

# A COMPARATIVE STUDY OF THE EFFICACY OF 4% WHITE RADISH ROOT EXTRACT CREAM VERSUS 2% ALPHA ARBUTIN CREAM IN FACIAL WHITENING

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## ABSTRACT

This study aims to evaluate the effectiveness of radish root extract in facial whitening and to compare its results with the well-established whitening agent, 2% alpha-arbutin. The primary objective is to examine how a 4% radish root extract cream performs in terms of facial skin whitening, in comparison to a 2% alpha-arbutin cream, which is widely used in the treatment of hyperpigmentation. The study followed a parallel group design, with the two different creams being applied and observed simultaneously. During the 12-week period, the effectiveness of the creams was assessed using advanced skin analysis technologies, including the Mexameter® MX18 and VISIA® systems, to measure any changes in pigmentation and skin tone. A total of 24 volunteers, consisting of both male and female participants aged between 20 and 50 years, with Fitzpatrick skin types II to V, were included in the study. The participants were instructed to apply either a cream containing 4% radish root extract or a cream containing 2% alpha-arbutin to their faces twice daily for a period of 12 weeks. The results demonstrated that the 4% radish root extract cream significantly reduced pigmentation, with no reported side effects, indicating its safety and effectiveness. Radish root extract, known for inhibiting the tyrosinase enzyme and its antioxidant properties, presents a promising natural alternative to traditional whitening agents like alpha-arbutin. Additionally, its low cost and ease of cultivation in Thailand support its potential as a viable, affordable option for skin whitening.

**Keywords:** Radish Root Extract, Alpha Arbutin, Facial Whitening

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## INTRODUCTION

In today's society, cosmetics have become a means for women to express their modern sense of identity and independence. Cosmetics are no longer just tools for beauty enhancement but also a way to show respect and impress others. In particular, fair skin has become a popular beauty standard across Asia, leading to a rise in the demand for skin-lightening products. Beauty routines today often reflect personal values and cultural standards, with fair skin emerging as a prominent ideal across much of Asia. This preference has led to a growing demand for skin-lightening products, making whitening care an essential part of many women's daily beauty regimens.

The science behind skin lightening is complex, influenced by factors such as genetics, sun exposure, diet, lifestyle, and stress. (Park & Yaar, n.d.) Skin tone itself acts as a protective barrier, which is resistant to change. (Ortonne, 2012) A key player in the pigmentation process is tyrosinase, a copper-containing enzyme involved in melanin production within melanosomes. Because of its central role in hyperpigmentation, tyrosinase has become a prime target in the cosmetic industry, with inhibitors like alpha-arbutin widely used to reduce skin discoloration. (Saeedi et al., 2021)

Melanin, the pigment responsible for skin color, is produced by specialized cells called melanocytes. Overproduction can lead to pigmentation disorders such as age spots, melasma, and solar keratosis. To address these issues, both synthetic and plant-based whitening agents are employed. Many of these target tyrosinase activity, while others—such as niacinamide and soy—interfere with the transfer of melanosomes from melanocytes to keratinocytes. Retinoic acid also contributes by promoting skin turnover and reducing melanin concentration through desquamation. (Leyden & Wallo, n.d.)

Among natural remedies, white radish (*Raphanus sativus* L.) holds a notable place in East Asian traditions, valued both as a food and for its medicinal properties. Traditionally used to treat ailments like rheumatic pain, burns, and bruises, radish is also utilized in Thailand, where fresh slices are applied to the skin to treat melasma. Recent research highlights its potential in skincare, revealing that radish extract exhibits both anti-tyrosinase and antioxidant effects, positioning it as a promising natural ingredient for skin-whitening formulations. (Hanlon & Barnes, 2011)

With growing awareness of the risks associated with synthetic chemicals, the cosmetic industry is shifting towards more natural, plant-based alternatives for skin lightening. The global trend toward herbal remedies has led to an increased interest in ingredients like radish extract. Recent studies have shown that white radish extract cream can effectively lighten skin with fewer side effects compared to synthetic alternatives, supporting its potential as a safe and natural whitening solution. The researcher aims to compare the effectiveness of alpha arbutin and white radish root extract in skin whitening, with the goal of exploring alternative skin whitening agents.

## LITERATURE REVIEWS

Human skin color is determined by various chromophores, including melanin, which is the primary determinant of skin pigmentation. Melanin is produced by melanocytes, which are located in the basal layer of the epidermis. Melanocytes synthesize melanin within melanosomes, which are then transported to keratinocytes, contributing to skin color and UV protection. (D'Mello et al., 2016) Melanogenesis, the process of melanin production, is regulated by enzymes such as tyrosinase, which is crucial for the synthesis of melanin. There are two types of melanin: eumelanin (brownish-black) and pheomelanin (reddish-yellow), with variations in the synthesis of these pigments contributing to skin color. (Park & Yaar, n.d.)

Melanosomes are transported along microtubules to keratinocytes, where they provide UV protection (Kondo & Hearing, 2011). The tanning response occurs when skin exposure to UV

light increases melanin production as a protective mechanism. Tanning can be immediate (within 5-10 minutes) or delayed (3-4 days), with UVB exposure playing a role in both types of tanning. Ultraviolet (UV) radiation influences melanogenesis by stimulating melanocytes to produce more melanin, although it does not increase the number of melanocytes themselves. UV exposure also leads to changes in cytokine levels, growth factors, and hormones, further enhancing melanin production. (Kameyama et al., n.d.)

Tyrosinase inhibitors have been commonly used in skin whitening agents for years. These inhibitors target the enzyme tyrosinase, which plays a key role in melanin synthesis. (Kanlayavattanakul & Lourith, 2018) Hydroquinone, one of the most effective tyrosinase inhibitors, has been used to treat hyperpigmentation but carries risks such as permanent damage to melanocytes. Other natural tyrosinase inhibitors such as aloesin (from aloe vera), arbutin (from bearberries), and kojic acid (from fungi) work by reducing melanin production, helping to lighten the skin. Additionally, ingredients like Niacinamide and soy extract contribute to depigmentation by inhibiting melanosome transfer. Antioxidants, including **vitamins C and E** as well as **selenium**, are also commonly incorporated into skincare formulations. These compounds help protect the skin from UV-induced oxidative stress, which can trigger hyperpigmentation. Furthermore, exfoliating agents such as **alpha hydroxy acids (AHA)** and **beta hydroxy acids (BHA)** enhance skin renewal by accelerating epidermal turnover, aiding in the removal of excess melanin from the surface layers of the skin. (Parvez et al., 2006)

Among tyrosinase inhibitors, alpha arbutin is one of the most widely used chemical compounds in commercial skin-lightening agents. Alpha-arbutin is typically produced through a synthetic process involving the enzymatic or chemical hydrolysis of natural arbutin, which is extracted from plants like bearberry, cranberry, or mulberry. The hydrolysis breaks down the glycoside bond in arbutin, resulting in the formation of alpha-arbutin, which is then isolated and purified for use in cosmetic formulations. Alpha-arbutin works by inhibiting the enzyme tyrosinase without causing melanotoxicity, making it a safer alternative to traditional depigmenting agents like hydroquinone and kojic acid. (Zhao et al., 2025) Alpha-arbutin is considered safe for use in face creams at concentrations of up to 2% and in body lotions at concentrations up to 0.5%. This has been confirmed by the Scientific Committee on Consumer Safety (SCCS) 2023, even when used in combination. Alpha Arbutin is generally considered safe for use in skincare; however, some cases of contact dermatitis have been reported in certain individuals, as observed in a study. (Matsuo et al., 2015)

Nowadays, herbal remedies for skin lightening are becoming more popular because they have fewer side effects and are safe for long-term use. *R. sativus* root extract is known to be effective as a natural skin lightening and anti-aging agent due to its ability to inhibit tyrosinase activity and neutralize harmful reactive oxygen species. Studies show that its ability to inhibit tyrosinase is comparable to other well-known agents like L-ascorbic acid and licorice extract. One study found that *R. sativus* in 50% propylene glycol had a high tyrosinase inhibition of 88.50% among the most effective of the 16 plant extracts tested. White radish root has both antioxidant and anti-tyrosinase properties, making it a promising natural option for skin lightening. While research shows it inhibits tyrosinase and scavenges reactive oxygen species, some allergic reactions have been reported. Therefore, more studies are needed to fully understand its safety and effectiveness. (Arporn Koosuwan, 2013)

A study from Japan found that radish extract inhibited nitric oxide generation by over 70% at a concentration of 200 mcg/ml, without significant cell toxicity. A 2018 Korean study showed that 3% radish extract improved skin elasticity and reduced wrinkles. In a 2013 Thai study, a 4% white radish root extract cream was found to reduce melanin formation with minimal adverse effects. (Arporn Koosuwan, 2013) Based on these studies, the safety and effectiveness of white radish root extract are evident. This study aims to compare the effectiveness of 4% white radish root extract cream with 2% alpha arbutin cream, a conventional skin-lightening

agent. White radish extract is a natural, cost-effective alternative, and this research could provide a safer option compared to alpha-arbutin for skin lightening in the future.

## RESEARCH METHODOLOGY

This study is a randomized, single-blinded, comparative clinical experimental investigation designed to assess the efficacy of 4% white radish extract cream versus 2% alpha arbutin cream for facial skin whitening. The study population comprises volunteers of both genders, aged 20-50 years, with Fitzpatrick skin types II-V, who willingly participate in facial skin whitening. The study is conducted at Mae Fah Luang University Hospital, Bangkok.

The research process includes a thorough patient selection procedure, wherein participants are informed of the study's objectives, potential benefits, and risks, and provide written consent. A complete medical history is documented for each participant. A patch test is conducted on the participants' arms by applying both the 4% white radish extract cream and 2% alpha arbutin cream for 24 hours, with subsequent observations at 48 and 96 hours post-application. Participants exhibiting severe reactions (i.e., ++ or higher) are excluded from the study. The baseline skin condition is assessed utilizing the VISIA® Complexion Analysis System and Mexameter® device, which measures the melanin index at specific facial areas, both at baseline and at 4-week intervals (4th, 8th, and 12th weeks). Preparation Steps for 4% white radish root extract cream

Step A:

Combine Aqua (68.8%), Butylene Glycol (2%), Polysorbate 20 (0.8%), and PEG-40 Hydrogenated Castor Oil (0.5%). Heat this mixture to a temperature of 75-80°C.

Step B:

Combine Stearyl Alcohol (2%), Cyclopentasiloxane (2%), Dimethicone (2%), Squalane (1.5%), Cetyl Alcohol (1.5%), PEG-100 and Glyceryl Stearate (1.5%), Liquid Paraffin (1%), and Sorbitan Monooleate (0.3%). Heat this mixture to a temperature of 75-80°C.

Step C:

Gradually mix the heated mixture from Step B into the mixture from Step A.

Homogenize (blend thoroughly) the combined mixture until it cools down to 45°C.

Once at 45°C, add Raphanus Sativus Root Extract (4%), Glyceryl Glucoside (1%), Glydant Liquid (1%), and Tetrasodium EDTA (0.1%).

These steps ensure that the cream has the right texture and that all ingredients are evenly distributed in the process of 4% white radish root extract cream. The cream is a colorless, odorless, and thin consistency. Participants are instructed to cleanse their faces twice daily and apply the designated cream twice daily, with the additional recommendation to use sunscreen when exposed to sunlight. Follow-up visits are required every 4 weeks for the evaluation of skin whitening effects and monitoring of potential side effects.

Outcome measurements include the melanin index, assessed using the Mexameter® MX 18 at 4, 8, and 12 weeks. Side effects are monitored through a questionnaire evaluating pruritus, erythema duration, and possible allergic reactions. Efficacy is determined using the Global Aesthetic Improvement Scale, with improvement assessed via photographic documentation using the VISIA® system at each follow-up point. Dermatologists also assess overall satisfaction, and participants provide feedback on their experiences. Data analysis will include the assessment of participant eligibility and confidentiality of personal information. Descriptive statistical methods will be applied to summarize demographic data, side effects, and satisfaction scores. The baseline and follow-up melanin index scores will be compared using repeated measures ANOVA. Patient satisfaction scores will be compared at the 12-week follow-up using the Chi-square test. A significance level of  $p < 0.05$  will be used for all statistical tests. Data will be analyzed using SPSS 18 software and Microsoft Excel 2010.

## RESEARCH RESULTS

**Table 1** Demographic data

Demographic data	4% White Radish Root (n=12)	2% Alpha Arbutin (n=12)	P-value
Gender, n (%)			
Male	4 (33.3)	6 (50.0)	0.408 <sup>c</sup>
Female	8 (66.7)	6 (50.0)	
Age (years), mean±SD	31.92±5.95	32.67±6.98	0.780 <sup>a</sup>
Occupation, n (%)			
Student	7 (58.3)	8 (66.7)	0.714 <sup>d</sup>
Employee	4 (33.3)	2 (16.7)	
Housewife	1 (8.3)	2 (16.7)	
Underlying disease, n (%)	0 (0.0)	0 (0.0)	-
Fitzpatrick skin type			
II	1 (8.3)	2 (16.7)	1.000 <sup>d</sup>
III	8 (66.7)	7 (58.3)	
IV	3 (25.0)	3 (25.0)	
Exposure to sunlight (minute/day), median (IQR)	15 (10, 30)	20 (10, 30)	0.627 <sup>b</sup>
Cosmetics treatment 4 weeks before study, n (%)	0 (0.0)	0 (0.0)	-
Food or drug allergy, n (%)	1 (8.3)	1 (8.3)	1.000 <sup>d</sup>
Cosmetics allergy, n (%)	0 (0.0)	0 (0.0)	-
Personal medication & supplement, n (%)	3 (25.0)	3 (25.0)	1.000 <sup>d</sup>

Data were analyzed with Independent t-test<sup>a</sup>, Mann-Whitney U test<sup>b</sup>, Chi-square test<sup>c</sup>, Fisher's exact test<sup>d</sup>

\* Statistically significant at the 0.05 level

According to Table 1, the demographic data of participants shows that, among those who applied the 4% White Radish Root cream, 8 were female and 4 were male, with a mean age of 31.92±5.95 years. Most participants were students (n=7), employees (n=4), and housewives (n=1). None of the participants had any underlying disease. The Fitzpatrick skin types of the participants were Type III (n=8), Type IV (n=3), and Type II (n=1). The median of sunlight exposure was 15 (IQR 10, 30) minutes/day. None of the participants had received cosmetic treatments in the 4 weeks prior to the study. One participant had a history of drug and food allergies, but no participant had a history of cosmetic allergies. Three participants were using personal medications and supplements.

Among the participants who applied the 2% Alpha Arbutin cream, 6 were female and 6 were male, with a mean age of 32.67±6.98 years. Most participants were students (n=8), employees (n=2), and housewives (n=2). None had chronic illnesses. The Fitzpatrick skin types of the participants were mostly Type III (n=7), Type IV (n=3), and Type II (n=2). The median exposure to sunlight was 20 (IQR 10, 30) minutes per day. None had received cosmetic treatments in the 4 weeks prior to the study. One participant had a history of drug and food allergies, but no participant had a history of cosmetic allergies. Three participants were using personal medications and supplements. When comparing the demographic data between the groups that received the 4% White Radish Root cream and the 2% Alpha Arbutin cream, no statistically significant differences were found between the two groups (P>0.05).

### Mean Melanin index

**Table 2** Comparison of mean melanin index for 4% White Radish Root cream and 2% Alpha Arbutin cream across follow-up times

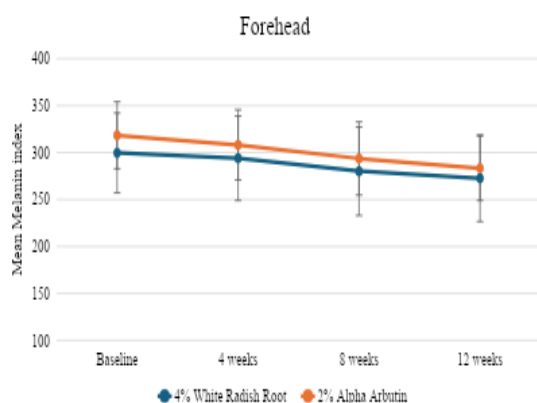
Follow-up times	4% White Radish Root, mean±SD	2% Alpha Arbutin, mean±SD	Mean difference (95%CI)	P-value <sup>a</sup>
<b>Forehead</b>				
Baseline	299.58±42.55	318.42±35.68	-18.83 (-52.08, 14.41)	0.253
4 weeks	293.92±44.94	308.17±37.37	-14.25 (-49.24, 20.74)	0.407
8 weeks	280.08±47.11	293.67±38.97	-13.58 (-50.18, 23.02)	0.450
12 weeks	272.67±46.16	283.33±34.32	-10.67 (-45.10, 23.77)	0.527
Partial 2	0.841	0.902		
P-value <sup>b</sup>	<0.001*	<0.001*		
<b>Cheek</b>				
Baseline	261.5±48.46	280.17±35.95	-18.67 (-54.79, 17.46)	0.296
4 weeks	250.92±49.34	264.50±35.0	-13.58 (-49.80, 22.63)	0.445
8 weeks	238.92±51.88	251.83±37.49	-12.92 (-51.24, 25.40)	0.492
12 weeks	233.42±49.92	245.08±36.33	-11.67 (-48.63, 25.29)	0.520
Partial 2	0.886	0.903		
P-value <sup>b</sup>	<0.001*	<0.001*		

Data were analyzed with independent t-test<sup>a</sup>, Repeated measure ANOVA<sup>b</sup>

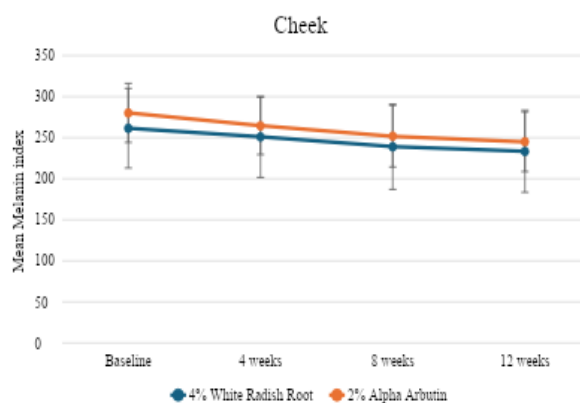
\* Statistically significant at the 0.05 level

According to Table 2, the comparison of the mean melanin index in the forehead and cheek areas reveals that the group using the 4% White Radish Root cream showed mean melanin index values for the forehead at baseline, 4, 8, and 12 weeks of 299.58±42.55, 293.92±44.94, 280.08±47.11, and 272.67±46.16, respectively. These values showed a statistically significant decrease at the 0.05 level ( $P < 0.001$ ), with a partial  $\eta^2$  of 0.841. This indicates that the 4% White Radish Root cream was effective in changing the mean melanin index in the forehead area to 84.1%. On the other hand, the 2% Alpha Arbutin group had average melanin index values for the forehead at baseline, 4, 8, and 12 weeks of 318.42±35.68, 308.17±37.37, 293.67±38.97, and 283.33±34.32, respectively. These values also showed a statistically significant decrease at the 0.05 level ( $P < 0.001$ ), with a partial  $\eta^2$  of 0.902. This indicates that the 2% Alpha Arbutin cream was effective in changing the mean melanin index in the forehead area to 90.2%. However, when comparing the mean melanin index in the forehead area between the two groups at each follow-up time point, no statistically significant differences were found ( $P > 0.05$ ).

For the cheek area, the 4% White Radish Root cream group showed average melanin index values at baseline, 4, 8, and 12 weeks of 261.5±48.46, 250.92±49.34, 238.92±51.88, and 233.42±49.92, respectively. These values showed a statistically significant decrease at the 0.05 level ( $P < 0.001$ ), with a partial  $\eta^2$  of 0.886, indicating that the 4% White Radish Root cream was effective in changing the mean melanin index in the cheek area to 88.6%. Meanwhile, the 2% Alpha Arbutin cream group showed mean melanin index values at baseline, 4, 8, and 12 weeks of 280.17±35.95, 264.50±35.0, 251.83±37.49, and 245.08±36.33, respectively. These values also demonstrated a statistically significant decrease at the 0.05 level ( $P < 0.001$ ), with a partial  $\eta^2$  of 0.903, meaning the 2% Alpha Arbutin cream was effective in changing the mean melanin index in the cheek area to 90.3%. However, when comparing the mean melanin index in the cheek area between the two groups at each follow-up time point, no statistically significant differences were found ( $P > 0.05$ ).



**Figure 1** Line graph showing mean melanin index on the forehead for 4% White Radish Root cream and 2% Alpha Arbutin cream at baseline, 4, 8, and 12 weeks



**Figure 2** Line graph showing mean melanin index on the cheek for 4% White Radish Root cream and 2% Alpha Arbutin cream at baseline, 4, 8, and 12 weeks

**Table 3** Multiple comparison analysis (Post-hoc test) of Mean melanin index

Pairwise	4% White Radish Root, mean difference (P-value)	2% Alpha Arbutin, mean difference (P-value)
<b>Forehead</b>		
Baseline - 4 weeks	-5.67 (P=0.091)	-10.25 (P<0.001*)
Baseline - 8 weeks	-19.50 (P<0.001*)	-24.75 (P<0.001*)
Baseline - 12 weeks	-26.92 (P<0.001*)	-35.08 (P<0.001*)
4 weeks - 8 weeks	-13.83 (P<0.001*)	-14.50 (P<0.001*)
4 weeks - 12 weeks	-21.25 (P<0.001*)	-24.83 (P<0.001*)
8 weeks - 12 weeks	-7.42 (P=0.073)	-10.33 (P=0.020*)
<b>Cheek</b>		
Baseline - 4 weeks	-10.58 (P<0.001*)	-15.67 (P<0.001*)
Baseline - 8 weeks	-22.58 (P<0.001*)	-28.33 (P<0.001*)
Baseline - 12 weeks	-28.08 (P<0.001*)	-35.08 (P<0.001*)
4 weeks - 8 weeks	-12.00 (P=0.001*)	-12.67 (P<0.001*)
4 weeks - 12 weeks	-17.50 (P<0.001*)	-19.42 (P<0.001*)
8 weeks - 12 weeks	-5.50 (P=0.164)	-6.75 (P=0.078)

Adjustment for multiple comparisons by Bonferroni method\* the mean difference is significant at the 0.05 level

According to Table 3, the multiple comparison analysis of the mean melanin index indicates that in the 4% White Radish Root cream group, the mean melanin index on the forehead at weeks 8 and 12 was lower than at baseline by 19.50 and 26.92, respectively. Additionally, the values at weeks 8 and 12 were lower than week 4 by 13.83 and 21.25, respectively, all comparisons showed statistical significance at the 0.05 level ( $P<0.05$ ). In the 2% Alpha Arbutin cream group, the mean melanin index on the forehead at weeks 4, 8, and 12 was lower than at baseline by 10.25, 24.75, and 35.08, respectively. The values at weeks 8 and 12 were lower than week 4 by 14.50 and 24.83, respectively, and the value at week 12 was lower than week 8 by 10.33. All changes were statistical significance at the 0.05 level ( $P<0.05$ ). For the cheek area, in the 4% White Radish Root cream group, the mean melanin index at weeks 4, 8, and 12 was lower than baseline by 10.58, 22.58, and 28.08, respectively. The values at weeks 8 and 12 were lower than week 4 by 12.00 and 17.50, respectively, all with statistical significance at the 0.05 level ( $P<0.05$ ). In the 2% Alpha Arbutin cream group, the mean melanin index at weeks 4, 8, and 12 was lower than baseline by 15.67, 28.33, and 35.08, respectively. The values

at weeks 8 and 12 were lower than week 4 by 12.67 and 19.42, respectively, all with statistical significance at the 0.05 level ( $P < 0.05$ ).

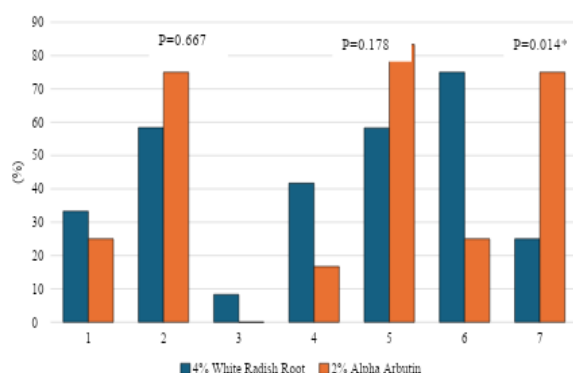
#### Dermatologists' evaluation score

**Table 4** Dermatologists' evaluation scores for 4% White Radish Root cream and 2% Alpha Arbutin cream across follow-up times

Follow-up times	4% White Radish Root	2% Alpha Arbutin	P-value
<b>4 weeks</b>			
No change	4 (33.3)	3 (25.0)	0.667
Fair satisfaction	7 (58.4)	9 (75.0)	
Moderate satisfaction	1 (8.3)	0 (0.0)	
<b>8 weeks</b>			
Fair satisfaction	5 (41.7)	2 (16.7)	0.178
Moderate satisfaction	7 (58.3)	10 (83.3)	
<b>12 weeks</b>			
Moderate satisfaction	9 (75.0)	3 (25.0)	0.014*
Good satisfaction	3 (25.0)	9 (75.0)	

Table 4 Data were analyzed with Chi-square test

\* Statistically significant at the 0.05 level



**Figure 3** Bar chart showing proportion of dermatologists' evaluation scale for 4% White Radish Root cream and 2% Alpha Arbutin cream

According to Table 4, which presents dermatologists' evaluation scores from three physicians, it was found that at 4 weeks, in the 4% White Radish Root cream group, 58.4% of evaluations were rated as "Fair satisfaction," followed by "No change" at 33.3%, and "Moderate satisfaction" at 8.3%. In the 2% Alpha Arbutin cream group, 75.0% of evaluations were rated as "Fair satisfaction," and 25.0% as "No change." There was no statistically significant difference between the groups ( $P = 0.667$ ).

At 8 weeks, in the 4% White Radish Root cream group, 58.3% of evaluations were rated as "Moderate satisfaction," and 41.7% as "Fair satisfaction." In the 2% Alpha Arbutin cream group, 83.3% were rated as "Moderate satisfaction," and 16.7% as "Fair satisfaction." Again, there was no statistically significant difference ( $P = 0.178$ ).

At 12 weeks, in the 4% White Radish Root cream group, 75.0% were rated as "Moderate satisfaction," and 25.0% were rated as "Good satisfaction." In contrast, in the 2% Alpha Arbutin cream group, 25.0% were rated as "Moderate satisfaction," and 75.0% as "Good satisfaction." This showed a statistically significant difference ( $P = 0.014$ ).



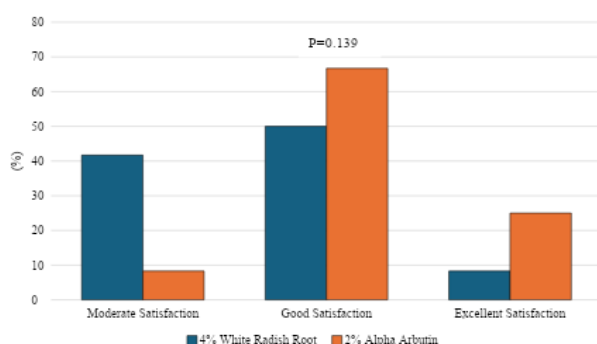
### Participant's satisfaction score

**Table 5** Participant's satisfaction score for 4% White Radish Root cream and 2% Alpha Arbutin cream at 12 weeks

Satisfaction levels	4% White Radish Root	2% Alpha Arbutin
Moderate Satisfaction	5 (41.7)	1 (8.3)
Good Satisfaction	6 (50.0)	8 (66.7)
Excellent Satisfaction	1 (8.3)	3 (25.0)
<b>P-value</b>	<b>0.139</b>	

Table 5 Data were analyzed with Chi-square test.

\* Statistically significant at the 0.05 level



**Figure 4** Bar chart showing proportion of participant's satisfaction scale for 4% White Radish Root cream and 2% Alpha Arbutin cream

According to Table 5, which presents the participants' satisfaction scores at 12 weeks, most participants who applied the 4% White Radish Root cream rated their satisfaction as "Good Satisfaction" at 50.0%, followed by "Moderate Satisfaction" at 41.7%, and "Excellent Satisfaction" at 8.3%. For those who applied the 2% Alpha Arbutin cream, most participants rated their satisfaction as "Good Satisfaction" at 66.7%, followed by "Excellent Satisfaction" at 25.0%, and "Moderate Satisfaction" at 8.3%. There was no statistically significant difference between the two groups ( $P = 0.139$ ).

## DISCUSSION & CONCLUSION

In this study, 24 participants (both male and female) with the Fitzpatrick skin type II to type V, were joined. A statistically significant reduction in melanin concentration from the baseline period was observed in the study's results following a 12-week application of 4% white radish root extract cream and 2% alpha arbutin cream. Anti-tyrosinase properties of 4% white radish root extract cream and 2% alpha arbutin cream take part in reduction of melanin index, which is key enzyme for inhibiting melanogenesis. (Suttisri & Tengamnuay, n.d.)

At 4th week, three dermatologists rated the results of the treatments, both the 4% White Radish Root cream and 2% Alpha Arbutin cream groups had mostly "Fair satisfaction" ratings, with no significant difference between the groups ( $P=0.667$ ). At 8th week, the 2% Alpha Arbutin group had slightly more "Moderate satisfaction" ratings, but again, no significant difference was found ( $P=0.178$ ). However, at 12th week, the 4% White Radish Root cream group had more "Moderate satisfaction," while the 2% Alpha Arbutin group had more "Good satisfaction," showing a significant difference ( $P=0.014$ ).

Regarding participants' satisfaction score, after 12 weeks, most participants who used the 4% White Radish Root cream rated their satisfaction as "Good" (50%), followed by "Moderate" (41.7%) and "Excellent" (8.3%). For those using the 2% Alpha Arbutin cream, most rated their

satisfaction as "Good" (66.7%), followed by "Excellent" (25%) and "Moderate" (8.3%). There was no significant difference between the two groups.

Regarding side effects, no severe side effects, such as redness, rashes, or other skin problems, were observed with either the 4% white radish root extract cream or the 2% alpha arbutin cream within study period. The 4% white radish root extract cream was well tolerated and considered safe for longer use.

In conclusion, although 2% Alpha Arbutin cream showed a slightly better reduction in melanin levels than 4% White Radish Root extract cream, the difference was minimal. This indicates that the 4% White Radish Root extract cream is almost as effective as the 2% Alpha Arbutin cream in reducing melanin. Significant skin lightening was observed after just 4 weeks of use. The 4% White Radish Root extract cream caused no side effects, and volunteers were generally satisfied with the results. Therefore, it is a promising, safe, and cost-effective option for facial whitening. However, further research is needed to determine how long it takes for the 4% White Radish Root extract cream to achieve its maximum whitening effect and to assess any potential side effects from prolonged use.

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