

Evaluation Of The Use And Formulation Of Cosmeceuticals

ABSTRACT

Background

Antioxidants are compounds that counteract the harmful effects of reactive oxygen species in the cells of the body. **Oxidative stress** results when there is an imbalance between the level of pro-oxidants such as free radicals and reactive oxygen species and the level of antioxidants in the cell. The pro oxidants can cause damage to the cells, only when the cell is deprived of antioxidants. Antioxidants act by either stabilizing the free radical species or by deactivating them. **Retinol** or Vitamin A is fat-soluble antioxidant that serves to prevent photoageing. Retinols affect the processes of cell growth and differentiation, alterations in cell surface proteins and immune system modulation. **L- Ascorbic acid** is the biologically active form of Ascorbic acid and used for treatment processes. Not only does it act as an antioxidant to counteract the ROS, but it also has properties of collagen synthesis and can act as a depigmenting agent.

Objective

The objective of this study is to judge the efficacy of the two components, L-Ascorbic Acid and Retinol, when being used as topical antioxidant, in an age group of 18-50 years.

Methods

63 participants, belonging to the age-group of 18-30 years were surveyed after they had been using both the antioxidant crèmes on two different halves of the face, for a period of 6 weeks

Results

When the participants were surveyed regarding their perception on the use of L-Ascorbic Acid as a topical antioxidant agent, 52.38% of the participants agreed to the fact that the texture of the product and the consistency was comfortable while almost 43% were of the view that the texture was too light. The same perception, when tested for Retinol gave the results that almost 80% of the participants agreed for the product texture being comfortable and 14% agreed to it being too light. Almost 62% of the participants voted for the perception that the product caused slight improvement in the pigmentation conditions while 6% saw a significant improvement in their skin pigmentation levels. In case of Retinol, the percentages were 23.80% and 0%. This means that L-ascorbic Acid is better in curing skin pigmentation problems than Retinol.

Conclusion

After the survey, it could be effectively concluded that L-Ascorbic Acid acts as a better antioxidant agent than Retinol, especially when reducing pigmentation problems and improving the skin texture of the users.

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Introduction

Antioxidants are compounds that counteract the harmful effects of reactive oxygen species in the cells of the body. All living organisms use oxygen in order to carry out respiration. Respiration is the oxidation of food materials such as carbohydrates, proteins and fats in order to liberate energy, which is stored in the form of ATP. However, oxygen being a highly reactive molecule is capable of forming free radicals that are highly damaging to the cells. Free radicals are a major cause of aging and diseases like cardiovascular diseases, cancer and loss of brain and immune functions. **Free radicals** contain unpaired electrons, and therefore it tends to react with other substances in order to capture electrons from them, which would make them stable entities. **Reactive oxygen species**, which forms several free radicals, interact with phospholipids in the cell membrane and proteins, nucleic acids and enzymes in the cell (Ray *et al.*, 2012).

Oxidative stress results when there is an imbalance between the level of pro-oxidants such as free radicals and reactive oxygen species and the level of antioxidants in the cell. The pro oxidants can cause damage to the cells, only when the cell is deprived of antioxidants. Antioxidants act by either stabilizing the free radical species or by deactivating them. The main sources of antioxidants are fruits and vegetables (Gülçin, 2012). **Ascorbic acid** (Vitamin C) and **retinol** (Vitamin A) are the components that provide antioxidant properties to these food items.

Ascorbic acid is a major water-soluble antioxidant, which is highly recommended to reduce photo ageing (Traikovich, 2009). In addition to chronological aging, photo ageing is increasing in recent times. **Photo ageing** refers to the damage caused to the skin due to the harmful UV radiations of the sun. Ascorbic acid is a major component of several creams and serums that are applied topically on the skin surfaces in order to prevent photoageing. Ascorbic acid is found in two isomeric forms, namely **L- ascorbic acid** and **D- ascorbic acid**. L- Ascorbic acid is the biologically active form of Ascorbic acid and used for treatment processes. LAA is preferred for topical application as only a negligible amount of it can be absorbed by the small intestine (Telang, 2013). Additionally if Vitamin C is administered orally, its bioavailability to the skin is lowered. Not only does it act as an antioxidant to counteract the ROS, but it also has properties of collagen synthesis and can act as a depigmenting agent.

Retinol or Vitamin A is fat-soluble antioxidant that serves to prevent photoageing. Retinols affect the processes of cell growth and differentiation, alterations in cell surface proteins and immune system modulation (Mukherjee, 2018). The effects of retinols are manifested due to various interactions retinols have with the cellular and nucleic acid receptors (Babamiri and Nassab, 2012). Among retinol compounds that are used for topical treatment of photoageing, tretinoin is the most important. However, tretinoin has several side effects that include burning, scaling and dermatitis (Skinceuticals-za.com. 2018). Therefore, further research is required to establish tretinoin as a successful topical agent for treating photoageing.

Methods

The trial was aimed to be carried out among the individuals belonging to the age group of 18 yrs-50 yrs, non-random group in which all the female students and only one male student who were initially on-campus students of the university, participated in the survey. The duration of the trial was 6 weeks during which the participants were required to apply the different samples of the

antioxidant creams manufactured by using L-Ascorbic acid and retinol, on two separate halves of the face. The retinol-based cream was required to be applied on the left-side of the face while l-Ascorbic acid was required to be applied on the right side. One important factor determined the success of the use of topical antioxidants on the face of the participants; the face required to be clean from any dirt or impurities before the application of the cream, in order to ensure that there was no side effects occurring from the impurities which stayed back in the pores of the face. In order to ensure minimal cross-reactivity, no other compounds were advised to be used along with the topical creams formulated; this also served to ensure that the results obtained on the skin, whether good or bad, could be attributed to the use of the sample antioxidant crèmes under experimentation. The participants were surveyed about their views and the results on their skin after a span of 6 weeks and those were evaluated by means of graphs constructed on the reviews obtained.

Results

The data collected from the 63 student participants, regarding the topical application of L-Ascorbic acid and Retinol as antioxidants on half of the face, for a period of six weeks revealed the fact that the users were differently tolerable to the levels of Ascorbic acid and Retinol. The action on the individuals also varied considerably. Both the products exhibited anti-ageing activities on the users and helped in the reduction of fine lines and pigmentation. Most of the individuals did not develop any rashes or irritation when the products were used on the skin, thus stating the fact that both L-Ascorbic Acid as well as Retinol were safe to be used as topical agents except on those individuals who were overtly sensitive to the products.

RESULTS FOR L-ASCORBIC ACID:

Perception Criteria	Rating	No. of participants reporting the following:
Product texture and consistency (How does it feel on your skin?)	Too heavy	3
	Comfortable	32
	Too light	27
Effects on pigmentation	No change	20
	Slight improvement	39
	Significant improvement	3
Effects on fine lines	No change	41
	Slight improvement	20
	Significant improvement	1
Effects on skin moisture content	No change	22
	Slight improvement	38
	Significant improvement	2
Effects in skin surface texture (pores, roughness etc)	No change	16
	Slight improvement	38
	Significant improvement	8
Side effects: stinging with initial application	None	35
	Mild	24
	Uncomfortable	3
Side effects: erythema	None	56
	Mild	4
	Moderate	2
Other side effects? Please list		
3 participants reported an increase in acne lesions 3 yellowing of fingers		
1 participant reported mild erythema 1 congestion		
3 participants reported an increase in skin dryness 1 oxidation, blocked pores		
Comments:		
Product consistency is very light, individuals with dry skin may need to use a heavy moisturiser to compensate.		
6 too light, dry skin 4 skin texture improved, softened		
3 inappropriate for oily skin type 4 unpleasant sticky, applies unevenly		
3 improvement in PIHP 4 unpleasant odour		

Fig: The collated results of the survey for L-Ascorbic Acid

RESULTS FOR RETINOL:

Perception Criteria	Rating	No. of participants reporting the following:
Product texture and consistency (How does it feel on your skin?)	Too heavy	4
	Comfortable	49
	Too light	9
Effects on pigmentation	No change	47
	Slight improvement	15
	Significant improvement	0
Effects on fine lines	No change	42
	Slight improvement	17
	Significant improvement	3
Effects on skin moisture content	No change	39
	Slight improvement	12
	Significant improvement	11
Effects in skin surface texture (pores, roughness etc)	No change	12
	Slight improvement	39
	Significant improvement	11
Side effects: stinging with initial application	None	51
	Mild	11
	Uncomfortable	0
Side effects: erythema	None	45
	Mild	10
	Moderate	7
<i>Other side effects? Please list: 2 participants reported dryness and irritation 1 participant noted that skin was red and felt warm Stopped Rx because of pimples</i>		
<i>Other Comments: 3 Not sufficient hydration 1 reduced acne lesions 2 strange texture, smell 5 significant congestion, comedones, pustules 7 enjoyed product, well hydrated 5 improved lines 1 Too oily 2 Too sticky 1 Stopped treatment due to reaction (details of reaction not noted)</i>		

Fig: The collated results of the students regarding retinol

My results after application of L-Ascorbic Acid

Perception Criteria	Rating
Product Texture and consistency	Comfortable
Effects in Pigmentation	Significant Improvement
Effects on fine lines	Slight Improvement
Effects on skin moisture content	No change
Effects in skin surface texture	Slight Improvement
Side effects: stinging with initial application	None
Side effects: erythema	None

Collated results of the participants after the application of L-Ascorbic Acid

Perception Criteria	Rating	No. of Participants	Percentage
Product Texture and consistency	Too heavy	3	4.76

	Comfortable	33	52.38
	Too Light	27	42.85
Effects in Pigmentation	No change	20	31.74
	Slight Improvement	39	61.90
	Significant Improvement	4	6.00
Effects on fine lines	No Change	41	65.07
	Slight Improvement	21	33.33
	Significant Improvement	1	1.58
Effects on skin moisture content	No Change	22	66.66
	Slight Improvement	39	61.90
	Significant Improvement	2	3.17
Effects in skin surface texture	No Change	16	25.39
	Slight Improvement	39	61.90
	Significant Improvement	8	12.69
Side effects: stinging with initial application	None	36	57.14
	Mild	24	38.09
	Uncomfortable	3	4.76
Side effects: erythema	None	57	90.47
	Mild	4	6.34
	Moderate	2	3.17

Graphs for the Collated results of the participants after the application of L-Ascorbic Acid

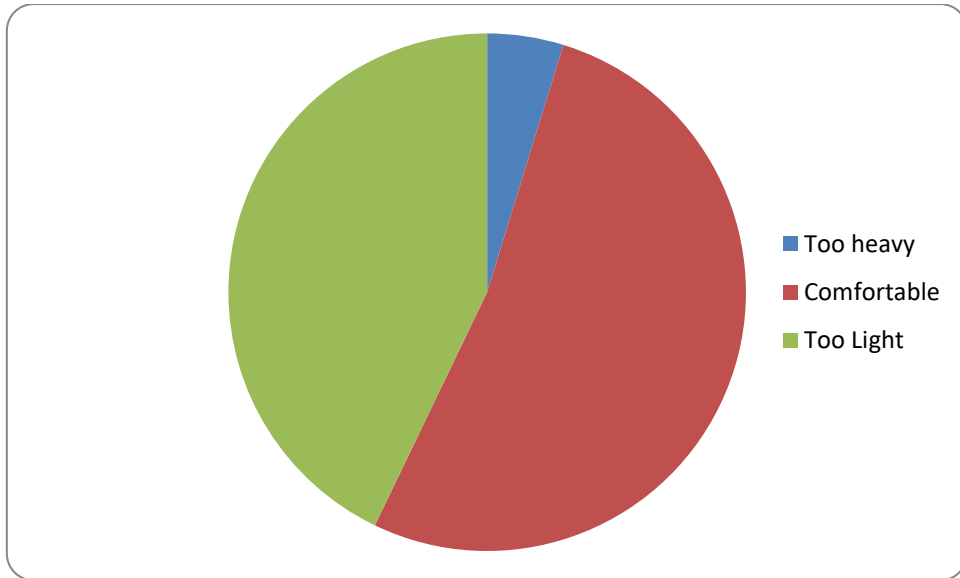


Fig 1: Product Texture and consistency

Source: Created by Author

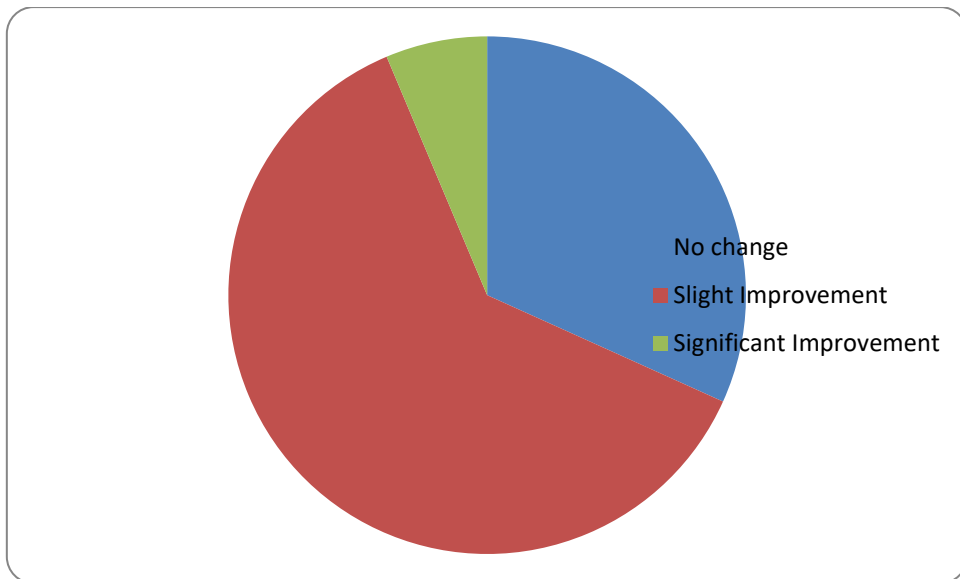


Fig 2: Effects in Pigmentation

Source: Created by Author

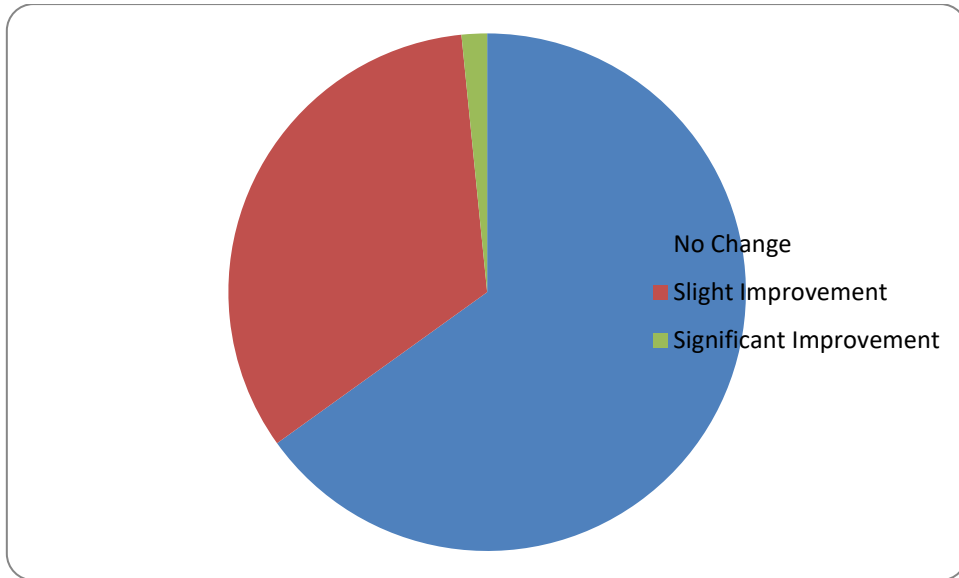


Fig 3: Effects on fine lines

Source: Created by Author

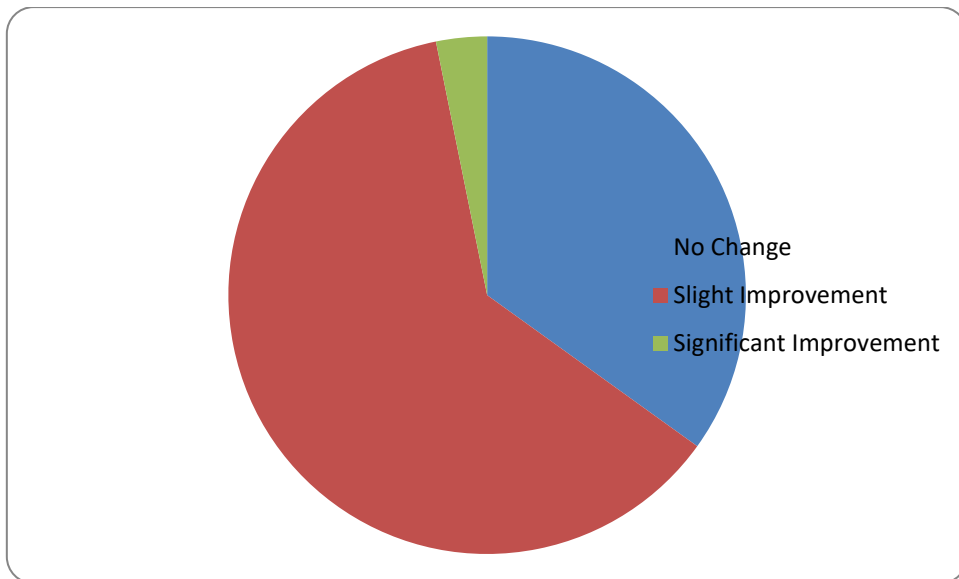


Fig 4: Effects on skin moisture content

Source: Created by Author

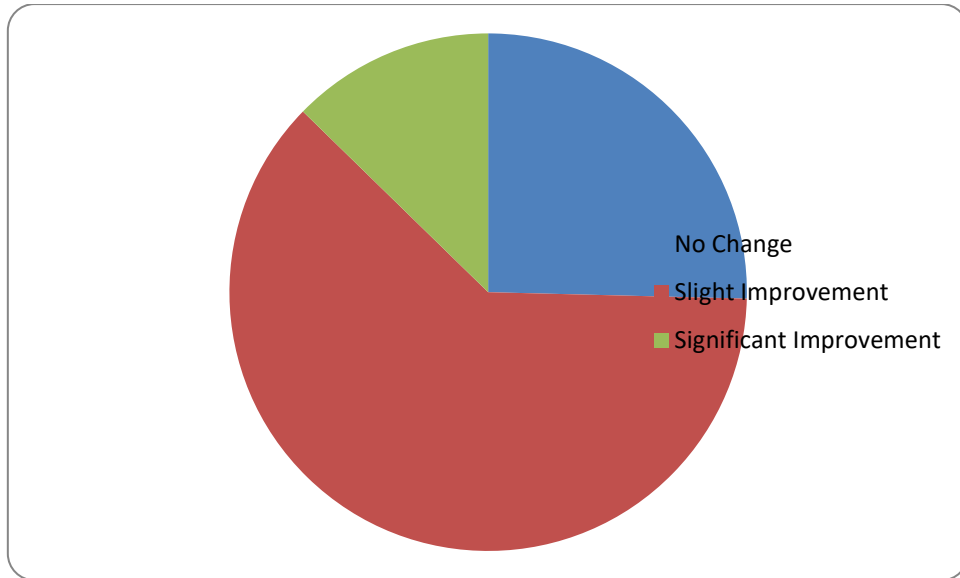


Fig 5: Effects in skin surface texture

Source: Created by Author

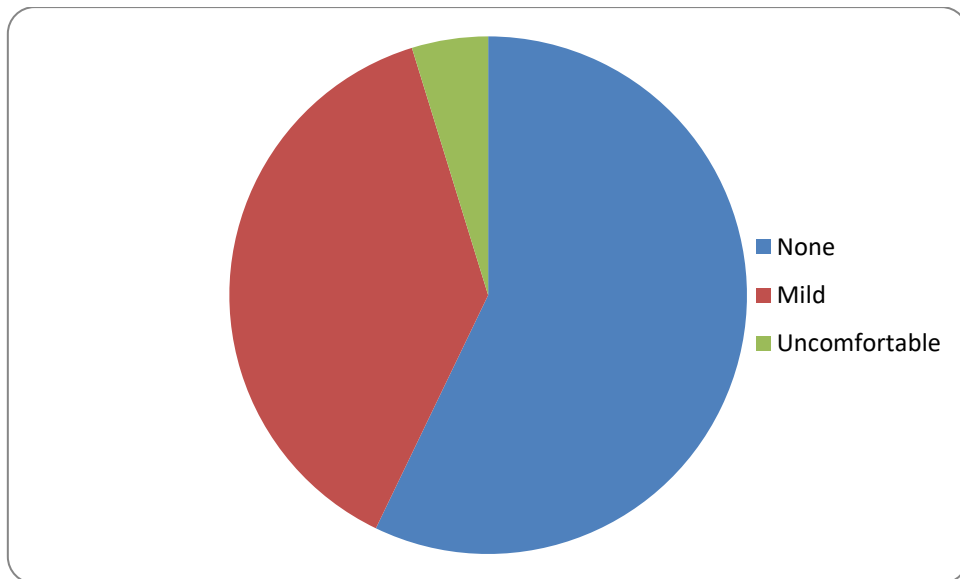


Fig 6: Side effects: stinging with initial application

Source: Created by Author

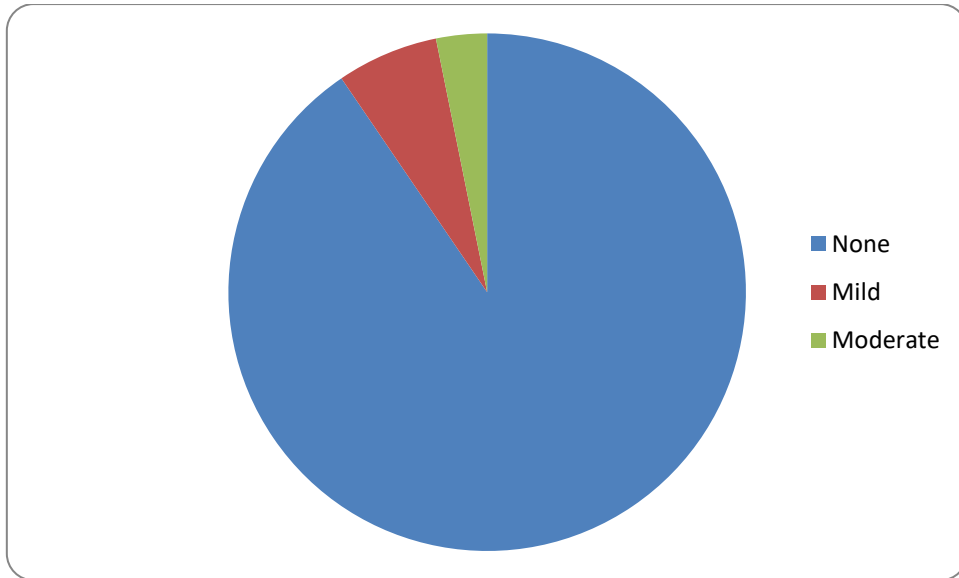


Fig 7: Side effects: erythema

Source: Created by Author

My results after application of Retinol

<i>Perception Criteria</i>	<i>Rating</i>
Product Texture and consistency	Too light
Effects in Pigmentation	No change
Effects on fine lines	Slight improvement
Effects on skin moisture content	Slight Improvement
Effects in skin surface texture	No change
Side effects: stinging with initial application	Mild
Side effects: erythema	None

Collated results of the participants after the application of Retinol

<i>Perception Criteria</i>	<i>Rating</i>	<i>No. of Participants</i>	<i>Percentage</i>
Product Texture and consistency	Too heavy	4	6.34
	Comfortable	50	79.36
	Too Light	9	14.28
Effects in Pigmentation	No change	48	76.19
	Slight Improvement	15	23.80
	Significant Improvement	0	0
Effects on fine lines	No Change	42	66.66
	Slight Improvement	18	28.57
	Significant Improvement	3	4.76
Effects on skin moisture content	No Change	39	61.9
	Slight Improvement	13	20.63
	Significant Improvement	11	17.46
Effects in skin surface texture	No Change	13	20.63
	Slight Improvement	39	61.9
	Significant Improvement	11	17.46
Side effects: stinging with initial application	None	51	80.92
	Mild	12	19.04
	Uncomfortable	0	0
Side effects: erythema	None	46	73.01
	Mild	10	15.87
	Moderate	7	11.11

Graphs for the Collated results of the participants after the application of L-Ascorbic Acid

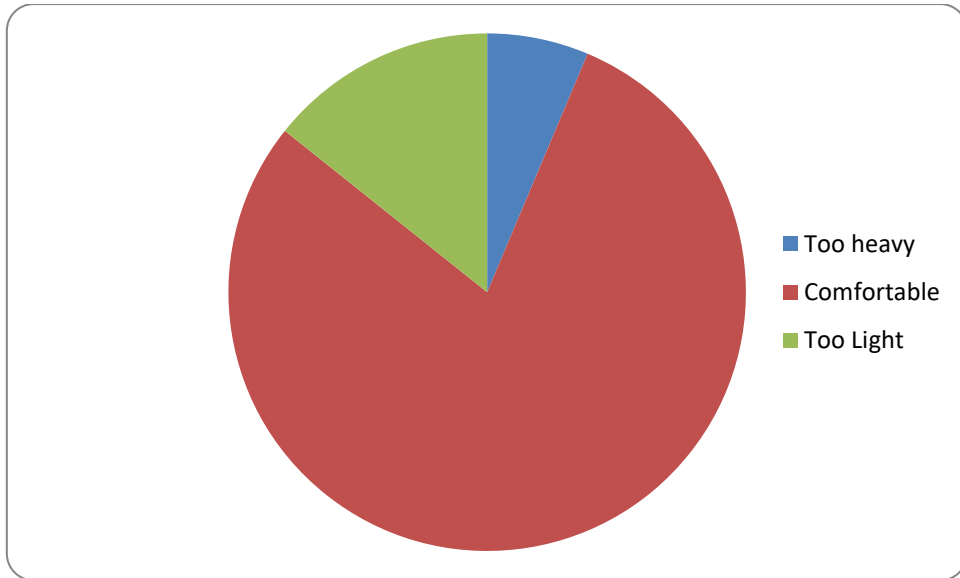


Fig 1: Product Texture and consistency

Source: Created by Author

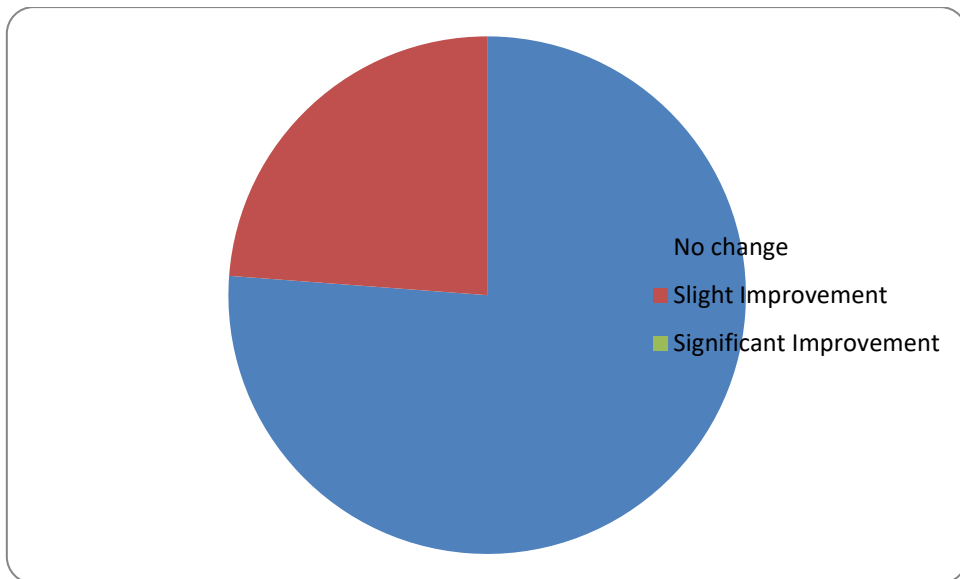


Fig 2: Effects in Pigmentation

Source: Created by Author

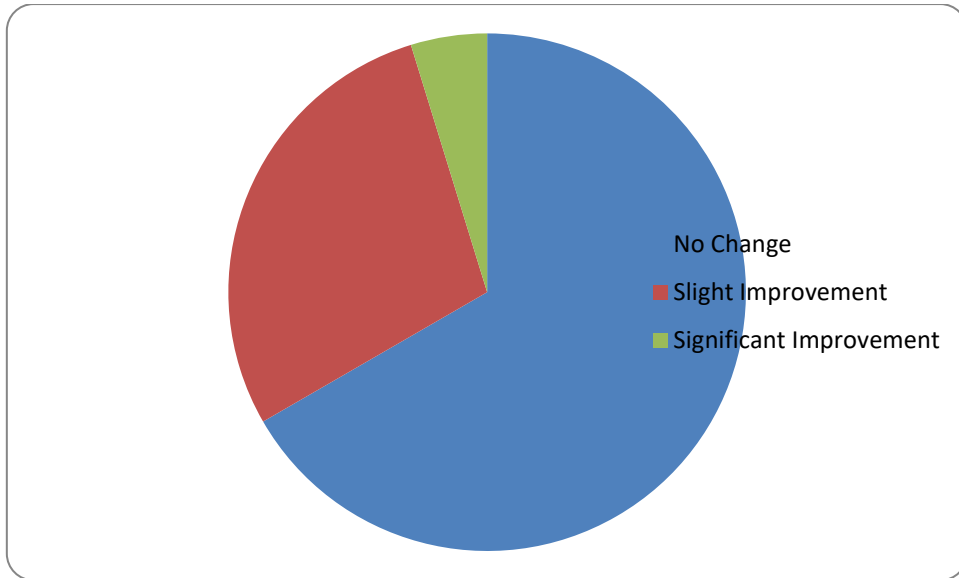


Fig 3: Effects on fine lines

Source: Created by Author

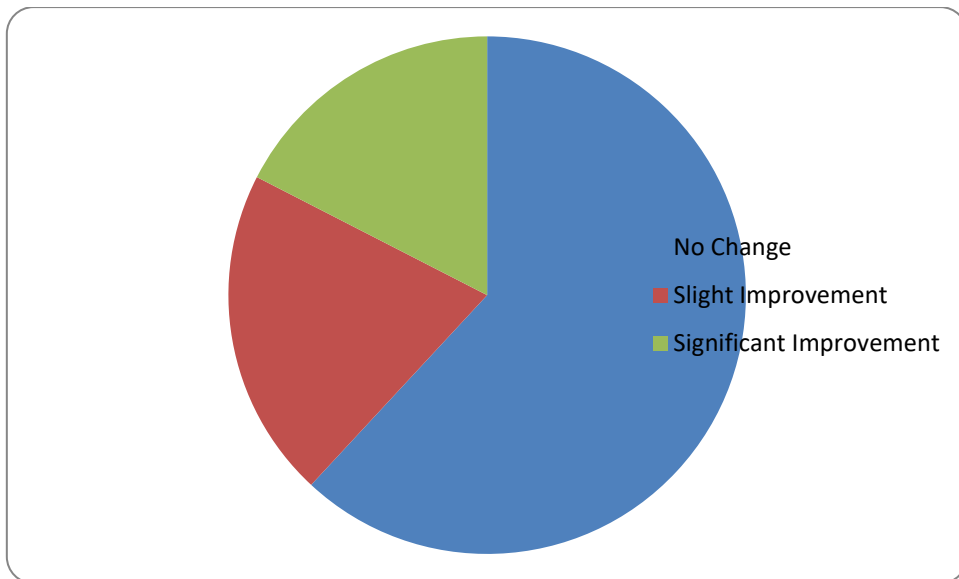


Fig 4: Effects on skin moisture content

Source: Created by Author

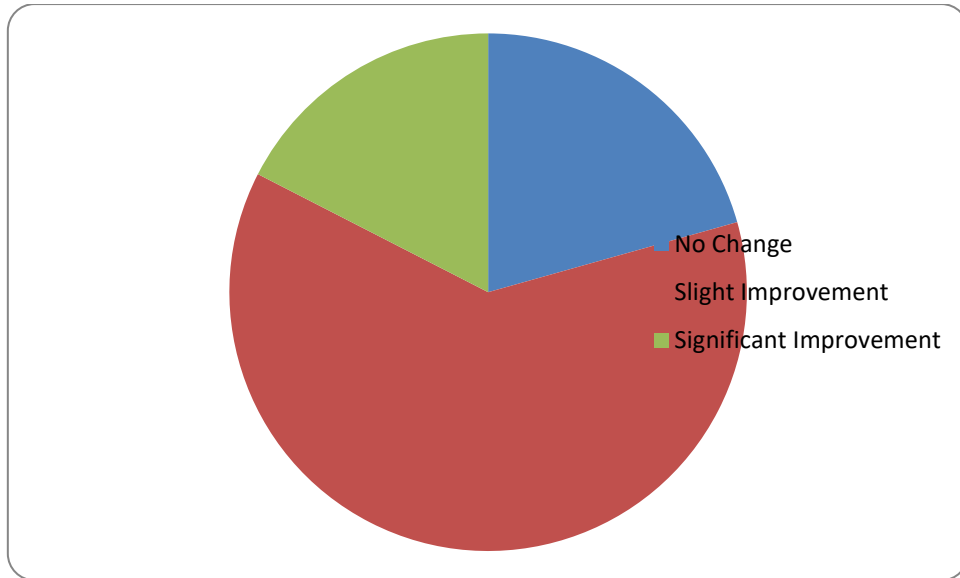


Fig 5: Effects in skin surface texture

Source: Created by Author

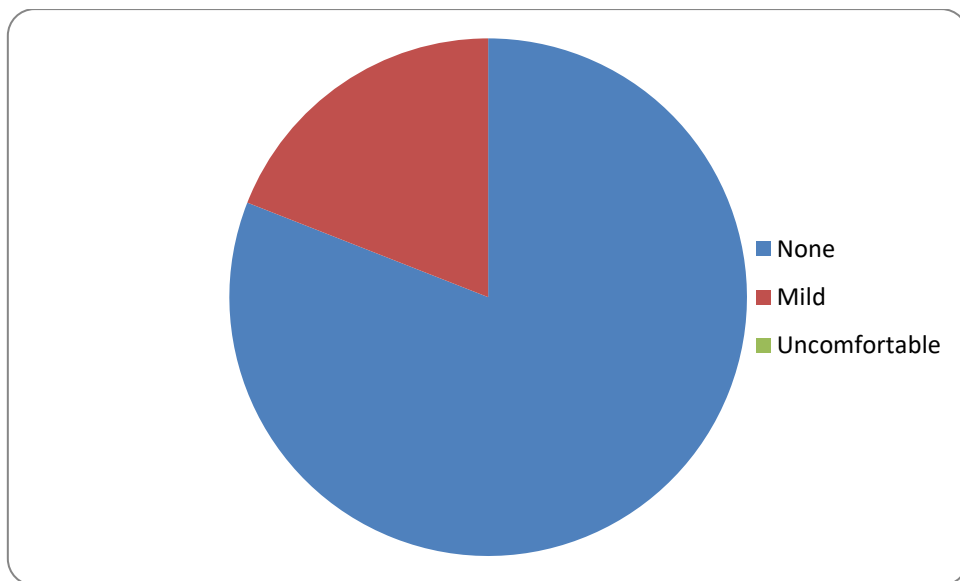


Fig 6: Side effects: stinging with initial application

Source: Created by Author

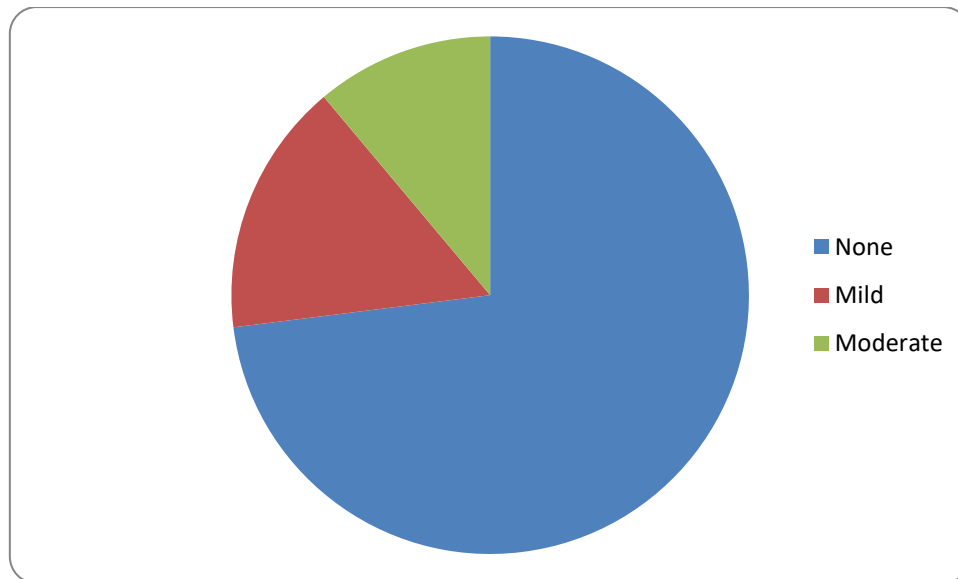


Fig 7: Side effects: erythema

Source: Created by Author

Discussion

The participants were surveyed based on seven different perception criteria of the participants and their ratings were analyzed for reaching a valid conclusion regarding the perception. When the participants were surveyed regarding their perception on the use of L-Ascorbic Acid as a topical antioxidant agent, 52.38% of the participants agreed to the fact that the texture of the product and the consistency was comfortable while almost 43% were of the view that the texture was too light. The same perception, when tested for Retinol gave the results that almost 80% of the participants agreed for the product texture being comfortable and 14% agreed to it being too light. Almost 62% of the participants voted for the perception that the product caused slight improvement in the pigmentation conditions while 6% saw a significant improvement in their skin pigmentation levels. In case of Retinol, the percentages were 23.80% and 0%. This means that L-ascorbic Acid is better in curing skin pigmentation problems than Retinol. The author of the research was one of them who observed significant effect in skin pigmentation. While 65% of the participants saw no changes in their fine lines, 33% noticed a slight improvement and only 1.58% noticed a significant improvement. 62% of the participants noticed a slight improvement in their skin moisture content when L-Ascorbic acid was used as a topical agent; the same for retinol was reportedly low, at 20.63%; this reveals the fact that L-Ascorbic acid is a better moisturizer than Retinol. Slight improvement in skin texture was reported by 62% of the participants in case of L-Ascorbic acid and almost the same results were obtained on using Retinol as well. The percentage of participants observing significant improvement in their skin texture was, however, lower in case of L-Ascorbic Acid than in Retinol. Both the products were observed to be topically safe when applied on the face; no major cross-reactions were observed except in very sensitive cases.

Reference List

Babamiri, K. and Nassab, R. (2012). Cosmeceuticals: The Evidence Behind the Retinoids. *Aesthetic Surgery Journal*, 30(1), pp.74-77.

Gülçin, I., 2012. Antioxidant activity of food constituents: an overview. *Archives of toxicology*, 86(3), pp.345-391.

Ray, P.D., Huang, B.W. and Tsuji, Y., 2012. Reactive oxygen species (ROS) homeostasis and redox regulation in cellular signaling. *Cellular signalling*, 24(5), pp.981-990.

Siddharth Mukherjee, G. 2018. Retinoids in the treatment of skin aging: an overview of clinical efficacy and safety. [online] PubMed Central (PMC). Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2699641/> [Accessed 30 Jul. 2018].

Skinceuticals-za.com. (2018). [online] Available at: http://www.skinceuticals-za.com/resources/INT_EN/pdf/SCIENCLP_KEYSTUDY_1.pdf [Accessed 30 Jul. 2018].

Telang, P.S., 2013. Vitamin C in dermatology. *Indian dermatology online journal*, 4(2), p.143.

Traikovich, S. 2009. Use of Topical Ascorbic Acid and Its Effects on Photodamaged Skin Topography. *Archives of Otolaryngology–Head & Neck Surgery*, 125(10), p.1091.