

## THE EFFECTIVENESS OF ASTAXANTHIN CREAM COMPARED WITH VITAMIN E CREAM TO IMPROVE SKIN CONDITION

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### Abstract

**Objective:** To study the effectiveness of Astaxanthin cream compare with Vitamin E cream to improve skin condition (improve skin moisturization and decrease wrinkle, redness and dark spot)

**Material and Method:** A Prospective, Randomized, Double-blind, Experimental Clinical trial in 25 subjects, age greater than or equal 30 year olds in both male and female subjects. Apply astaxanthin cream in one side around eye and another side apply Vitamin E cream. Then take a photo and measure skin moisturizer by Cutometer MPA 580, measure melanin pigment and skin erythema by Mexameter and measure skin wrinkle by Visioscan@VC98at week 0, 2, 4.

**Results:** Astaxanthin cream can increase skin moisturizer in 2 weeks and still increase skin moisturizer in 4 weeks ( $p = 0.03$  and  $p = 0.03$  respectively). Astaxanthin cream can decrease both Melanin pigments in 2 weeks, 4 weeks ( $p = 0.04$  and  $p = 0.01$  respectively) and decrease skin erythema in 2 weeks, 4 weeks ( $p = 0.01$  and  $p = 0.01$  respectively). The study found that Astaxanthin cream can reduce skin wrinkle but no statistically significant in 2 and 4 weeks ( $p = 0.86$  and  $p = 0.39$  respectively). The subjects reported satisfaction after study with statistically significant ( $p < 0.001$ ).

**Conclusion:** Astaxanthin cream can increase skin moisturizer, decrease both melanin pigment and decrease skin erythema, however Astaxanthin cream cannot decrease skin wrinkle.

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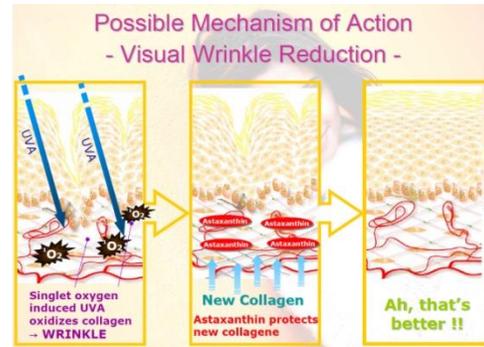
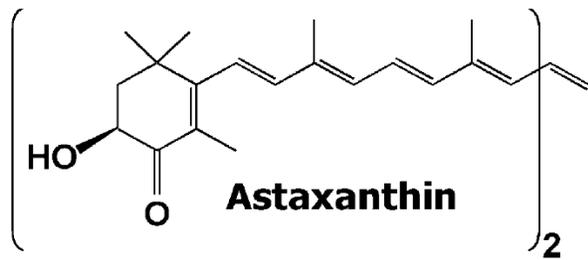
**Keywords:** Astaxanthin, vitamin E, moisturization, wrinkle, dark spot, erythema

## Introduction :

Now in a modern world has changed a lot in terms of health and technology. The longevity, comfortable, anti aging technology such as medical or alter native medicine has played the important roles. It is recognized that no body wants to old. But in reality, the physical condition deteriorated by age. Moreover, the current work load with more stress, lack of exercise, not enough sleep, eating low quality food, eating bad food, no balancing diets and environment filled with pollution, dust, smoke, sunlight or living in air conditioning room for long time (dry environment), causing decreased skin moisturization and increase wrinkle, which created anxiety (depress mood) that will become chronic problem in the further. Nowadays, there are many creams and many supplements are sale in the market, one of them is Astaxanthin cream. The mechanism of action in anti aging processes are protection of cell membrane and mitochondria from antioxidant, no pro-oxidant property, anti-inflammation, prevent NK-cell movement in many organs (such as gastrointestinal tract, vascular system, musculoskeletal, eye, kidney and brain), prevent DNA damage and prevent photo-oxidative damage from UV light that are the main cause of decrease skin moisturization and increase skin wrinkle in aging skin. Astaxanthin is carotenoid group which both water-soluble and fat-soluble. They found in many plants, algae, fungi, bacteria containing red, orange, yellow colors. (Cooper, Eldridge & Peters, 1999). Astaxanthin has antioxidant properties, catch with singlet oxygen (Edge, McGarvey & Truscott, 1997; Mortensen, Skibsted, Sampson, Rice-Evans & Everett, 1997) and also prevent light absorption by prevent photo-oxidation and light from ultraviolet.

Astaxanthin is most commonly found in Algae, Salmon, Lobster, Unicellular algae: *Haematococcus pluvialis* (H. pluvialis). (Odeberg, Lignell, Len Pattersson & Höglund, 2003; Refer, Moeseneder, Briviba, Rechkemmer & Bub, 2008; Barbosaa, Moraisa & Choubertb, 1999). Astaxanthin is similar structure as vitamin A, but the unique characteristic is a group of Hydroxyl group and keto-group that located at the end of the ring (Figure 1). These groups have potent anti-oxidant properties compared with vitamins and nutrients, such as the following lists below (Edge, 1997; Mortensen, 1997).

- Antioxidant level 500 times > Vitamin E 500
- Antioxidant level 800 times > Coenzyme Q10
- Antioxidant level 3000 times > Resveratrol
- Antioxidant level 6000 times > Vitamin C



**Figure 1** Chemical Structure of Astaxanthin  
Mechanism of Action in Antiaging

**Figure 2** Mechanism of Astaxanthin in Reduce Skin Wrinkle

Skin Moisturization is measured by the water content in the stratum corneum. Based on the difference of the capacity in place to measure. Which is closely related to the amount of water in the stratum corneum by using Cutometer MPA 580.

Factors Effecting to Moisturize of Skin: Individual-related variables

1. Different skin regions have different moisturization, especially for head and palm that have more moisturization. Abdomen and extremities have less moisturization. But no different in both sides. (Blichmann & Serup, 1988; Rogiers, Derde, Verleye & Roseeuw, 1990; Bare1, Clarys, Wessels & de Romsee, 1991)
2. Sweat gland activity is effected to skin moisturization. Need to control temperature and humidity in research room. The subjects need to rest at least 10-20 minutes before measurement and open skin region. Choose the hairless area to be measured. Eliminate stress that caused sweat gland more production.
3. Characteristic of skin surface such as surfactant, cream, talc. Need to clean skin and avoid use skin surfactant at least 4 weeks
4. Sin cleanser has effect to skin moisturization then avoid clean skin at least 2 hours before measure. (Rogiers et al., 1990)

Environment-Related Variables

1. Room temperature and humidity have effected to skin moisturization in stratum corneum. Need to control room temperature and humidity when measurement. Keep 40 to 60 percent humidity and 20 to 22 degree Celsius. (Bare1 & Clarys, 1995; Clar, Her & Sturelle, 1975; Tagami, 1989)

2. Season and different time have effected to skin moisturization then need to measure in same time and same season.(Tagami, 1989; Prall, Theiler, Bowser & Walsh, 1986)

#### Instrumental-Related Variables

Probe measurement in perpendicular with skin. Measurement in the same area need to rest at least 5 seconds or measurement nearby the same area. Because measurement in the same area decreasing skin hydration and impact probe and can causing abnormal test.(Beradesca, 1997)

Now a day, we have many technology to treatment skin wrinkle such as prevention, tropical drug use, oral drug, operative procedure (peeling, resurfacing, laser, filler, surgery). However no gold standard and best effective technology. (Yaar, M. & Gilcrest, 2003)

The Visioscan®VC98: it photographs skin with different light lengths and analysis the skin condition with high effective and high accuracy.

The pilot study Astaxanthin can reduce skin wrinkle (Seki, Sueki, Kono, Suganuma& Yamashita, 2001) by protect skin collagen and causing decrease skin wrinkle and increase skin moisturization. No side effect is found in this study. However this study is research in three subjects and young age group (26-30 years old). In 2002, The effectiveness of astaxanthin supplement and vitamin E(Yamashita, 2002) was reseached in mean 47 years old subjects. After take 2 mg. astaxanthin supplement with 40 mg. vitamin E in 2 weeks, in dry skin group had increase skin moisturization and decrease skin wrinkle.

The study in USA in effectiveness of Astaxanthin supplement (Yamashita, 2005), used 4 mg. astacanthin combine with Canolar oil compared with placebo (Canolar oil). They found that astaxanthin combine with Canolar oil can increase skin moisturization and decrease skin wrinkle.

The effectiveness of astaxanthin with skin condition (Yamashita, 2006a; 2006b) used 2 mg. astaxanthin in the morning and afternoon, totally 4 mg. per day in 3 and 6 weeks compared with placebo. They found that Astaxanthin can increase skin moisturization and decrease skin wrinkle better than placebo.

The recent study of the effectiveness of astaxanthin with human skin (Tominaga, Hongo, Karato& Yamashita, 2012), they separate two groups: first group in women and second group in men. Both groups take 6 mg. astaxanthin and apply tropical astaxanthin(78.9 micromole). They found that Astaxanthin can increase skin moisturization and decrease skin wrinkle in both groups.

No previous study about the effectiveness of astaxanthin compared with standard cream base in skin condition, it is a source of this study.

The objective of this study is to compare the effectiveness of Astaxanthin cream and Vitamin E cream in skin condition.

### **Material and Method :**

A Prospective, Randomized, Double-blind, Experimental Clinical trial in 25 subjects, age greater than or equal 30 year olds in both male and female subjects. Inclusion criteria are male and Female, age at least 30 years old, accept to continuous use Astaxanthin cream and Vitamin E cream in different side, no change skin care during study, no facial treatment or skin lazer during study and no Botox and Filler used. Exclusion criteria are allergy to Astaxanthin cream or Vitamin E cream, medical condition and pregnancy. Discontinuation criteria are severe side effect or allergy, cannot continuous use Asthaxanthin or Vitamin E cream, pregnancy, other medical condition and the subject is deny.

Photograph skin before study: measure skin moisturization by Cutometer MPA 580 and measure skin wrinkle by Visioscan®VC98. Patch test before apply skin creams. Then apply 1 ml. astaxanthin cream in one side and apply 1 ml. Vitamin E cream in another side in the morning and afternoon. Both subjects and Researcher do not know the side of astaxanthin cream or Vitamin E cream. Record data. Then 2 and 4 weeks later, follow up and take a photo as the first time: measure skin moisturizatio by Cutometer MPA 580 and measure skin wrinkle by Visioscan®VC98. Record data and analysis. Record skin moisturizatio by Cutometer MPA 580 and skin wrinkle by Visioscan®VC98in record sheet and computer. General data: age sex occupation address and previous medical history that related to skin moisturization and wrinkle, Score from Cutometer MPA 580, Score from Visioscan®VC98, Assesssatisfaction by subjects in 2 and 4 weeks and Side effect from the study.

### **Results :**

The aim of this research is study the effectiveness of astaxanthin cream compared with Vitamin E cream for decrease wrinkles, increasing skin moisturizing, decrease redness and decrease dark spot in 25 subjects. Randomly, one side use astaxanthin cream and another side use Vitamin E cream. Apply creams in the morning and afternoon for 28 days, then analysis the data and separate results in 3 steps as following: General characteristic, Results and Assesssatisfaction and side effects

1. General characteristic

Demographic information: 25 subjects (5 males and 20 females) and the ratio is 1:4. All of them had complete follow up: 15 subjects with ages between 30-39 years old, 5 subjects with ages between 40-49 years old, 3 subjects with ages between 50-59 years old and 2 subject with ages between 60-69 years old. Total 25 subjects with maximal age is 67 years old and minimum age is 30 years old, mean age is 40.45 years old and SD = 10.99. The study shows that 10 subjects had dry skin type, 6 subjects had oily skin type and 9 subjects had combination type.

2. Result of wrinkle

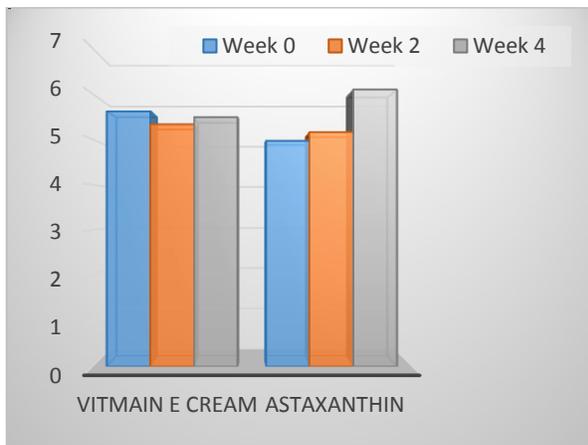


Figure 3 Result of Wrinkle

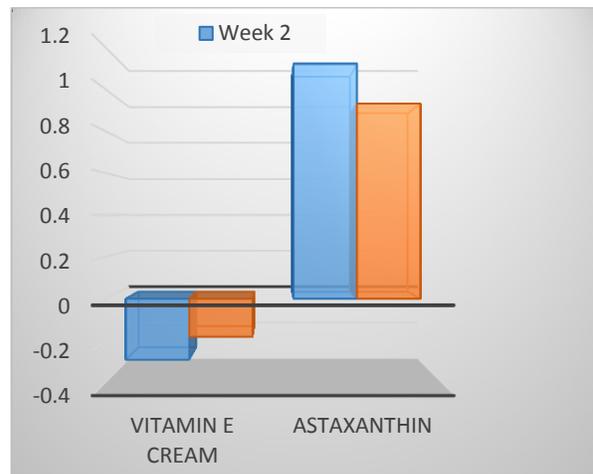


Figure 4 Y-axis: Change rate (Post/Pre)

From Table 1, Figure3 and 4 show increasing mean wrinkle in Vitamin E cream group, however no statistically significant when compared with week 2 and 4. ( $p = 0.82$  and  $p = 0.92$ , respectively) Mean  $\pm$  SD in week0 is  $5.62 \pm 5.26$ , week2 is  $5.33 \pm 3.85$  and week4 is  $5.49 \pm 4.35$ .

The mean wrinkle in astaxanthin group is decreasing but no statistically significant in week 2 and 4 ( $p = 0.86$  and  $p = 0.39$  respectively) Mean  $\pm$  SD in week 0 is  $4.97 \pm 4.24$ , week 2 is  $5.16 \pm 3.73$  and week4 is  $6.09 \pm 4.82$ .

3. Result of skin moisturization

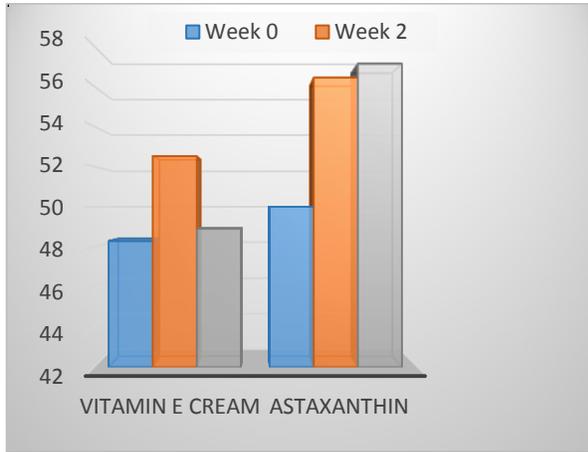


Figure 5 Skin Moisturization



Figure 6 Y-axis: Change rate (Post/Pre)

From Table 2, Figure 5 and 6 show mean of skin moisturization in Vitamin E cream group has no statistically significant when compared with week 2 and 4 ( $p = 0.21$  and  $p = 0.89$  respectively). Mean  $\pm$  SD in week 0 is  $48.30 \pm 12.30$ , week 2 is  $52.52 \pm 10.63$  and week 4 is  $48.89 \pm 11.35$ .

The mean of skin moisturization in astaxanthin group has increasing and statistically significant when compared with week 2 and 4 ( $p = 0.03$  and  $p = 0.03$  respectively). Mean  $\pm$  SD in week 0 is  $50.00 \pm 10.45$ , week 2 is  $56.45 \pm 10.55$  and week 4 is  $57.13 \pm 11.73$ .

4. Result in dark spot

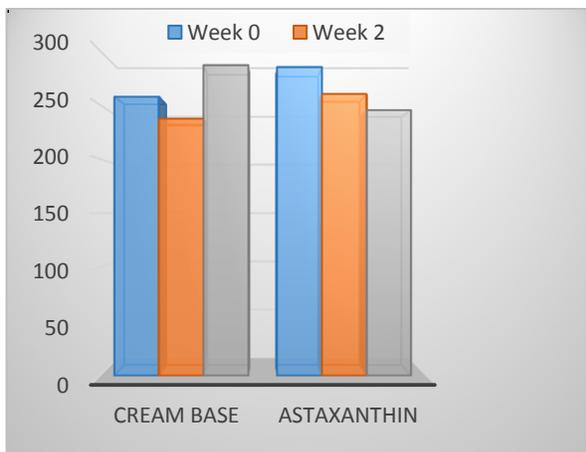


Figure 7 Result in Dark Spot

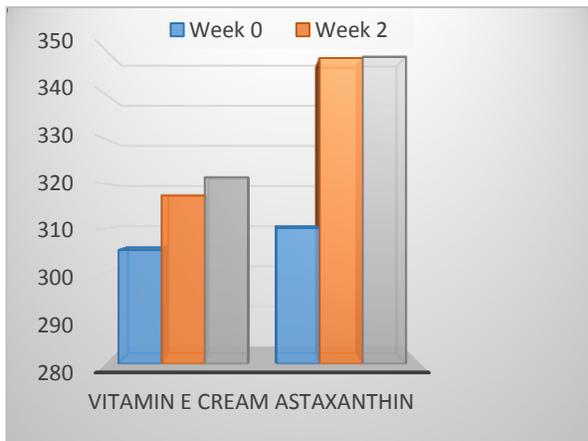


**Figure 8** Y-axis: Change rate (Post/Pre)

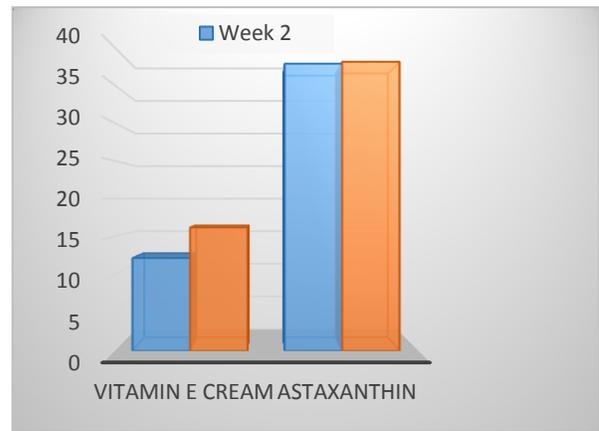
From Table 3, Figure 7 and 8 show the mean dark spots Vitamin E cream group has no statistically significant when compared with week 2 and 4. ( $p = 0.39$  and  $p = 0.78$  respectively). Mean  $\pm$  SD in week 0 is  $250.25 \pm 60.00$ , week 2 is  $235.45 \pm 61.15$  and week 4 is  $280.55 \pm 58.89$ .

But the mean dark spots in astaxanthin group has decreasing and statistically significant when compared with week 2 ( $p = 0.04$ ) and week 4 ( $p = 0.01$ ). Mean  $\pm$  SD in week 0 is  $280.25 \pm 80.00$ , week 2 is  $230.45 \pm 82.50$  and week 4 is  $227.45 \pm 63.95$ .

**5. Result in erythematous**



**Figure 9** Result in Erythematous



**Figure 10** Y-axis: Change rate (Post/Pre)

From Table 4, Figure 9 and 10 show the mean of erythematous skin in Vitamin E cream group has no statistically significant when compared with week 2 and 4 (  $p = 0.38$  and  $p = 0.21$  respectively). Mean  $\pm$  SD in week 0 is  $305.25 \pm 35.00$ , week 2 is  $317.42 \pm 58.56$  and week 4 is  $321.45 \pm 53.98$ .

The erythematous skin in astaxanthin group has decreasing and statistically significant when compared with week 2 ( $p = 0.01$ ) and week 4 has statistically significant ( $p = 0.01$ ). Mean  $\pm$  SD in week 0 is  $310.15 \pm 40.00$ , week 2 is  $347.86 \pm 60.15$  and week 4 is  $348.15 \pm 58.15$ .

*6. Result of satisfaction*

The study show satisfaction in astaxanthin cream is more than Vitamin E cream with statistically significant ( $p = 0.0007$ ).

**Table 1** Result of Wrinkle

Wrinkle score	Treatment			
	Vitamin E cream	p-value	Astaxanthin cream	p-value
	Mean $\pm$ SD		Mean $\pm$ SD	
Week 0	$5.62 \pm 5.26$	Reference	$4.97 \pm 4.24$	Reference
Week 2	$5.33 \pm 3.85$	0.82	$5.16 \pm 3.73$	0.86
Week 4	$5.49 \pm 4.35$	0.92	$6.09 \pm 4.82$	0.39

**Note.** \*Significant at  $p < 0.05$ , p-value from Student t-test

**Table 2** Skin Moisturization

Corneometer score	Treatment			
	Vitamin E cream	p-value	Astaxanthin cream	p-value
	Mean $\pm$ SD		Mean $\pm$ SD	
Week 0	$48.30 \pm 12.30$	Reference	$50.00 \pm 10.45$	Reference
Week 2	$52.52 \pm 10.63$	0.21	$56.45 \pm 10.55$	<b>0.03*</b>
Week 4	$48.89 \pm 11.35$	0.86	$57.13 \pm 11.73$	<b>0.03*</b>

**Note.** \*Significant at  $p < 0.05$ , p-value from Student t-test

**Table 3** Result in Dark Spot

Mexameter score	Treatment			
	Vitamin E cream	p-value	Astaxanthin cream	p-value
	Mean ± SD		Mean ± SD	
Week0	250.25 ± 60.00	Reference	280.25 ± 80.00	Reference
Week2	235.45 ± 61.15	0.39	230.45 ± 82.50	<b>0.04*</b>
Week4	280.55 ± 58.89	0.78	227.45 ± 63.95	<b>0.01*</b>

**Note.** \*Significant at  $p < 0.05$ , p-value from Student t-test

**Table 4** Result in Erythematous

Mexameter score	Treatment			
	Vitamin E cream	p-value	Astaxanthin cream	p-value
	Mean ± SD		Mean ± SD	
Week0	305.25 ± 35.00	Reference	310.15 ± 40.00	Reference
Week2	317.42 ± 58.56	0.38	347.86 ± 60.15	<b>0.01*</b>
Week4	321.45 ± 53.98	0.21	348.15 ± 58.15	<b>0.01*</b>

**Note.** \*Significant at  $p < 0.05$ , p-value from Student t-test

### Discussion :

From this research found that mean of wrinkle in astaxanthin group had decreasing but no statistically significant when compared with week 2 and 4 ( $p = 0.82$  and  $p = 0.92$  respectively). The results were different from previous study (Yamashita, 2002; Tominaga et al., 2012). The results may be due to environment and temperature because there is long weekend during study. After take with subjects, all of them traveled with their family along the weekend and had cool temperature.

The mean of skin moisturization in astaxanthin group had increasing and statistically significant when compared with week 2 and 4 ( $p = 0.03$  and  $p = 0.03$  respectively). Whereas Vitamin E cream group had no statistically significant when compared with week 2 and 4 ( $p = 0.21$  and  $p = 0.86$  respectively). The results were related with the previous study (Seki et al., 2001; Yamashita, 2002; Tominaga et al, 2012).

The mean of dark spot in astaxanthin group had decreasing and statistically significant when compared with week 2 ( $p = 0.04$ ) and week 4 ( $p = 0.01$ ).

The mean of erythematous skin in astaxanthin group had decreasing and statistically significant when compared with week 2 ( $p = 0.01$ ) and week 4 ( $p = 0.01$ ).

The mean of wrinkle, skin moisturization, dark spots and erythematous skin in Vitamin E cream group had no statistically significant when compared with week 2 and 4.

From the results can conclusion as the following:

1. Astaxanthin cream can increasing skin moisturization in week 2 and continuous increasing in week 4.
2. Astaxanthin cream can decreasing dark spots in week 2 and week 4.
3. Astaxanthin cream can decreasing erythematous skin in week 2 and week 4.
4. Astaxanthin cream cannot decreasing wrinkle in week 2 and 4.
5. Vitamin E cream cannot decreasing wrinkle, skin moisturization, dark spot and erythematous skin.
6. Disadvantage of the research: temperature, environment, long weekend and difference in skin cream used in different subjects.

### **Conclusion :**

This research is a Prospective, Randomized, Double-blind, Experimental Clinical trial for study for study the effectiveness of astaxanthin cream compared with Vitamin E cream to improve skin moisturization and decrease wrinkle in 25 subjects.

There is increasing mean wrinkle in Vitamin E cream group, however no statistically significant when compared with week 2 and 4. ( $p = 0.82$  and  $p = 0.92$ , respectively) Mean  $\pm$  SD in week 0 is  $5.62 \pm 5.26$ , week 2 is  $5.33 \pm 3.85$  and week 4 is  $5.49 \pm 4.35$ . The mean wrinkle in astaxanthin group is decreasing but no statistically significant in week 2 and 4 ( $p = 0.86$  and  $p = 0.39$  respectively) Mean  $\pm$  SD in week 0 is  $4.97 \pm 4.24$ , week 2 is  $5.16 \pm 3.73$  and week 4 is  $6.09 \pm 4.82$

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week 2 is  $235.45 \pm 61.15$  and week 4 is  $280.55 \pm 58.89$ . But the mean dark spots in astaxanthin group has decreasing and statistically significant when compared with week 2 ( $p = 0.04$ ) and week 4 ( $p = 0.01$ ). Mean  $\pm$  SD in week 0 is  $280.25 \pm 80.00$ , week 2 is  $230.45 \pm 82.50$  and week 4 is  $227.45 \pm 63.95$ .

The mean of erythematous skin in Vitamin E cream group has no statistically significant when compared with week 2 and 4 ( $p = 0.38$  and  $p = 0.21$  respectively). Mean  $\pm$  SD in week 0 is  $305.25 \pm 35.00$ , week 2 is  $317.42 \pm 58.56$  and week 4 is  $321.45 \pm 53.98$ . The erythematous skin in astaxanthin group has decreasing and statistically significant when compared with week 2 ( $p = 0.01$ ) and week 4 has statistically significant ( $p = 0.01$ ). Mean  $\pm$  SD in week 0 is  $310.15 \pm 40.00$ , week 2 is  $347.86 \pm 60.15$  and week 4 is  $348.15 \pm 58.15$ .

The satisfaction in astaxanthin cream is more than Vitamin E cream with statistically significant ( $p = 0.0007$ ).

There are 2 subjects (8 percent) had mild side effect from Vitamin E cream. And 1 subject (1 percent) in astaxanthin group had mild side effect. However no statistically significant ( $p = 0.5$ ). All subjected has side effect in 1-2 hours after study and mild burning sensation for 2 hours. After use the cream, all of them had no further side effect.

### **Recommendation**

1. Can use research data to improve astaxanthin cream for increase effectiveness. For another option to increase skin moisturization, decrease dark spot and erythematous skin.
2. The research maybe used to be a database for further research about skin moisturization, dark spot and erythematous skin.
3. The temperature, environment and difference in skin cream used in different subjects are research variables and need to control in the next study.
4. For the next study maybe compared between cost-benefit between astaxanthin cream and other cream(s).

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