (1.67) | 569.2 (1.48) | 490.2 (1.92) | 572.0 (3.39) | 490.0 (2.24) | 567.0 (11.83) | 491.4 (1.34) | 577.8 (4.55) | 486.0 (1.87) | 561.4 (6.88) | 482.0 (1.00) | 569.0 (13.25) |

Table 9 Skin measurement before and after applying propylene glycol (control) in volunteers group C. The data show average values (n = 5 measurements).

| Volunteer No. | Control group (left arm) | | | | | | | | | | | | | | | | | | | | | | | |
|---------------|--------------------------|--------|--------|---------|--------|---------|--------|---------|--------|---------|---------|---------|---------|---------|--|--|--|--|--|--|--|--|--|--|
| | Week 0 | | Week 2 | | Week 4 | | Week 6 | | Week 8 | | Week 10 | | Week 12 | | | | | | | | | | | |
| | M | E | M | E | M | E | M | E | M | E | M | E | M | E | | | | | | | | | | |
| C 1 | 478.2 | 567.0 | 483.0 | 572.2 | 477.2 | 563.4 | 479.0 | 578.0 | 478.8 | 580.6 | 481.4 | 563.8 | 481.6 | 578.2 | | | | | | | | | | |
| (SD) | (2.77) | (6.89) | (0.71) | (2.59) | (2.95) | (9.56) | (3.74) | (11.38) | (1.48) | (5.41) | (3.05) | (8.73) | (2.07) | (6.22) | | | | | | | | | | |
| C 2 | 492.4 | 600.4 | 491.6 | 585.0 | 490.8 | 584.8 | 493.0 | 596.0 | 492.8 | 591.2 | 494.8 | 578.4 | 493.8 | 588.0 | | | | | | | | | | |
| | (1.52) | (8.44) | (2.88) | (6.75) | (1.48) | (10.35) | (1.73) | (7.97) | (1.92) | (10.18) | (2.49) | (6.19) | (1.48) | (6.52) | | | | | | | | | | |
| C 3 | 507.0 | 599.2 | 496.4 | 576.6 | 498.6 | 589.8 | 498.2 | 600.4 | 502.6 | 583.2 | 508.8 | 593.8 | 507.6 | 585.0 | | | | | | | | | | |
| | (3.00) | (5.26) | (2.88) | (5.41) | (1.95) | (15.47) | (5.07) | (7.47) | (2.70) | (11.32) | (3.03) | (5.40) | (2.61) | (5.15) | | | | | | | | | | |
| C 4 | 512.4 | 591.4 | 513.8 | 583.4 | 518.4 | 589.4 | 512.2 | 597.8 | 512.0 | 583.6 | 512.2 | 593.0 | 509.6 | 589.0 | | | | | | | | | | |
| | (2.30) | (4.39) | (1.64) | (3.36) | (1.14) | (8.82) | (6.14) | (7.56) | (1.00) | (5.90) | (1.10) | (8.00) | (1.14) | (3.39) | | | | | | | | | | |
| C 5 | 527.6 | 610.0 | 517.0 | 606.2 | 516.4 | 599.6 | 519.6 | 610.2 | 520.2 | 604.8 | 526.4 | 602.2 | 525.2 | 601.8 | | | | | | | | | | |
| | (2.07) | (2.55) | (2.55) | (4.38) | (2.61) | (4.77) | (1.67) | (5.17) | (1.30) | (4.82) | (0.55) | (10.50) | (2.86) | (7.56) | | | | | | | | | | |
| C 6 | 521.6 | 602.6 | 526.8 | 593.0 | 522.0 | 602.0 | 523.6 | 606.2 | 519.8 | 610.2 | 527.4 | 608.8 | 527.2 | 609.6 | | | | | | | | | | |
| | (2.70) | (2.19) | (3.96) | (3.94) | (1.87) | (7.11) | (1.82) | (2.39) | (1.30) | (8.58) | (1.14) | (3.90) | (1.92) | (13.30) | | | | | | | | | | |
| C 7 | 533.6 | 630.6 | 528.4 | 615.6 | 524.8 | 603.2 | 518.6 | 609.6 | 526.0 | 605.6 | 524.6 | 602.2 | 523.4 | 610.4 | | | | | | | | | | |
| | (1.34) | (2.07) | (1.34) | (7.92) | (5.40) | (4.82) | (3.36) | (6.73) | (1.87) | (4.45) | (1.34) | (4.09) | (1.52) | (5.68) | | | | | | | | | | |
| C 8 | 479.0 | 555.2 | 480.4 | 557.2 | 479.6 | 557.0 | 478.6 | 571.2 | 474.8 | 558.4 | 479.4 | 563.0 | 479.6 | 562.6 | | | | | | | | | | |
| | (1.22) | (7.33) | (0.55) | (7.46) | (1.34) | (4.30) | (1.14) | (3.63) | (2.77) | (3.13) | (1.82) | (6.08) | (1.82) | (8.85) | | | | | | | | | | |
| C 9 | 490.0 | 574.4 | 502.0 | 576.4 | 486.0 | 559.2 | 492.6 | 571.2 | 494.4 | 568.0 | 495.4 | 563.2 | 495.4 | 563.2 | | | | | | | | | | |
| | (1.73) | (1.52) | (1.41) | (4.16) | (3.16) | (5.93) | (1.52) | (6.38) | (3.13) | (2.12) | (3.05) | (4.38) | (0.89) | (6.30) | | | | | | | | | | |
| C 10 | 495.0 | 598.6 | 496.8 | 585.2 | 499.4 | 593.2 | 493.6 | 580.6 | 495.8 | 588.0 | 495.8 | 578.2 | 496.8 | 585.2 | | | | | | | | | | |
| | (0.71) | (8.32) | (2.59) | (10.31) | (1.95) | (4.55) | (2.61) | (12.72) | (1.48) | (8.57) | (1.30) | (5.12) | (2.49) | (6.61) | | | | | | | | | | |

Table 9 Skin measurement before and after applying propylene glycol (control) in volunteers group C. The data show average values (n = 5 measurements).

| Volunteer No. | Control group (right arm) | | | | | | | | | | | | | |
|---------------|---------------------------|--------|--------|---------|--------|---------|--------|---------|--------|---------|---------|---------|---------|---------|
| | Week 0 | | Week 2 | | Week 4 | | Week 6 | | Week 8 | | Week 10 | | Week 12 | |
| | M | E | M | E | M | E | M | E | M | E | M | E | M | E |
| C11 | 508.4 | 589.4 | 507.8 | 584.8 | 511.6 | 584.8 | 508.4 | 576.6 | 509.4 | 581.2 | 515.0 | 573.2 | 514.0 | 586.0 |
| (SD) | (1.14) | (5.94) | (1.30) | (4.66) | (2.19) | (8.41) | (1.82) | (4.04) | (2.07) | (4.60) | (1.58) | (4.02) | (1.22) | (4.06) |
| C12 | 524.2 | 633.8 | 525.4 | 629.8 | 521.8 | 615.4 | 516.6 | 624.6 | 518.6 | 617.8 | 516.2 | 626.8 | 515.8 | 613.2 |
| | (0.45) | (6.57) | (3.51) | (10.06) | (4.49) | (9.63) | (2.70) | (4.22) | (2.61) | (6.38) | (2.17) | (11.52) | (0.84) | (6.02) |
| C13 | 528.8 | 616.2 | 522.8 | 608.6 | 518.2 | 614.2 | 513.2 | 604.8 | 517.6 | 606.2 | 522.0 | 601.4 | 522.8 | 614.8 |
| | (2.17) | (2.59) | (1.30) | (3.51) | (2.17) | (3.35) | (3.35) | (4.15) | (3.05) | (9.68) | (2.74) | (7.27) | (3.49) | (5.40) |
| C14 | 496.0 | 609.4 | 483.2 | 581.0 | 484.8 | 562.8 | 484.4 | 576.0 | 488.6 | 585.2 | 490.6 | 587.0 | 490.2 | 575.4 |
| | (1.58) | (1.95) | (1.10) | (3.67) | (4.76) | (10.43) | (4.39) | (12.94) | (2.88) | (4.09) | (0.55) | (6.82) | (2.28) | (7.30) |
| C15 | 498.8 | 591.8 | 498.8 | 586.6 | 497.2 | 601.4 | 493.2 | 586.2 | 495.0 | 594.4 | 496.4 | 592.2 | 498.2 | 569.4 |
| | (2.59) | (5.85) | (1.30) | (6.50) | (9.96) | (9.45) | (3.49) | (4.66) | (3.61) | (10.33) | (2.51) | (2.17) | (1.10) | (7.30) |
| C16 | 517.0 | 587.8 | 518.6 | 600.4 | 521.8 | 590.8 | 522.0 | 590.0 | 527.4 | 596.0 | 529.0 | 588.4 | 528.2 | 590.2 |
| | (1.58) | (4.82) | (1.52) | (3.65) | (1.30) | (4.32) | (1.00) | (8.89) | (3.58) | (5.70) | (1.22) | (4.83) | (1.30) | (7.29) |
| C17 | 538.2 | 609.6 | 531.0 | 601.2 | 517.4 | 587.0 | 512.4 | 596.2 | 518.4 | 594.6 | 525.0 | 599.8 | 523.4 | 610.2 |
| | (1.30) | (6.84) | (1.22) | (3.27) | (4.22) | (5.70) | (5.41) | (4.55) | (1.52) | (7.16) | (3.00) | (8.56) | (2.70) | (10.83) |
| C18 | 503.2 | 591.6 | 501.4 | 614.2 | 498.6 | 589.6 | 501.6 | 593.2 | 497.4 | 577.4 | 505.6 | 588.0 | 501.4 | 577.0 |
| | (1.64) | (2.61) | (5.18) | (7.92) | (2.07) | (6.99) | (1.52) | (8.70) | (1.67) | (9.99) | (2.79) | (11.90) | (2.19) | (4.64) |
| C19 | 519.0 | 603.6 | 517.2 | 597.4 | 511.0 | 598.6 | 510.4 | 601.2 | 502.2 | 573.0 | 501.4 | 586.4 | 502.2 | 589.8 |
| | (6.40) | (5.50) | (1.48) | (1.14) | (3.67) | (8.38) | (1.82) | (4.55) | (1.79) | (8.03) | (4.56) | (9.02) | (1.79) | (1.64) |
| C20 | 496.4 | 595.6 | 496.8 | 600.4 | 498.4 | 583.8 | 491.0 | 586.0 | 491.8 | 578.0 | 497.2 | 580.8 | 498.2 | 592.6 |
| | (3.51) | (4.98) | (5.07) | (7.83) | (5.03) | (5.72) | (1.87) | (6.89) | (1.64) | (4.69) | (3.11) | (7.29) | (3.83) | (7.92) |

Table 10 Skin measurement before and after applying 0.25 % w/v Licorice extract in volunteers group C. The data show average values (n = 5 measurements).

| Volunteer | 0.25 % w/v Licorice extract group (right arm) | | | | | | | | | | | | | | | | | |
|-----------|---|--------|--------|---------|--------|---------|--------|---------|--------|---------|---------|---------|---------|---------|--|--|--|--|
| | Week 0 | | Week 2 | | Week 4 | | Week 6 | | Week 8 | | Week 10 | | Week 12 | | | | | |
| | M | E | M | E | M | E | M | E | M | E | M | E | M | E | | | | |
| C 1 | 479.2 | 582.0 | 477.4 | 571.2 | 473.6 | 575.8 | 473.4 | 579.8 | 476.8 | 574.0 | 472.4 | 557.2 | 470.6 | 573.2 | | | | |
| (SD) | (1.30) | (3.81) | (2.07) | (6.91) | (2.41) | (10.11) | (1.95) | (9.23) | (2.17) | (6.16) | (1.52) | (10.99) | (0.55) | (5.54) | | | | |
| C 2 | 499.8 | 602.0 | 494.6 | 582.0 | 499.0 | 586.4 | 496.0 | 591.2 | 491.4 | 582.6 | 490.4 | 584.0 | 490.4 | 590.2 | | | | |
| (SD) | (0.45) | (5.05) | (0.89) | (6.75) | (4.00) | (4.56) | (1.73) | (7.22) | (3.29) | (14.06) | (1.95) | (4.95) | (0.55) | (9.65) | | | | |
| C 3 | 503.2 | 603.4 | 492.4 | 578.8 | 494.6 | 592.4 | 489.2 | 592.0 | 494.0 | 580.6 | 501.2 | 578.6 | 498.2 | 576.6 | | | | |
| (SD) | (0.45) | (5.18) | (2.07) | (11.71) | (2.88) | (15.19) | (2.39) | (14.00) | (1.58) | (2.88) | (1.48) | (11.26) | (2.49) | (11.97) | | | | |
| C 4 | 518.2 | 584.6 | 515.0 | 582.2 | 513.2 | 577.0 | 510.2 | 587.0 | 510.0 | 578.0 | 511.6 | 577.6 | 506.2 | 573.4 | | | | |
| (SD) | (3.83) | (4.51) | (0.71) | (3.77) | (2.39) | (4.42) | (3.35) | (8.63) | (1.00) | (4.64) | (2.07) | (6.66) | (1.30) | (6.11) | | | | |
| C 5 | 538.8 | 625.6 | 528.4 | 601.8 | 526.2 | 609.2 | 521.0 | 606.2 | 527.4 | 607.8 | 519.8 | 597.4 | 518.6 | 593.8 | | | | |
| (SD) | (3.96) | (7.47) | (3.29) | (3.96) | (1.79) | (5.89) | (1.22) | (6.98) | (0.89) | (8.35) | (1.64) | (5.90) | (1.14) | (5.89) | | | | |
| C 6 | 522.8 | 600.0 | 531.6 | 604.8 | 522.2 | 591.6 | 524.2 | 603.2 | 516.6 | 600.0 | 512.6 | 591.4 | 513.8 | 589.8 | | | | |
| (SD) | (1.10) | (4.95) | (2.07) | (6.14) | (3.70) | (6.80) | (1.64) | (7.60) | (1.82) | (4.74) | (3.51) | (8.20) | (1.79) | (5.72) | | | | |
| C 7 | 539.0 | 637.0 | 532.6 | 621.0 | 524.0 | 614.0 | 508.2 | 608.0 | 517.2 | 607.2 | 517.0 | 611.4 | 512.4 | 598.2 | | | | |
| (SD) | (1.58) | (7.65) | (3.05) | (8.46) | (2.24) | (8.22) | (3.03) | (7.18) | (1.64) | (7.16) | (0.71) | (3.05) | (4.93) | (8.50) | | | | |
| C 8 | 486.6 | 568.6 | 484.0 | 563.8 | 483.6 | 558.0 | 481.2 | 575.2 | 482.8 | 572.8 | 481.6 | 563.6 | 479.6 | 561.6 | | | | |
| (SD) | (1.14) | (6.19) | (1.00) | (8.35) | (2.30) | (4.74) | (0.84) | (6.34) | (1.79) | (4.09) | (1.95) | (3.78) | (0.55) | (10.04) | | | | |
| C 9 | 493.4 | 561.8 | 490.2 | 576.8 | 488.6 | 554.4 | 485.0 | 563.2 | 484.6 | 555.6 | 488.4 | 556.8 | 487.6 | 553.2 | | | | |
| (SD) | (1.95) | (6.94) | (0.84) | (3.03) | (2.41) | (4.67) | (3.81) | (11.19) | (1.52) | (3.36) | (0.55) | (6.26) | (0.55) | (7.19) | | | | |
| C 10 | 494.4 | 606.8 | 498.0 | 587.0 | 502.4 | 594.4 | 494.2 | 589.8 | 495.6 | 583.8 | 493.6 | 568.4 | 491.6 | 575.2 | | | | |
| (SD) | (0.89) | (7.60) | (2.00) | (6.63) | (2.19) | (7.16) | (2.68) | (7.66) | (0.89) | (7.12) | (2.30) | (7.47) | (2.41) | (4.02) | | | | |

Table 10 Skin measurement before and after applying 0.25 % w/v Licorice extract in volunteers group C. The data show average values (n = 5 measurements).

| Volunteer | | 0.25 % w/v Licorice extract group (left arm) | | | | | | | | | | | | | | | | | | | | | | | |
|-----------|-----------|--|--------|--------|--------|--------|---------|--------|---------|--------|---------|---------|---------|---------|---------|--|--|--|--|--|--|--|--|--|--|
| No. | Volunteer | Week 0 | | Week 2 | | Week 4 | | Week 6 | | Week 8 | | Week 10 | | Week 12 | | | | | | | | | | | |
| | | M | E | M | E | M | E | M | E | M | E | M | E | M | E | | | | | | | | | | |
| C11 | | 499.4 | 578.4 | 503.4 | 564.6 | 502.0 | 571.0 | 498.6 | 575.2 | 503.6 | 574.0 | 508.2 | 572.2 | 504.0 | 567.6 | | | | | | | | | | |
| (SD) | | (1.67) | (2.41) | (1.14) | (2.88) | (2.35) | (3.39) | (2.70) | (15.47) | (1.34) | (6.87) | (0.84) | (7.60) | (1.22) | (1.52) | | | | | | | | | | |
| C12 | | 528.8 | 635.4 | 520.2 | 626.4 | 524.2 | 622.4 | 515.2 | 620.4 | 512.6 | 604.0 | 512.6 | 609.6 | 511.6 | 611.0 | | | | | | | | | | |
| (SD) | | (5.36) | (3.91) | (4.09) | (7.60) | (3.90) | (9.10) | (2.59) | (10.01) | (2.97) | (7.78) | (4.72) | (4.16) | (3.58) | (1.87) | | | | | | | | | | |
| C13 | | 525.6 | 617.0 | 527.0 | 610.0 | 519.0 | 603.6 | 518.0 | 618.4 | 518.6 | 604.2 | 518.0 | 605.2 | 518.2 | 603.2 | | | | | | | | | | |
| (SD) | | (1.52) | (4.00) | (1.58) | (4.06) | (2.74) | (10.53) | (2.74) | (9.18) | (1.82) | (10.35) | (1.22) | (1.92) | (0.84) | (9.15) | | | | | | | | | | |
| C14 | | 487.8 | 599.2 | 486.8 | 588.6 | 483.0 | 568.2 | 483.8 | 576.6 | 482.4 | 575.4 | 481.2 | 569.2 | 477.2 | 572.0 | | | | | | | | | | |
| (SD) | | (0.84) | (3.11) | (0.45) | (4.04) | (4.06) | (4.76) | (1.64) | (5.41) | (1.67) | (6.99) | (1.30) | (10.35) | (1.79) | (10.75) | | | | | | | | | | |
| C15 | | 502.4 | 578.2 | 501.8 | 561.6 | 502.2 | 597.8 | 498.8 | 590.6 | 494.2 | 584.2 | 494.6 | 585.4 | 491.4 | 575.4 | | | | | | | | | | |
| (SD) | | (1.14) | (3.96) | (3.19) | (3.29) | (2.77) | (9.58) | (2.59) | (13.13) | (1.92) | (9.47) | (1.14) | (7.50) | (1.95) | (6.77) | | | | | | | | | | |
| C16 | | 519.8 | 595.8 | 525.2 | 599.8 | 524.2 | 592.4 | 521.4 | 592.2 | 530.6 | 593.6 | 523.4 | 584.2 | 524.2 | 583.8 | | | | | | | | | | |
| (SD) | | (2.28) | (2.95) | (2.68) | (2.17) | (1.30) | (8.44) | (1.52) | (5.26) | (3.21) | (5.50) | (1.52) | (1.30) | (1.30) | (5.81) | | | | | | | | | | |
| C17 | | 518.2 | 583.4 | 513.4 | 586.0 | 507.6 | 579.2 | 508.6 | 596.8 | 506.4 | 589.2 | 508.4 | 581.6 | 506.4 | 587.6 | | | | | | | | | | |
| (SD) | | (1.10) | (5.50) | (0.55) | (4.18) | (2.07) | (3.27) | (2.88) | (5.12) | (0.89) | (6.91) | (2.41) | (8.05) | (2.51) | (9.81) | | | | | | | | | | |
| C18 | | 509.8 | 597.4 | 506.8 | 602.8 | 508.2 | 585.4 | 510.4 | 588.8 | 509.6 | 603.2 | 509.4 | 586.8 | 510.6 | 581.2 | | | | | | | | | | |
| (SD) | | (1.30) | (6.66) | (2.59) | (3.90) | (4.02) | (8.71) | (3.05) | (7.19) | (1.82) | (2.17) | (2.70) | (6.76) | (1.52) | (6.34) | | | | | | | | | | |
| C19 | | 513.8 | 605.0 | 504.4 | 590.4 | 503.6 | 603.2 | 503.0 | 598.6 | 500.2 | 575.4 | 502.2 | 584.6 | 500.6 | 586.8 | | | | | | | | | | |
| (SD) | | (1.64) | (3.39) | (1.14) | (5.32) | (1.67) | (5.45) | (1.22) | (6.35) | (0.84) | (9.94) | (1.30) | (6.47) | (0.89) | (10.35) | | | | | | | | | | |
| C20 | | 499.8 | 593.2 | 497.8 | 579.6 | 499.4 | 593.4 | 488.6 | 579.2 | 486.6 | 569.6 | 488.4 | 580.8 | 492.0 | 599.6 | | | | | | | | | | |
| (SD) | | (1.30) | (4.71) | (1.30) | (3.65) | (1.67) | (5.03) | (1.67) | (2.39) | (1.14) | (12.03) | (0.55) | (5.07) | (0.71) | (7.23) | | | | | | | | | | |

Table 11 Skin measurement before and after applying propylene glycol (control) in volunteers group D. The data show average values (n = 5 measurements).

| Volunteer No. | Control group (left arm) | | | | | | | | | | | | | |
|---------------|--------------------------|--------|--------|--------|--------|---------|--------|---------|--------|---------|---------|---------|---------|--------|
| | Week 0 | | Week 2 | | Week 4 | | Week 6 | | Week 8 | | Week 10 | | Week 12 | |
| | M | E | M | E | M | E | M | E | M | E | M | E | M | E |
| D 1 | 480.6 | 597.8 | 485.0 | 563.8 | 484.6 | 587.4 | 479.0 | 581.6 | 479.2 | 579.0 | 484.4 | 587.8 | 482.8 | 584.4 |
| (SD) | (4.77) | (3.96) | (1.22) | (3.42) | (1.95) | (12.50) | (1.73) | (5.27) | (1.92) | (5.34) | (1.34) | (7.98) | (1.79) | (1.52) |
| D 2 | 494.0 | 601.4 | 494.4 | 598.2 | 491.0 | 579.4 | 492.6 | 591.6 | 498.6 | 585.8 | 497.4 | 589.4 | 497.4 | 582.2 |
| | (1.58) | (8.20) | (1.14) | (4.66) | (1.87) | (11.46) | (1.52) | (9.29) | (2.70) | (8.79) | (4.16) | (9.81) | (1.52) | (9.86) |
| D 3 | 509.8 | 600.0 | 508.2 | 593.6 | 504.4 | 592.8 | 499.6 | 593.4 | 500.0 | 585.8 | 501.0 | 574.6 | 498.8 | 587.2 |
| | (2.28) | (7.58) | (1.79) | (3.29) | (1.14) | (3.96) | (0.55) | (2.07) | (1.00) | (5.26) | (1.22) | (12.42) | (5.54) | (7.16) |
| D 4 | 510.0 | 614.6 | 510.2 | 595.4 | 503.0 | 599.6 | 503.4 | 603.0 | 507.0 | 600.0 | 507.4 | 596.4 | 508.2 | 595.2 |
| | (2.35) | (5.03) | (1.79) | (4.16) | (2.00) | (4.51) | (3.13) | (6.24) | (1.41) | (9.06) | (1.82) | (2.88) | (3.96) | (8.35) |
| D 5 | 512.0 | 603.0 | 513.4 | 611.2 | 510.0 | 578.4 | 509.4 | 595.0 | 507.6 | 582.4 | 509.4 | 593.6 | 508.4 | 582.8 |
| | (1.73) | (4.53) | (2.30) | (1.92) | (4.36) | (4.98) | (3.85) | (7.42) | (1.67) | (6.80) | (1.14) | (4.98) | (2.70) | (4.87) |
| D 6 | 530.2 | 602.4 | 531.0 | 624.6 | 523.2 | 593.4 | 523.2 | 603.2 | 518.2 | 615.4 | 532.6 | 600.4 | 531.8 | 623.0 |
| | (1.64) | (1.14) | (1.41) | (4.39) | (0.84) | (6.77) | (2.17) | (5.76) | (3.90) | (10.41) | (2.19) | (3.44) | (2.17) | (7.42) |
| D 7 | 498.0 | 595.6 | 490.4 | 592.8 | 490.0 | 589.6 | 489.0 | 592.6 | 494.8 | 594.4 | 492.0 | 589.0 | 489.4 | 582.0 |
| | (2.92) | (6.99) | (2.07) | (2.59) | (1.22) | (5.03) | (2.00) | (11.93) | (0.84) | (12.54) | (1.22) | (4.06) | (1.14) | (4.53) |
| D 8 | 501.2 | 582.8 | 503.4 | 580.6 | 502.8 | 575.8 | 498.8 | 580.8 | 499.4 | 558.6 | 500.8 | 567.0 | 504.0 | 570.8 |
| | (1.92) | (4.02) | (2.70) | (9.99) | (0.84) | (1.79) | (2.59) | (3.56) | (0.89) | (7.92) | (1.92) | (3.24) | (3.32) | (4.32) |
| D 9 | 512.2 | 583.2 | 506.0 | 585.6 | 506.6 | 579.4 | 510.6 | 591.4 | 511.0 | 592.2 | 511.4 | 584.4 | 512.8 | 580.4 |
| | (1.30) | (1.64) | (1.87) | (3.97) | (2.41) | (6.11) | (3.21) | (5.77) | (2.35) | (3.11) | (0.89) | (2.19) | (1.10) | (3.21) |
| D 10 | 522.4 | 627.4 | 517.2 | 627.4 | 509.2 | 601.8 | 512.0 | 602.6 | 513.8 | 598.4 | 512.0 | 608.4 | 511.8 | 606.2 |
| | (0.55) | (2.61) | (2.28) | (5.64) | (2.95) | (5.72) | (0.71) | (3.13) | (2.49) | (8.50) | (1.22) | (5.98) | (2.17) | (2.49) |

Table 11 Skin measurement before and after applying propylene glycol (control) in volunteers group D. The data show average values (n = 5 measurements).

| Volunteer No. | Control group (right arm) | | | | | | | | | | | | | | | | | | | | | | | |
|---------------|---------------------------|--------|--------|---------|--------|---------|--------|--------|--------|---------|---------|---------|---------|--------|--|--|--|--|--|--|--|--|--|--|
| | Week 0 | | Week 2 | | Week 4 | | Week 6 | | Week 8 | | Week 10 | | Week 12 | | | | | | | | | | | |
| | M | E | M | E | M | E | M | E | M | E | M | E | M | E | | | | | | | | | | |
| D11 | 529.2 | 628.6 | 529.6 | 627.0 | 528.0 | 624.0 | 529.8 | 620.6 | 525.2 | 618.0 | 528.2 | 616.8 | 522.4 | 618.8 | | | | | | | | | | |
| (SD) | (1.79) | (7.23) | (1.82) | (5.66) | (2.65) | (3.08) | (3.11) | (2.88) | (2.17) | (6.60) | (1.64) | (2.39) | (4.67) | (4.76) | | | | | | | | | | |
| D12 | 500.2 | 573.8 | 501.8 | 581.4 | 507.2 | 581.0 | 505.2 | 582.2 | 504.8 | 573.4 | 504.8 | 568.2 | 505.4 | 573.0 | | | | | | | | | | |
| | (1.30) | (2.95) | (2.17) | (6.23) | (2.59) | (5.70) | (1.64) | (2.77) | (2.59) | (5.59) | (1.48) | (5.81) | (2.97) | (2.55) | | | | | | | | | | |
| D13 | 529.2 | 619.2 | 537.2 | 615.6 | 536.4 | 621.4 | 536.4 | 620.0 | 531.6 | 606.2 | 533.8 | 614.2 | 533.2 | 605.0 | | | | | | | | | | |
| | (2.17) | (3.42) | (3.27) | (6.02) | (3.36) | (8.44) | (0.55) | (3.46) | (2.79) | (17.95) | (1.30) | (3.19) | (3.11) | (5.39) | | | | | | | | | | |
| D14 | 522.2 | 626.0 | 520.8 | 611.2 | 515.6 | 601.6 | 513.2 | 613.8 | 520.4 | 611.6 | 520.6 | 606.8 | 521.0 | 615.8 | | | | | | | | | | |
| | (4.09) | (4.24) | (2.39) | (7.22) | (2.19) | (2.61) | (2.28) | (8.29) | (1.67) | (5.27) | (2.30) | (6.57) | (1.41) | (6.30) | | | | | | | | | | |
| D16 | 507.4 | 567.4 | 506.0 | 565.6 | 512.0 | 573.6 | 511.2 | 567.8 | 509.0 | 566.8 | 508.6 | 562.8 | 507.2 | 563.2 | | | | | | | | | | |
| | (1.52) | (5.37) | (2.65) | (5.46) | (2.65) | (3.65) | (3.70) | (5.12) | (2.35) | (5.07) | (1.67) | (3.42) | (1.64) | (3.42) | | | | | | | | | | |
| D17 | 510.4 | 612.6 | 517.2 | 613.2 | 521.8 | 621.4 | 517.0 | 610.2 | 514.2 | 591.6 | 520.4 | 607.4 | 519.4 | 604.6 | | | | | | | | | | |
| | (1.52) | (6.23) | (2.77) | (2.59) | (4.44) | (1.67) | (1.87) | (8.53) | (3.77) | (9.45) | (2.51) | (2.07) | (2.70) | (5.32) | | | | | | | | | | |
| D18 | 503.6 | 601.8 | 502.2 | 588.6 | 495.0 | 589.4 | 501.6 | 582.8 | 504.2 | 589.4 | 505.4 | 589.8 | 503.8 | 599.2 | | | | | | | | | | |
| | (2.41) | (4.09) | (0.45) | (6.07) | (8.57) | (9.04) | (3.05) | (5.54) | (2.28) | (5.59) | (2.07) | (11.03) | (2.49) | (5.54) | | | | | | | | | | |
| D19 | 535.4 | 617.8 | 529.4 | 611.2 | 523.0 | 603.2 | 524.2 | 603.2 | 523.4 | 582.2 | 518.8 | 600.6 | 520.8 | 593.6 | | | | | | | | | | |
| | (2.19) | (8.67) | (4.77) | (11.50) | (1.22) | (10.40) | (1.30) | (8.04) | (2.41) | (10.11) | (1.10) | (6.99) | (2.68) | (5.08) | | | | | | | | | | |
| D20 | 498.4 | 621.8 | 501.0 | 610.2 | 499.2 | 601.4 | 494.6 | 611.6 | 494.0 | 602.2 | 498.8 | 611.0 | 497.6 | 608.4 | | | | | | | | | | |
| | (2.07) | (6.22) | (1.22) | (5.81) | (2.28) | (9.32) | (2.19) | (1.14) | (1.58) | (9.98) | (2.59) | (5.57) | (0.89) | (7.60) | | | | | | | | | | |

Table 12 Skin measurement before and after applying 3.00 % w/v Kojic acid in volunteers group D. The data show average values (n = 5 measurements).

| Volunteer No. | 3.00 % w/v Kojic acid group (right arm) | | | | | | | | | | | | | | |
|---------------|---|---------|--------|--------|--------|---------|--------|---------|--------|---------|---------|--------|---------|--------|--|
| | Week 0 | | Week 2 | | Week 4 | | Week 6 | | Week 8 | | Week 10 | | Week 12 | | |
| | M | E | M | E | M | E | M | E | M | E | M | E | M | E | |
| D1 | 480.8 | 593.4 | 477.4 | 578.4 | 481.2 | 580.4 | 476.6 | 580.0 | 479.2 | 580.0 | 483.0 | 585.8 | 482.2 | 580.0 | |
| (SD) | (0.84) | (1.14) | (2.51) | (4.00) | (3.56) | (11.13) | (2.41) | (6.00) | (0.45) | (13.66) | (1.87) | (5.26) | (1.92) | (9.97) | |
| D2 | 492.8 | 594.8 | 497.2 | 609.2 | 488.2 | 578.8 | 488.8 | 590.6 | 493.4 | 578.4 | 492.4 | 613.6 | 489.0 | 572.8 | |
| (SD) | (1.64) | (5.89) | (3.35) | (4.82) | (0.84) | (5.89) | (1.10) | (8.32) | (1.52) | (1.95) | (1.34) | (7.23) | (1.87) | (9.71) | |
| D3 | 507.8 | 604.2 | 507.4 | 593.4 | 505.2 | 592.6 | 500.0 | 608.0 | 499.0 | 587.6 | 497.6 | 588.4 | 494.0 | 588.8 | |
| (SD) | (2.17) | (10.40) | (3.13) | (7.09) | (1.30) | (5.27) | (3.08) | (6.36) | (1.58) | (8.53) | (1.14) | (9.56) | (2.74) | (7.05) | |
| D4 | 515.6 | 616.4 | 506.4 | 598.0 | 507.4 | 602.8 | 503.4 | 597.8 | 499.4 | 587.2 | 495.6 | 594.2 | 499.6 | 597.4 | |
| (SD) | (3.36) | (5.90) | (2.70) | (6.20) | (1.95) | (8.79) | (3.29) | (4.76) | (2.41) | (10.52) | (2.51) | (5.93) | (3.29) | (5.98) | |
| D5 | 519.2 | 608.6 | 517.4 | 610.4 | 512.0 | 587.8 | 505.0 | 589.2 | 508.8 | 587.4 | 508.8 | 589.8 | 505.2 | 575.0 | |
| (SD) | (1.30) | (4.16) | (3.65) | (7.60) | (2.92) | (3.56) | (4.06) | (4.09) | (0.84) | (5.90) | (0.45) | (2.86) | (2.49) | (1.73) | |
| D6 | 534.2 | 613.8 | 526.2 | 603.4 | 522.6 | 597.6 | 514.4 | 602.8 | 513.4 | 601.8 | 512.6 | 588.2 | 510.4 | 585.4 | |
| (SD) | (1.64) | (3.27) | (3.83) | (6.80) | (1.52) | (6.58) | (2.88) | (2.95) | (0.89) | (2.86) | (1.14) | (2.77) | (1.67) | (2.07) | |
| D7 | 488.8 | 593.8 | 489.6 | 584.4 | 488.2 | 576.0 | 482.8 | 593.6 | 487.0 | 579.6 | 481.0 | 588.0 | 480.2 | 580.0 | |
| (SD) | (1.64) | (9.98) | (2.07) | (3.51) | (2.39) | (6.63) | (1.64) | (5.13) | (0.71) | (3.85) | (1.58) | (2.00) | (0.84) | (6.40) | |
| D8 | 503.6 | 583.2 | 504.0 | 581.8 | 504.6 | 580.4 | 500.6 | 580.8 | 501.4 | 566.4 | 506.4 | 580.0 | 501.6 | 570.6 | |
| (SD) | (1.52) | (3.56) | (1.58) | (8.01) | (0.89) | (6.95) | (1.82) | (8.38) | (1.95) | (7.27) | (1.14) | (3.61) | (4.72) | (9.50) | |
| D9 | 525.6 | 595.8 | 511.4 | 582.8 | 514.4 | 581.6 | 513.6 | 585.2 | 511.2 | 582.0 | 508.0 | 583.6 | 506.4 | 564.8 | |
| (SD) | (2.07) | (5.63) | (3.58) | (2.49) | (3.21) | (6.43) | (4.04) | (3.96) | (2.39) | (6.32) | (1.41) | (6.27) | (1.67) | (2.17) | |
| D10 | 526.2 | 636.2 | 513.8 | 626.0 | 516.2 | 601.6 | 513.2 | 602.4 | 508.6 | 593.4 | 508.2 | 589.6 | 505.2 | 594.2 | |
| (SD) | (0.84) | (2.59) | (4.15) | (4.85) | (3.83) | (5.73) | (3.96) | (10.55) | (2.88) | (5.59) | (1.30) | (7.40) | (4.27) | (6.38) | |

Table 12 Skin measurement before and after applying 3.00 % w/v Kojic acid in volunteers group A. The data show average values (n = 5 measurements).

| Volunteer No. | 3.00 % w/v Kojic acid group (left arm) | | | | | | | | | | | | | |
|---------------|--|--------|--------|--------|--------|--------|--------|---------|--------|---------|---------|--------|---------|---------|
| | Week 0 | | Week 2 | | Week 4 | | Week 6 | | Week 8 | | Week 10 | | Week 12 | |
| | M | E | M | E | M | E | M | E | M | E | M | E | M | E |
| D11 | 531.8 | 629.0 | 534.4 | 632.6 | 523.6 | 622.6 | 523.6 | 614.4 | 522.4 | 609.6 | 517.6 | 604.4 | 517.6 | 624.4 |
| (SD) | (2.28) | (7.68) | (1.82) | (2.07) | (2.30) | (5.03) | (1.67) | (6.47) | (1.14) | (5.90) | (2.19) | (9.71) | (1.14) | (8.62) |
| D12 | 500.4 | 580.2 | 496.6 | 580.4 | 499.0 | 573.2 | 493.4 | 573.8 | 492.6 | 553.0 | 490.0 | 552.8 | 490.0 | 555.0 |
| | (2.88) | (3.35) | (4.04) | (9.96) | (1.87) | (5.54) | (2.51) | (6.14) | (1.82) | (10.42) | (2.55) | (4.97) | (1.41) | (3.00) |
| D13 | 542.8 | 629.8 | 552.8 | 630.4 | 544.6 | 616.8 | 540.0 | 622.0 | 546.4 | 604.8 | 534.8 | 608.2 | 530.4 | 598.8 |
| | (2.77) | (3.56) | (3.49) | (1.67) | (4.34) | (4.97) | (2.74) | (4.85) | (2.30) | (5.45) | (3.11) | (3.70) | (3.71) | (5.12) |
| D14 | 523.6 | 628.2 | 522.6 | 608.6 | 511.8 | 600.6 | 512.8 | 597.4 | 511.8 | 595.8 | 512.0 | 592.0 | 502.2 | 581.6 |
| | (2.88) | (5.93) | (1.95) | (3.44) | (2.59) | (7.09) | (2.95) | (7.70) | (1.10) | (6.06) | (1.00) | (9.27) | (2.59) | (10.26) |
| D16 | 501.4 | 571.0 | 506.0 | 566.4 | 504.8 | 567.2 | 498.6 | 565.6 | 498.4 | 559.8 | 497.8 | 564.2 | 494.0 | 568.8 |
| | (1.95) | (4.85) | (1.41) | (3.91) | (2.86) | (3.49) | (1.14) | (10.67) | (2.07) | (3.35) | (1.64) | (2.68) | (3.94) | (9.12) |
| D17 | 510.4 | 601.0 | 514.8 | 610.6 | 517.8 | 600.0 | 502.6 | 597.4 | 507.8 | 595.0 | 506.8 | 609.4 | 505.4 | 587.8 |
| | (2.30) | (6.04) | (4.21) | (6.95) | (2.95) | (9.41) | (2.30) | (6.39) | (3.11) | (10.70) | (1.64) | (9.40) | (0.55) | (6.53) |
| D18 | 497.6 | 593.4 | 500.2 | 587.0 | 500.6 | 583.8 | 499.8 | 583.4 | 497.6 | 579.6 | 497.8 | 579.0 | 495.6 | 580.0 |
| | (3.65) | (3.91) | (4.60) | (3.54) | (4.39) | (9.28) | (1.64) | (2.19) | (1.34) | (7.96) | (0.84) | (9.62) | (0.89) | (3.08) |
| D19 | 527.2 | 618.6 | 529.6 | 607.4 | 523.0 | 608.0 | 515.8 | 590.0 | 518.2 | 590.4 | 514.4 | 589.6 | 511.8 | 593.4 |
| | (3.90) | (3.78) | (4.39) | (5.13) | (3.46) | (7.11) | (3.83) | (5.34) | (1.64) | (4.93) | (1.82) | (6.84) | (3.03) | (8.08) |
| D20 | 501.4 | 613.8 | 502.2 | 618.2 | 498.6 | 604.8 | 496.0 | 602.2 | 494.2 | 605.8 | 492.2 | 603.8 | 490.2 | 603.8 |
| | (0.89) | (9.58) | (0.45) | (1.64) | (2.88) | (8.35) | (1.22) | (7.56) | (2.77) | (14.10) | (1.10) | (5.26) | (2.05) | (4.21) |

Appendix IIc

Individual %Whitening of female volunteers for

0.50% Puag-Haad (group A)

0.25% Puag-Haad (group B)

0.25 % Licorice extract (group C)

3.00% Kojic acid (group D)

Skin color was evaluated on outside areas of upper arms with Mexameter MX 16 described in methods.



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จุฬาลงกรณ์มหาวิทยาลัย

Table 13 The % whitening values in the upper arms of volunteers (group A) treated with 0.5 % Puag-Haad and Propylene glycol for 12 weeks.

| Volunteer No. | % Whitening (0.5 % Puag-Haad) | | | | | | | | | | | | % Whitening (Propylene glycol) | | | | | | | | | | | |
|---------------|-------------------------------|--------|--------|--------|---------|---------|--------|--------|--------|--------|---------|---------|--------------------------------|--------|--------|--------|---------|---------|--|--|--|--|--|--|
| | week 2 | week 4 | week 6 | week 8 | week 10 | week 12 | week 2 | week 4 | week 6 | week 8 | week 10 | week 12 | week 2 | week 4 | week 6 | week 8 | week 10 | week 12 | | | | | | |
| A1 | 0.95 | 0.12 | 0.70 | 0.58 | -0.82 | 0.33 | 1.06 | 0.82 | 0.53 | -0.49 | -0.37 | 0.61 | 1.06 | 0.82 | 0.53 | -0.49 | -0.37 | 0.61 | | | | | | |
| A2 | -1.77 | -0.45 | -0.25 | -1.52 | -0.86 | -0.70 | -0.36 | -0.32 | -0.24 | -0.20 | -1.54 | -1.50 | -0.36 | -0.32 | -0.24 | -0.20 | -1.54 | -1.50 | | | | | | |
| A3 | 1.11 | 0.59 | 2.10 | 1.70 | 0.91 | 1.31 | 0.28 | -0.28 | -0.36 | -0.24 | -0.40 | -0.32 | 0.28 | -0.28 | -0.36 | -0.24 | -0.40 | -0.32 | | | | | | |
| A4 | 0.43 | 1.37 | 1.77 | 1.77 | 2.24 | 2.36 | 1.35 | 3.16 | 2.74 | 2.04 | 1.62 | 1.66 | 1.35 | 3.16 | 2.74 | 2.04 | 1.62 | 1.66 | | | | | | |
| A5 | -0.27 | 0.81 | 0.08 | -1.00 | 1.04 | 0.73 | 0.26 | 0.45 | 1.62 | 1.36 | 1.51 | 1.81 | 0.26 | 0.45 | 1.62 | 1.36 | 1.51 | 1.81 | | | | | | |
| A6 | 0.26 | 1.82 | 2.57 | 2.64 | 2.49 | 2.83 | 0.48 | 0.93 | 1.19 | 0.89 | 0.63 | 1.00 | 0.48 | 0.93 | 1.19 | 0.89 | 0.63 | 1.00 | | | | | | |
| A7 | 0.60 | 0.79 | 1.53 | 0.26 | 2.58 | 2.66 | -1.75 | -1.19 | -1.16 | -1.12 | -1.38 | -1.60 | -1.75 | -1.19 | -1.16 | -1.12 | -1.38 | -1.60 | | | | | | |
| A8 | -1.19 | -0.76 | 0.55 | -0.89 | -0.76 | -0.51 | -1.14 | -1.52 | -1.99 | -1.27 | -1.74 | -1.82 | -1.14 | -1.52 | -1.99 | -1.27 | -1.74 | -1.82 | | | | | | |
| A10 | -0.81 | 1.09 | 2.51 | 1.05 | 0.73 | 1.17 | -0.67 | 2.29 | 2.68 | 3.00 | 2.25 | 2.49 | -0.67 | 2.29 | 2.68 | 3.00 | 2.25 | 2.49 | | | | | | |
| A11 | 0.27 | 1.97 | 2.51 | 3.36 | 2.78 | 2.63 | 0.85 | 1.63 | 2.48 | 1.63 | 1.78 | 1.47 | 0.85 | 1.63 | 2.48 | 1.63 | 1.78 | 1.47 | | | | | | |
| A12 | 1.46 | 0.75 | 1.81 | 2.64 | 2.21 | 2.68 | -0.40 | -1.00 | -0.52 | -0.32 | -0.96 | -1.12 | -0.40 | -1.00 | -0.52 | -0.32 | -0.96 | -1.12 | | | | | | |
| A13 | 0.27 | 0.04 | 0.96 | 1.00 | 1.46 | 2.30 | 0.91 | 0.42 | 0.84 | 0.23 | 0.46 | 1.79 | 0.91 | 0.42 | 0.84 | 0.23 | 0.46 | 1.79 | | | | | | |
| A14 | 0.32 | -0.24 | -0.32 | 0.76 | 0.68 | 1.75 | -0.24 | 0.08 | -0.53 | -0.44 | -0.93 | -0.69 | -0.24 | 0.08 | -0.53 | -0.44 | -0.93 | -0.69 | | | | | | |
| A15 | -0.16 | 0.70 | 1.86 | 2.17 | 3.65 | 4.11 | 1.64 | 0.31 | 1.88 | 1.45 | 1.52 | 1.52 | 1.64 | 0.31 | 1.88 | 1.45 | 1.52 | 1.52 | | | | | | |
| A16 | -0.50 | 0.50 | 1.15 | 2.19 | 2.73 | 4.53 | 1.97 | 1.59 | 2.69 | 1.97 | 2.53 | 2.35 | 1.97 | 1.59 | 2.69 | 1.97 | 2.53 | 2.35 | | | | | | |
| A17 | -1.73 | -1.96 | -0.88 | -1.81 | -1.19 | -0.73 | -1.48 | -1.02 | -0.64 | -0.34 | -0.57 | -0.57 | -1.48 | -1.02 | -0.64 | -0.34 | -0.57 | -0.57 | | | | | | |
| A19 | 1.59 | 1.21 | 1.93 | 1.85 | 1.85 | 2.34 | 1.60 | 0.53 | 0.53 | 0.69 | 0.69 | 2.32 | 1.60 | 0.53 | 0.53 | 0.69 | 0.69 | 2.32 | | | | | | |
| Average | 0.05 | 0.49 | 1.21 | 0.99 | 1.28 | 1.75 | 0.26 | 0.40 | 0.69 | 0.52 | 0.30 | 0.55 | 0.26 | 0.40 | 0.69 | 0.52 | 0.30 | 0.55 | | | | | | |
| (SD) | (1.00) | (0.98) | (1.08) | (1.54) | (1.49) | (1.56) | (1.12) | (1.27) | (1.48) | (1.22) | (1.39) | (1.53) | (1.12) | (1.27) | (1.48) | (1.22) | (1.39) | (1.53) | | | | | | |

Table 14 The % whitening values in the upper arms of volunteers (group B) treated with 0.25 % Puag-Haad and Propylene glycol for 12 weeks.

| Volunteer No. | % Whitening (0.25 % Puag-Haad) | | | | | | | | | | | | % Whitening (Propylene glycol) | | | | | | | | | | | |
|---------------|--------------------------------|--------|--------|--------|---------|---------|--------|--------|--------|--------|---------|---------|--------------------------------|--------|--------|--------|---------|---------|--|--|--|--|--|--|
| | week 2 | week 4 | week 6 | week 8 | week 10 | week 12 | week 2 | week 4 | week 6 | week 8 | week 10 | week 12 | week 2 | week 4 | week 6 | week 8 | week 10 | week 12 | | | | | | |
| B1 | -0.29 | -0.29 | 0.87 | 1.29 | 0.83 | 1.21 | 0.33 | -1.08 | 0.04 | 0.12 | -0.29 | -0.17 | | | | | | | | | | | | |
| B2 | 0.20 | 2.19 | 1.90 | 1.90 | 1.90 | 2.23 | -0.12 | 1.41 | 1.82 | 1.41 | 1.74 | 1.29 | | | | | | | | | | | | |
| B3 | -0.04 | 0.60 | 0.76 | 1.97 | 1.13 | 1.85 | -0.24 | 0.04 | 0.12 | -0.28 | -0.20 | -0.12 | | | | | | | | | | | | |
| B4 | -0.27 | 0.51 | 0.59 | 0.43 | 1.33 | 1.10 | -0.35 | 1.10 | 0.63 | 0.43 | 0.43 | 0.63 | | | | | | | | | | | | |
| B5 | 0.76 | 1.52 | 3.50 | 3.69 | 3.84 | 3.95 | 0.87 | 1.78 | 2.77 | 2.24 | 2.51 | 2.81 | | | | | | | | | | | | |
| B6 | 0.56 | 2.97 | 3.05 | 3.79 | 5.42 | 5.72 | 1.16 | 1.08 | 1.72 | 1.57 | 2.16 | 2.28 | | | | | | | | | | | | |
| B7 | 1.07 | 0.88 | 2.03 | 2.36 | 3.17 | 3.46 | 1.43 | 2.12 | 3.37 | 1.79 | 2.60 | 2.93 | | | | | | | | | | | | |
| B8 | -0.21 | 1.69 | 1.90 | 2.64 | 1.90 | 2.68 | -0.25 | 0.75 | -0.46 | -0.04 | -0.71 | -0.50 | | | | | | | | | | | | |
| B9 | -0.16 | 0.44 | 0.81 | 0.77 | -0.24 | 0.73 | -0.20 | -0.77 | -0.57 | -0.53 | -1.06 | -0.94 | | | | | | | | | | | | |
| B10 | -0.48 | -0.40 | -0.12 | -0.56 | 0.40 | 0.36 | -1.71 | -1.39 | -0.88 | -0.76 | -0.92 | -0.48 | | | | | | | | | | | | |
| B11 | 0.39 | 1.54 | 2.70 | 2.89 | 2.97 | 3.86 | 1.48 | 0.70 | 0.78 | 0.90 | 0.62 | 0.51 | | | | | | | | | | | | |
| B12 | -0.86 | -0.31 | 1.21 | 0.86 | 1.33 | 1.53 | -1.62 | -1.21 | -1.36 | -0.90 | -0.45 | -0.11 | | | | | | | | | | | | |
| B13 | 0.75 | 1.57 | 2.72 | 3.55 | 3.10 | 3.96 | -0.15 | 0.71 | 1.27 | 2.54 | 1.12 | 0.93 | | | | | | | | | | | | |
| B14 | 1.55 | 0.33 | 1.71 | 1.75 | 1.83 | 3.66 | -0.49 | -0.08 | 0.73 | 1.55 | 1.71 | 1.55 | | | | | | | | | | | | |
| B15 | -0.24 | -0.56 | 1.51 | 1.71 | 2.19 | 2.54 | -0.39 | -1.03 | 1.78 | 1.03 | 0.59 | 1.10 | | | | | | | | | | | | |
| B16 | 0.20 | -0.08 | 1.86 | 2.62 | 2.38 | 2.34 | 0.67 | -0.63 | 0.75 | 1.22 | -0.20 | 0.16 | | | | | | | | | | | | |
| B17 | 1.62 | 1.25 | 1.85 | 1.92 | 2.68 | 3.25 | 0.91 | 0.68 | 0.83 | 0.76 | 1.17 | 1.55 | | | | | | | | | | | | |
| B18 | -0.12 | 1.26 | 2.32 | 2.87 | 2.75 | 2.83 | 1.09 | 0.16 | 0.39 | 0.51 | 0.00 | 0.43 | | | | | | | | | | | | |
| B19 | -1.12 | 2.93 | 2.31 | 3.12 | 5.58 | 5.74 | -1.15 | 0.11 | 0.00 | -0.57 | 0.23 | 0.23 | | | | | | | | | | | | |
| B20 | 0.36 | 1.01 | 1.05 | 0.77 | 1.86 | 2.67 | -1.17 | -1.01 | -0.12 | 0.40 | -1.21 | -1.17 | | | | | | | | | | | | |
| Average | 0.18 | 0.95 | 1.73 | 2.02 | 2.32 | 2.78 | 0.00 | 0.17 | 0.68 | 0.67 | 0.49 | 0.65 | | | | | | | | | | | | |
| (SD) | (0.72) | (1.04) | (0.91) | (1.17) | (1.47) | (1.47) | (0.97) | (1.05) | (1.19) | (1.01) | (1.18) | (1.16) | | | | | | | | | | | | |

Table 15 The % whitening values in the upper arms of volunteers (group C) treated with 0.25 % Licorice extract and Propylene glycol for 12 weeks.

| Volunteer No. | % Whitening (0.25 % Licorice extract) | | | | | | % Whitening (Propylene glycol) | | | | | |
|---------------|---------------------------------------|--------|--------|--------|---------|---------|--------------------------------|--------|--------|--------|---------|---------|
| | week 2 | week 4 | week 6 | week 8 | week 10 | week 12 | week 2 | week 4 | week 6 | week 8 | week 10 | week 12 |
| C1 | 0.38 | 1.17 | 1.21 | 0.50 | 1.42 | 1.79 | -1.00 | 0.21 | -0.17 | -0.13 | -0.67 | -0.71 |
| C2 | 1.04 | 0.16 | 0.76 | 1.68 | 1.88 | 1.88 | 0.16 | 0.32 | -0.12 | -0.08 | -0.49 | -0.28 |
| C3 | 2.15 | 1.71 | 2.78 | 1.83 | 0.40 | 0.99 | 2.09 | 1.66 | 1.74 | 0.87 | -0.36 | -0.12 |
| C4 | 0.62 | 0.96 | 1.54 | 1.58 | 1.27 | 2.32 | -0.27 | -1.17 | 0.04 | 0.08 | 0.04 | 0.55 |
| C5 | 1.93 | 2.34 | 3.30 | 2.12 | 3.53 | 3.75 | 2.01 | 2.12 | 1.52 | 1.40 | 0.23 | 0.45 |
| C6 | -1.68 | 0.11 | -0.27 | 1.19 | 1.95 | 1.72 | -1.00 | -0.08 | -0.38 | 0.35 | -1.11 | -1.07 |
| C7 | 1.19 | 2.78 | 5.71 | 4.04 | 4.08 | 4.94 | 0.97 | 1.65 | 2.81 | 1.42 | 1.69 | 1.91 |
| C8 | 0.53 | 0.62 | 1.11 | 0.78 | 1.03 | 1.44 | -0.29 | -0.13 | 0.08 | 0.88 | -0.08 | -0.13 |
| C9 | 0.65 | 0.97 | 1.70 | 1.78 | 1.01 | 1.18 | -2.45 | 0.82 | -0.53 | -0.90 | -1.10 | -1.10 |
| C10 | -0.73 | -1.62 | 0.04 | -0.24 | 0.16 | 0.57 | -0.36 | -0.89 | 0.28 | -0.16 | -0.16 | -0.36 |
| C11 | -0.80 | -0.52 | 0.16 | -0.84 | -1.76 | -0.92 | 0.12 | -0.63 | 0.00 | -0.20 | -1.30 | -1.10 |
| C12 | 1.63 | 0.87 | 2.57 | 3.06 | 3.06 | 3.25 | -0.23 | 0.46 | 1.45 | 1.07 | 1.53 | 1.60 |
| C13 | -0.27 | 1.26 | 1.45 | 1.33 | 1.45 | 1.41 | 1.13 | 2.00 | 2.95 | 2.12 | 1.29 | 1.13 |
| C14 | 0.21 | 0.98 | 0.82 | 1.11 | 1.35 | 2.17 | 2.58 | 2.26 | 2.34 | 1.49 | 1.09 | 1.17 |
| C15 | 0.12 | 0.04 | 0.72 | 1.63 | 1.55 | 2.19 | 0.00 | 0.32 | 1.12 | 0.76 | 0.48 | 0.12 |
| C16 | -1.04 | -0.85 | -0.31 | -2.08 | -0.69 | -0.85 | -0.31 | -0.93 | -0.97 | -2.01 | -2.32 | -2.17 |
| C17 | 0.93 | 2.05 | 1.85 | 2.28 | 1.89 | 2.28 | 1.34 | 3.86 | 4.79 | 3.68 | 2.45 | 2.75 |
| C18 | 0.59 | 0.31 | -0.12 | 0.04 | 0.08 | -0.16 | 0.36 | 0.91 | 0.32 | 1.15 | -0.48 | 0.36 |
| C19 | 1.83 | 1.99 | 2.10 | 2.65 | 2.26 | 2.57 | 0.35 | 1.54 | 1.66 | 3.24 | 3.39 | 3.24 |
| C20 | 0.40 | 0.08 | 2.24 | 2.64 | 2.28 | 1.56 | -0.08 | -0.40 | 1.09 | 0.93 | -0.16 | -0.36 |
| Average | 0.48 | 0.77 | 1.47 | 1.35 | 1.41 | 1.70 | 0.26 | 0.70 | 1.00 | 0.80 | 0.20 | 0.29 |
| (SD) | (1.02) | (1.10) | (1.44) | (1.41) | (1.37) | (1.42) | (1.18) | (1.30) | (1.44) | (1.31) | (1.37) | (1.36) |

Table 16 The % whitening values in the upper arms of volunteers (group D) treated with 3.00 % Kojic acid and Propylene glycol for 12 weeks.

| Volunteer | % Whitening (3 % Kojic acid) | | | | | | | | | | | | % Whitening (Propylene glycol) | | | | | | | | | | | |
|-----------|------------------------------|--------|--------|--------|--------|---------|---------|--------|--------|--------|--------|---------|--------------------------------|--------|--------|--------|--------|---------|---------|--------|--------|--------|--------|--|
| | No. | week 2 | week 4 | week 6 | week 8 | week 10 | week 12 | week 2 | week 4 | week 6 | week 8 | week 10 | week 12 | week 2 | week 4 | week 6 | week 8 | week 10 | week 12 | | | | | |
| D1 | 0.71 | -0.08 | 0.87 | 0.33 | -0.12 | 0.08 | -0.29 | -0.92 | -0.83 | 0.33 | 0.29 | -0.79 | -0.92 | -0.83 | 0.33 | 0.29 | -0.79 | -0.92 | -0.83 | 0.33 | 0.29 | -0.79 | -0.46 | |
| D2 | -0.89 | 0.93 | 0.81 | -0.12 | 0.08 | 0.77 | 0.77 | -0.08 | 0.61 | 0.28 | -0.93 | -0.69 | -0.08 | 0.61 | 0.28 | -0.93 | -0.69 | -0.08 | 0.61 | 0.28 | -0.93 | -0.69 | -0.69 | |
| D3 | 0.08 | 0.51 | 1.54 | 1.73 | 2.01 | 2.72 | 2.72 | 0.31 | 1.06 | 2.00 | 1.92 | 1.73 | 0.31 | 1.06 | 2.00 | 1.92 | 1.73 | 0.31 | 1.06 | 2.00 | 1.92 | 1.73 | 2.16 | |
| D4 | 1.78 | 1.59 | 2.37 | 3.14 | 3.88 | 3.10 | 3.10 | -0.04 | 1.37 | 1.29 | 0.59 | 0.51 | -0.04 | 1.37 | 1.29 | 0.59 | 0.51 | -0.04 | 1.37 | 1.29 | 0.59 | 0.51 | 0.35 | |
| D5 | 0.35 | 1.39 | 2.73 | 2.00 | 2.00 | 2.70 | 2.70 | -0.27 | 0.39 | 0.51 | 0.86 | 0.51 | -0.27 | 0.39 | 0.51 | 0.86 | 0.51 | -0.27 | 0.39 | 0.51 | 0.86 | 0.51 | 0.70 | |
| D6 | 1.50 | 2.17 | 3.71 | 3.89 | 4.04 | 4.46 | 4.46 | -0.15 | 1.32 | 1.32 | 2.26 | -0.45 | -0.15 | 1.32 | 1.32 | 2.26 | -0.45 | -0.15 | 1.32 | 1.32 | 2.26 | -0.45 | -0.30 | |
| D7 | -0.16 | 0.12 | 1.23 | 0.37 | 1.60 | 1.76 | 1.76 | 1.53 | 1.61 | 1.81 | 0.64 | 1.20 | 1.53 | 1.61 | 1.81 | 0.64 | 1.20 | 1.53 | 1.61 | 1.81 | 0.64 | 1.20 | 1.73 | |
| D8 | -0.08 | -0.20 | 0.60 | 0.44 | -0.56 | 0.40 | 0.40 | -0.44 | -0.32 | 0.48 | 0.36 | 0.08 | -0.44 | -0.32 | 0.48 | 0.36 | 0.08 | -0.44 | -0.32 | 0.48 | 0.36 | 0.08 | -0.56 | |
| D9 | 2.70 | 2.13 | 2.28 | 2.74 | 3.35 | 3.65 | 3.65 | 1.21 | 1.09 | 0.31 | 0.23 | 0.16 | 1.21 | 1.09 | 0.31 | 0.23 | 0.16 | 1.21 | 1.09 | 0.31 | 0.23 | 0.16 | -0.12 | |
| D10 | 2.36 | 1.90 | 2.47 | 3.34 | 3.42 | 3.99 | 3.99 | 1.00 | 2.53 | 1.99 | 1.65 | 1.99 | 1.00 | 2.53 | 1.99 | 1.65 | 1.99 | 1.00 | 2.53 | 1.99 | 1.65 | 1.99 | 2.03 | |
| D11 | -0.49 | 1.54 | 1.54 | 1.77 | 2.67 | 2.67 | 2.67 | -0.08 | 0.23 | -0.11 | 0.76 | 0.19 | -0.08 | 0.23 | -0.11 | 0.76 | 0.19 | -0.08 | 0.23 | -0.11 | 0.76 | 0.19 | 1.28 | |
| D12 | 0.76 | 0.28 | 1.40 | 1.56 | 2.08 | 2.08 | 2.08 | -0.32 | -1.40 | -1.00 | -0.92 | -0.92 | -0.32 | -1.40 | -1.00 | -0.92 | -0.92 | -0.32 | -1.40 | -1.00 | -0.92 | -0.92 | -1.04 | |
| D13 | -1.84 | -0.33 | 0.52 | -0.66 | 1.47 | 2.28 | 2.28 | -1.51 | -1.36 | -1.36 | -0.45 | -0.87 | -1.51 | -1.36 | -1.36 | -0.45 | -0.87 | -1.51 | -1.36 | -1.36 | -0.45 | -0.87 | -0.76 | |
| D14 | 0.19 | 2.25 | 2.06 | 2.25 | 2.22 | 4.09 | 4.09 | 0.27 | 1.26 | 1.72 | 0.34 | 0.31 | 0.27 | 1.26 | 1.72 | 0.34 | 0.31 | 0.27 | 1.26 | 1.72 | 0.34 | 0.31 | 0.23 | |
| D16 | -0.92 | -0.68 | 0.56 | 0.60 | 0.72 | 1.48 | 1.48 | 0.28 | -0.91 | -0.75 | -0.32 | 0.04 | 0.28 | -0.91 | -0.75 | -0.32 | -0.24 | 0.04 | -0.91 | -0.75 | -0.32 | -0.24 | 0.04 | |
| D17 | -0.86 | -1.45 | 1.53 | 0.51 | 0.71 | 0.98 | 0.98 | -1.33 | -2.23 | -1.29 | -0.74 | -1.76 | -1.33 | -2.23 | -1.29 | -0.74 | -1.96 | -1.76 | -2.23 | -1.29 | -0.74 | -1.96 | -1.76 | |
| D18 | -0.52 | -0.60 | -0.44 | 0.00 | -0.04 | 0.40 | 0.40 | 0.28 | 1.71 | 0.40 | -0.12 | -0.04 | 0.28 | 1.71 | 0.40 | -0.12 | -0.36 | -0.04 | 1.71 | 0.40 | -0.12 | -0.36 | -0.04 | |
| D19 | -0.46 | 0.80 | 2.16 | 1.71 | 2.43 | 2.92 | 2.92 | 1.12 | 2.32 | 2.09 | 2.24 | 3.10 | 1.12 | 2.32 | 2.09 | 2.24 | 3.10 | 2.73 | 2.32 | 2.09 | 2.24 | 3.10 | 2.73 | |
| D20 | -0.16 | 0.56 | 1.08 | 1.44 | 1.83 | 2.23 | 2.23 | -0.52 | -0.16 | 0.76 | 0.88 | -0.08 | -0.52 | -0.16 | 0.76 | 0.88 | -0.08 | 0.16 | -0.16 | 0.76 | 0.88 | -0.08 | 0.16 | |
| Average | 0.21 | 0.68 | 1.53 | 1.42 | 1.76 | 2.23 | 2.23 | 0.02 | 0.44 | 0.57 | 0.50 | 0.18 | 0.02 | 0.44 | 0.57 | 0.50 | 0.18 | 0.30 | 0.44 | 0.57 | 0.50 | 0.18 | 0.30 | |
| (SD) | (1.18) | (1.09) | (0.97) | (1.28) | (1.40) | (1.35) | (1.35) | (0.81) | (1.34) | (1.12) | (0.99) | (1.18) | (0.81) | (1.34) | (1.12) | (0.99) | (1.18) | (1.19) | (1.34) | (1.12) | (0.99) | (1.18) | (1.19) | |

Appendix III

Individual % tyrosinase inhibitory activity of

0.25% Puag-Haad solution in various types of antioxidants were prepared in the same solvent (20% propylene glycol in water) and coded as follows:

- P = 0.25% Puag-Haad
- P+A1 = 0.25% Puag-Haad + 0.15% sodium metabisulfite
- P+A2 = 0.25% Puag-Haad + 0.10% butylated hydroxy anisole (BHA)
- P+A3 = 0.25% Puag-Haad + 0.05% EDTA
- P+A4 = 0.25% Puag-Haad + 0.15% sodium metabisulfite + 0.10% BHA
= P + A1 + A2
- P+A5 = 0.25% Puag-Haad + 0.15% sodium metabisulfite + 0.05% EDTA
= P + A1 + A3
- P+A6 = 0.25% Puag-Haad + 0.10% BHA + 0.05% EDTA
= P + A2 + A3
- P+A7 = 0.25% Puag-Haad + 0.15% sodium metabisulfite + 0.10% BHA + 0.05% EDTA
= P + A1 + A2 + A3

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Table 1 Stability of Puag-Haad with and without antioxidants as determined from % tyrosinase inhibitory activity at room temperature (ambient 27 °C)

| Week 0 | | | | | | | | |
|---------|--------|--------|--------|--------|--------|--------|--------|--------|
| Test | P | P+A1 | P+A2 | P+A3 | P+A4 | P+A5 | P+A6 | P+A7 |
| 1 | 75.10 | 73.88 | 67.70 | 69.81 | 71.57 | 72.39 | 63.43 | 82.09 |
| 2 | 71.46 | 71.76 | 66.97 | 66.45 | 69.03 | 73.13 | 63.43 | 79.85 |
| 3 | 72.23 | 74.10 | 64.82 | 70.91 | 70.15 | 74.63 | 69.40 | 84.70 |
| Mean | 72.93 | 73.24 | 66.50 | 69.05 | 70.25 | 73.38 | 65.42 | 82.21 |
| (SD) | (1.92) | (1.29) | (1.50) | (2.32) | (1.27) | (1.14) | (3.45) | (2.43) |
| Week 4 | | | | | | | | |
| Test | P | P+A1 | P+A2 | P+A3 | P+A4 | P+A5 | P+A6 | P+A7 |
| 1 | 60.07 | 68.60 | 62.47 | 65.60 | 66.71 | 77.45 | 63.01 | 84.47 |
| 2 | 63.03 | 69.33 | 68.58 | 61.30 | 68.62 | 72.26 | 65.90 | 78.56 |
| 3 | 58.23 | 74.14 | 60.36 | 64.97 | 69.84 | 77.30 | 64.43 | 83.73 |
| Mean | 60.44 | 70.69 | 63.80 | 63.96 | 68.39 | 75.67 | 64.45 | 82.26 |
| (SD) | (2.42) | (3.01) | (4.27) | (2.32) | (1.58) | (2.96) | (1.45) | (3.22) |
| Week 8 | | | | | | | | |
| Test | P | P+A1 | P+A2 | P+A3 | P+A4 | P+A5 | P+A6 | P+A7 |
| 1 | 49.47 | 66.62 | 63.74 | 65.91 | 69.11 | 64.41 | 54.96 | 75.84 |
| 2 | 53.74 | 69.04 | 61.30 | 57.60 | 67.33 | 60.14 | 56.52 | 75.84 |
| 3 | 53.02 | 67.74 | 58.60 | 61.60 | 66.62 | 66.90 | 56.80 | 78.11 |
| Mean | 52.08 | 67.80 | 61.21 | 61.70 | 67.69 | 63.82 | 56.09 | 76.59 |
| (SD) | (2.29) | (1.21) | (2.57) | (4.15) | (1.28) | (3.42) | (0.99) | (1.31) |
| Week 12 | | | | | | | | |
| Test | P | P+A1 | P+A2 | P+A3 | P+A4 | P+A5 | P+A6 | P+A7 |
| 1 | 51.98 | 62.82 | 54.20 | 58.43 | 66.44 | 63.34 | 53.17 | 73.86 |
| 2 | 45.44 | 64.20 | 57.59 | 56.61 | 65.58 | 59.38 | 56.27 | 74.53 |
| 3 | 45.44 | 65.92 | 55.86 | 54.05 | 66.78 | 59.21 | 52.48 | 68.28 |
| Mean | 47.62 | 64.31 | 55.88 | 56.36 | 66.27 | 60.64 | 53.97 | 72.22 |
| (SD) | (3.78) | (1.55) | (1.69) | (2.20) | (0.62) | (2.34) | (2.02) | (3.43) |

Table 1 Stability of Puag-Haad with and without antioxidants as determined from % tyrosinase inhibitory activity at room temperature (ambient 27 °C)

Week 16

| Test | P | P+A1 | P+A2 | P+A3 | P+A4 | P+A5 | P+A6 | P+A7 |
|------|--------|--------|--------|--------|--------|--------|--------|--------|
| 1 | 51.25 | 58.27 | 54.26 | 59.49 | 64.71 | 62.55 | 54.29 | 66.55 |
| 2 | 49.25 | 56.21 | 58.54 | 54.99 | 63.51 | 60.13 | 57.03 | 67.26 |
| Mean | 50.25 | 57.24 | 56.40 | 57.24 | 64.11 | 61.34 | 55.66 | 66.90 |
| (SD) | (1.41) | (1.45) | (3.03) | (3.18) | (0.85) | (1.71) | (1.93) | (0.50) |

Week 24

| Test | P | P+A1 | P+A2 | P+A3 | P+A4 | P+A5 | P+A6 | P+A7 |
|------|--------|--------|--------|--------|--------|--------|--------|--------|
| 1 | 38.19 | 45.83 | 46.68 | 41.62 | 57.06 | 52.20 | 50.17 | 56.33 |
| 2 | 35.23 | 46.27 | 44.37 | 39.03 | 56.44 | 50.15 | 48.86 | 57.36 |
| Mean | 36.71 | 46.05 | 45.53 | 40.33 | 56.75 | 51.18 | 49.52 | 56.85 |
| (SD) | (2.09) | (0.31) | (1.63) | (1.83) | (0.44) | (1.45) | (0.93) | (0.73) |

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Table 2 Stability of Puag-Haad with and without antioxidants as determined from % tyrosinase inhibitory activity at 45 °C

| Week 0 | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Test | P | P+A1 | P+A2 | P+A3 | P+A4 | P+A5 | P+A6 | P+A7 |
| 1 | 75.10 | 73.88 | 67.70 | 69.81 | 71.57 | 72.39 | 63.43 | 82.09 |
| 2 | 71.46 | 71.76 | 66.97 | 66.45 | 69.03 | 73.13 | 63.43 | 79.85 |
| 3 | 72.23 | 74.10 | 64.82 | 70.91 | 70.15 | 74.63 | 69.40 | 84.70 |
| Mean | 72.93 | 73.24 | 66.50 | 69.05 | 70.25 | 73.38 | 65.42 | 82.21 |
| (SD) | (1.92) | (1.29) | (1.50) | (2.32) | (1.27) | (1.14) | (3.45) | (2.43) |

| Week 2 | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Test | P | P+A1 | P+A2 | P+A3 | P+A4 | P+A5 | P+A6 | P+A7 |
| 1 | 63.26 | 62.89 | 59.67 | 64.26 | 67.54 | 70.95 | 65.91 | 81.00 |
| 2 | 62.86 | 58.76 | 59.76 | 63.57 | 67.57 | 68.98 | 61.25 | 79.25 |
| 3 | 64.30 | 60.48 | 62.08 | 60.48 | 69.26 | 72.63 | 58.32 | 83.60 |
| Mean | 63.47 | 60.71 | 60.50 | 62.77 | 68.13 | 70.85 | 61.83 | 81.29 |
| (SD) | (0.74) | (2.07) | (1.36) | (2.01) | (0.98) | (1.83) | (3.83) | (2.19) |

| Week 4 | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Test | P | P+A1 | P+A2 | P+A3 | P+A4 | P+A5 | P+A6 | P+A7 |
| 1 | 53.70 | 58.78 | 58.35 | 66.67 | 71.95 | 75.58 | 62.71 | 81.95 |
| 2 | 51.39 | 56.67 | 60.96 | 61.39 | 64.69 | 64.69 | 55.45 | 78.98 |
| 3 | 56.01 | 59.65 | 62.05 | 66.01 | 68.65 | 64.69 | 67.00 | 79.31 |
| Mean | 53.70 | 58.36 | 60.45 | 64.69 | 68.43 | 68.32 | 61.72 | 80.08 |
| (SD) | (2.31) | (1.53) | (1.90) | (2.88) | (3.64) | (6.29) | (5.84) | (1.63) |

| Week 6 | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Test | P | P+A1 | P+A2 | P+A3 | P+A4 | P+A5 | P+A6 | P+A7 |
| 1 | 50.44 | 55.19 | 56.07 | 65.56 | 63.70 | 68.22 | 61.15 | 67.74 |
| 2 | 53.33 | 59.07 | 60.30 | 64.44 | 64.26 | 68.52 | 63.56 | 73.89 |
| 3 | 54.21 | 58.52 | 57.44 | 60.00 | 64.96 | 70.89 | 62.89 | 74.44 |
| Mean | 52.66 | 57.59 | 57.94 | 63.33 | 64.31 | 69.21 | 62.53 | 72.02 |
| (SD) | (1.97) | (2.10) | (2.15) | (2.94) | (0.63) | (1.46) | (1.24) | (3.72) |

Table 2 Stability of Puag-Haad with and without antioxidants as determined from % tyrosinase inhibitory activity at 45 °C

Week 8

| Test | P | P+A1 | P+A2 | P+A3 | P+A4 | P+A5 | P+A6 | P+A7 |
|------|--------|--------|--------|--------|--------|--------|--------|--------|
| 1 | 51.62 | 44.78 | 50.24 | 56.98 | 57.95 | 55.06 | 61.23 | 60.56 |
| 2 | 53.55 | 48.64 | 52.17 | 55.70 | 59.87 | 61.16 | 57.44 | 59.92 |
| 3 | 52.91 | 48.64 | 47.67 | 56.98 | 58.27 | 55.06 | 59.65 | 60.56 |
| Mean | 52.69 | 47.35 | 50.03 | 56.55 | 58.69 | 57.09 | 59.44 | 60.35 |
| (SD) | (0.98) | (2.22) | (2.25) | (0.74) | (1.03) | (3.52) | (1.90) | (0.37) |

Week 10

| Test | P | P+A1 | P+A2 | P+A3 | P+A4 | P+A5 | P+A6 | P+A7 |
|------|--------|--------|--------|--------|--------|--------|--------|--------|
| 1 | 55.17 | 48.38 | 42.91 | 53.45 | 55.36 | 54.98 | 49.27 | 52.45 |
| 2 | 57.09 | 47.79 | 45.40 | 49.23 | 52.87 | 52.11 | 46.97 | 56.30 |
| 3 | 55.75 | 49.34 | 47.32 | 52.87 | 55.56 | 53.07 | 50.87 | 57.47 |
| Mean | 56.00 | 48.50 | 45.21 | 51.85 | 54.60 | 53.38 | 49.04 | 55.41 |
| (SD) | (0.98) | (0.78) | (2.21) | (2.29) | (1.50) | (1.46) | (1.96) | (2.63) |

Week 12

| Test | P | P+A1 | P+A2 | P+A3 | P+A4 | P+A5 | P+A6 | P+A7 |
|------|--------|--------|--------|--------|--------|--------|--------|--------|
| 1 | 44.74 | 46.76 | 45.19 | 47.35 | 56.82 | 48.99 | 43.20 | 50.14 |
| 2 | 43.18 | 51.45 | 45.41 | 43.80 | 56.38 | 48.77 | 43.20 | 51.91 |
| 3 | 40.94 | 46.53 | 45.41 | 46.59 | 55.70 | 51.01 | 43.57 | 51.15 |
| Mean | 42.95 | 48.25 | 45.34 | 45.91 | 56.30 | 49.59 | 43.33 | 51.07 |
| (SD) | (1.91) | (2.78) | (0.13) | (1.87) | (0.56) | (1.23) | (0.21) | (0.89) |

Week 16

| Test | P | P+A1 | P+A2 | P+A3 | P+A4 | P+A5 | P+A6 | P+A7 |
|------|--------|--------|--------|--------|--------|--------|--------|--------|
| 1 | 44.90 | 50.32 | 52.14 | 47.27 | 53.15 | 48.55 | 47.03 | 52.07 |
| 2 | 45.87 | 51.01 | 44.58 | 50.85 | 55.70 | 52.09 | 44.26 | 49.20 |
| Mean | 45.39 | 50.67 | 48.36 | 49.06 | 54.42 | 50.32 | 45.64 | 50.63 |
| (SD) | (0.69) | (0.49) | (5.35) | (2.53) | (1.81) | (2.50) | (1.96) | (2.03) |

Table 2 Stability of Puag-Haad with and without antioxidants as determined from % tyrosinase inhibitory activity at 45 °C

Week 24

| Test | P | P+A1 | P+A2 | P+A3 | P+A4 | P+A5 | P+A6 | P+A7 |
|------|--------|--------|--------|--------|--------|--------|--------|--------|
| 1 | 28.31 | 38.24 | 35.33 | 35.61 | 42.56 | 40.85 | 36.38 | 40.29 |
| 2 | 28.00 | 36.55 | 37.75 | 36.01 | 40.83 | 42.19 | 34.92 | 43.48 |
| Mean | 28.16 | 37.40 | 36.54 | 35.81 | 41.70 | 41.52 | 35.65 | 41.89 |
| (SD) | (0.22) | (1.20) | (1.71) | (0.28) | (1.22) | (0.95) | (1.03) | (2.26) |



ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

VITA

Miss Koomkhwan Pengrungrangwong was born on 26th April 1976, in Nakornpathom, Thailand. She got Bachelor of Science in Pharmacy (2nd class Honor) in 1998 from Faculty of Pharmaceutical Science, Naresuan University, Thailand. She has been working as a pharmacist in pharmacy department, Makarak Hospital since 1999.



ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย