



ISSN (E): 2277- 7695

ISSN (P): 2349-8242

NAAS Rating: 5.03

TPI 2020; 9(5): 96-101

© 2020 TPI

www.thepharmajournal.com

Received: 28-03-2020

Accepted: 30-04-2020

KN Satheeshan

Department of Horticulture,
Regional Agricultural Research
Station, Pilicode, Kerala
Agricultural University, Kerala,
India

BR Seema

NAHEP, CAAST Project,
Regional Agricultural Research
Station, Pilicode, Kerala
Agricultural University, Kerala,
India

AV Meera Manjusha

Department of Horticulture,
Regional Agricultural Research
Station, Pilicode, Kerala
Agricultural University, Kerala,
India

Corresponding Author:

KN Satheeshan

Department of Horticulture,
Regional Agricultural Research
Station, Pilicode, Kerala
Agricultural University, Kerala,
India

Development of virgin coconut oil based body lotion

KN Satheeshan, BR Seema and AV Meera Manjusha

Abstract

Beauty and wellness industry are recording a tremendous growth, driven by rising incomes, greater awareness on preventive health care and life style in India. There is a growing trend among consumers searching for traditional healthcare and cosmetic products developed from natural constituents with some degree of pharmaceutical activity. Virgin coconut oil (VCO) is gaining popularity as a functional food supplement, nutraceutical and cosmetic with therapeutic properties. Currently, there is a great deal of research and commercial interest in utilizing VCO for cosmetic formulations. A study was conducted at the Regional Agricultural Research Station, Pilicode for developing a body lotion using virgin coconut oil as the base, along with *Aloe vera*, bee wax, cocoa butter, and fragrance principles. Considering the results obtained in sensory analysis, a combination of body lotion consisting Virgin coconut oil (76%), *Aloe vera* (12%), bee wax (8%), Cocoa butter (2%) and rose oil (2%) was adjudged as best combination which could be recommended for commercial production.

Keywords: Virgin coconut oil, body lotion, bee wax, sensory analysis

Introduction

Health care, beauty and wellness industry in India is recording a tremendous growth driven by rising incomes, greater awareness on preventive health care and life style. The wellness market in India is growing at a rapid pace twice as fast as USA and Europe and over the next few years India will be the second largest consumer market in the world. According to a KPMG report, the size of India's beauty and wellness market was around Rs 80370 crore at the end of 2018. The compounded annual growth rate of this sector has been around 18.0 percent (Ramaswamy *et al.*, 2018) [28].

In recent years, many international cosmetic brands and their products have been introduced in India competing with Indian brands, to address the perceived demand of consumers to look better and younger. In spite of this, there is a growing trend among consumers searching for traditional cosmetic and nutritional products developed from natural constituents with some degree of pharmaceutical activity. Inevitably, there is enormous potential for such 'cosmeceuticals' as their demand is rapidly escalating.

People in the tropical countries have effectively used coconut oil as a traditional moisturizer for centuries. Virgin coconut oil is the purest form of coconut oil with natural distinctive coconut taste and smell. Virgin Coconut Oil (VCO) is extracted from fresh, mature kernel of the coconut by natural means with or without application of heat. Nutritionally, VCO has more beneficial effect than copra oil because it retains most of its functional components. It is rich in vitamin E and antioxidants, and it is easily digestible due to presence of medium chain fatty acids (MCFA).

VCO is unique among all the other vegetable oils because of its high lauric acid content. VCO contains 92% Medium chain fatty acids consisting of 48% -53% lauric acid (C12), 1.5 - 2.5% oleic acid and other fatty acids such as 8% caprylic acid (C: 8) and 7% capric acid (C: 10) (Jiang *et al.*, 1998) [12]. Kabara (1984) [14] reported that lauric acid is the most active antimicrobial fatty acid and that monolaurin is the most effective antimicrobial compound that can be derived from lauric acid. Monolaurin displays antimicrobial activity by disintegrating the lipid membrane of certain bacteria including *Propionibacterium acnes*, *Staphylococcus aureus*, and *Staphylococcus epidermidis* (Preuss *et al.*, 2005) [27]. Coconut oil in concentrations of 5% to 40% (w/w) exhibited bactericidal activity against *Pseudomonas aeruginosa*, *Escherichia coli*, *Proteus vulgaris*, and *Bacillus subtilis* (Oyi *et al.*, 2010) [24]. Cellular studies have also shown that monolaurin exhibits antiviral and antifungal activity (Esquenasi *et al.*, 2002) [8].

Usually, mineral oil is the major ingredient for preparation of moisturizers (Pandiselvam *et al.*, 2019) [25]. Unlike mineral oil, fatty acids present in the coconut (particularly lauric acid) have been found to have antiseptic properties (Kumar *et al.*, 2018) [17] and is more efficient and safe. A natural moisturizer with antiseptic effects has higher consumer appeal in the market. So VCO can be viewed as an ingenious and safe replacement for mineral and petroleum based emollients because of its appreciable contents of skin active ingredients. Anti-ageing properties of VCO are closely related to presence of high amount of antioxidants present in it. The rich Vitamin E content in it prevents premature aging and maintains the vitality of the body. When VCO is used as a base in topical applications such as cream or lotion it can perform anti-ageing functions.

VCO is one of the natural skin moisturizers which can prevent tissue damage and provide protection to the skin. VCO does not cause skin irritation and can be applied even to the most sensitive skin. Clinical studies have revealed that VCO is effective and safe to use as a moisturizer and can improve skin hydration and accelerate healing in the skin. It reduces skin disorders by moisturizing and soothing the skin (Sahle, *et al.* 2015) [30]. Hence, one of the major applications of VCO is in the formulation of hypoallergenic cosmetics and skin care products (Agero and Verallo-Rowell, 2005) [1].

VCO is the best possible remedy to various skin ailments. The presence of fatty acids (especially lauric and oleic acid) in VCO softens the skin enhancing penetration potential (Kang *et al.*, 2006) [15]. The emollient effect of Virgin coconut oil has been successfully demonstrated in atopic dermatitis patients, thereby showing that coconut oil is a potent natural emollient to be used in treatment of xerosis. In a study conducted by Aziz *et al.* (2013) [3] to compare the difference between body lotion containing VCO-Solid lipid particles (SLPs) and lotion without VCO-SLPs, it was concluded that moisturizing lotion incorporated with VCO-SLPs was found to increase skin hydration and skin elasticity by 24.8% and 2.60% respectively from day 0 to day 28. VCO is the best skin care choice especially for babies, because it is natural and free from all chemical formulations and assures good protection to the baby skin. In a clinical trial with pediatric patients having mild to moderate atopic dermatitis, topical application of VCO for eight weeks was superior to that of mineral oil (Evangelista *et al.*, 2014) [9]. This shows that VCO solid lipid particles have the potential to be utilized as a carrier for improved dermal delivery of body lotions. Therefore, VCO could be useful in treating skin disorders with permeability barrier dysfunction, especially those accompanied by reduced epidermal protein expression, such as atopic dermatitis and eczema.

Topical application of virgin coconut oil also protects the skin from UV radiation. Varma *et al.* (2019) [38] evaluated the effect of VCO on skin hydration and barrier function on UV protection potential of VCO. The results indicated the anti-inflammatory activity of VCO by suppressing inflammatory markers and protecting the skin by enhancing skin barrier function. The study concluded that topical application of VCO bring anti inflammatory activity and improves skin barrier function by protecting against Ultra Violet B irradiation. The results warrant the use of VCO in sun screen skin care formulations.

There are several indigenous plant-based fats and oils or their derivatives with interesting bioactive properties that are increasingly recognized for their effects on both skin care and

the restoration of cutaneous homeostasis. Preparations for topical applications combining plant oils and bio active compounds may have a complimentary effect on the skin according to their composition and constituents. When applied topically, constituents of plant oils (triglycerides, FFAs, phenolic compounds and antioxidants) may act synergistically by several mechanisms:

- I. promoting skin barrier homeostasis;
- II. anti-oxidative activities;
- III. anti-inflammatory properties;
- IV. anti-microbial properties;
- V. promoting wound healing;
- VI. anti-carcinogenic properties (Lin *et al.*, 2015).

Literature survey reveals the potential for supplemental use of certain important bioactive compounds from plants along with VCO for their antimicrobial and anti-inflammatory activity, in curative and protective topical formulations. A combination of such constituents from plants with high percentage of tocopherols, phytosterols and triterpenes significantly reduce wrinkles and roughness of the skin (Mandawgade and Vandana, 2008) [21]. Moisturizing creams and lotions with VCO as base and containing such biocompatible compounds have high oxidative resistance. There is enough potential to develop skin care products using these plant-based compounds for dermatological treatments. Adding attractive or therapeutic fragrances either through the use of essential oils or by oil infusion will enhance its marketability as a skin conditioner.

Aloe vera is one of the richest natural sources of medicinal principles widely used in Ayurvedic, Homoeopathic and Allopathic streams of medicine (Serrano *et al.*, 2006). Traditionally, *Aloe vera* gel is used both topically as a skin tonic, and internally to treat various ailments such as constipation, ulcers, coughs, diabetes, arthritis, immune-system deficiencies and urinary complaints (Pathak and Sharma, 2017) [26]. *Aloe vera* leaf gel contains more than 200 different biologically active compounds including Sterols, proteins, lignin, polysaccharides, vitamins, minerals, enzymes, amino acids, anthraquinones and saponins having emollient, anti inflammatory, antioxidant, antiseptic and anticancer properties (Mahor and Ali, 2016, Pathak and Sharma, 2017) [19, 26]. Presence of minerals like calcium, magnesium, zinc, vitamins like A, B12, C, E and essential fatty acids make it a miracle beauty herb and an important component of cosmetics and skin care products.

The Aloe gel also acts as a moisturizing agent and gives a cooling effect to the skin. Empirical evidences validate the quality of this plant as a skin tonic and its potential to treat skin diseases. In clinical studies for treatment of dry skin associated with occupational exposure, *Aloe vera* gel improved the skin integrity, decreased appearance of fine wrinkle and erythema (West and Zhu, 2003) [39]. The anti-inflammatory activity of *Aloe vera* gel has been revealed in a number of studies through bradykinase activity (Che *et al.*, 1991) [7]. Topical application of the gel keeps the skin moist in harsh and dry weather and prevents forming flaky scalp and skin (Barcroft *et al.*, 2003) [4]. Mucopolysaccharides present in it help in binding moisture into the skin and softens it (Surjushe *et al.* 2008) [36]

Aloe vera is useful for the healing of first to second degree burns and wounds (Maenthaisong *et al.* 2007) [18]. Sahu *et al.*, (2013) [31] has reported that the external use of this herb prevents injury of epithelial tissues, accelerates wound

healing, cures acne and gives a youthful glow to skin and primarily acts as skin healer. It also has role in gerontology and rejuvenation of aging skin.

Due to antibacterial and antifungal properties, *Aloe vera* extracts are helpful in the treatment of minor skin infections. It is capable of inhibiting the growth of fungi that cause tinea and is useful in the treatment of boils and benign skin cysts (Shamim *et al.*, 2004) [34]. A processed *Aloe vera* gel preparation inhibited the growth of fungus *Candida albicans* and the inhibitory effect varied with concentration (Shireen *et al.*, 2015) [35]. *Aloe vera* gel can be used as an effective antibacterial agent in order to prevent wound infection caused by *Pseudomonas aeruginosa* (Goudarzi *et al.*, 2015) [11]. Antiseptic properties are due to presence of phenols, lupeol, sulphur, salicylic acid, urea nitrogen and cinnamic acid in the leaf gel which have inhibitory action on fungi, bacteria and viruses. Hence addition of *Aloe vera* to the cosmetic boosts antiseptic property.

The presence of a mixture of glucosides in the leaves of *Aloe vera* collectively known as aloin is the active constituent which is responsible for the skin healing properties (Mahor and Ali, 2016) [19]. Aloin and its gel are effective in curing pimples and rejuvenation of aging skin (Joseph and Raj, 2010) [13]. *Aloe vera* gel has an antioxidant protein, metallothionein, which scavenges hydroxyl radicals and suppress skin burn effect in radiation dermatitis. Use of *Aloe vera* gel have a positive effect on reduction of radiation therapy induced skin reactions and its symptoms and have protective effect against radiation damage to the skin (Marsy, 2013). It protects the skin from UV-induced suppression of delayed type hypersensitivity, (Byeon *et al.*, 1988) [6] and has been scientifically proven remedy for thermal, or solar radiation (Korac and Khambolija, 2011) [16] and hence can be included in sun screen lotion.

There are a number of cosmetic products in the market in which *Aloe vera* is a major constituent. *Aloe vera* gel, cream or lotion applied on the face forms a delicious cover that helps to shield the skin from dust and other elements injurious to the skin (Rawlings and Harding, 2004) [29]. Combined with other functional compounds and selected essential oils for fragrance, it makes an excellent product that may be used post-showering to obtain the skin in super soft shape. Due to its soothing and cooling qualities, it is suitable for formulating a whole range of beauty products.

Cocoa butter is the byproduct of cocoa bean processing industry and is obtained from the mature beans of *Theobroma cacao* pods. Cocoa butter contains a high proportion of saturated fat, palmitic acid and trace amounts of caffeine and theobromine. It also contains fat soluble antioxidants such as vitamin E in the form of β -tocopherol, α -tocopherol and γ -tocopherol and helps in its storage and impart an anti-ageing effect. Cocoa butter enjoys a reputation as one of the best skin moisturizers in the market. Its rich texture and high concentration of oleic acid make it a popular body moisturizer (Sethi *et al.*, 2016) [33]. Due to its moisturizing and antioxidant properties, cocoa butter is widely used in the formulations of cosmetics and soaps (Nayak and Kumar, 2014) [23].

Beeswax is a natural compound secreted by bees and is widely used as a supportive ingredient in cosmetic and pharmaceutical formulation. Since ancient times, the basic recipe for creams and ointments consisted of a mixture of beeswax and oil in various proportions according to the desired consistency. Beeswax is mainly composed of a mixture of hydrocarbons, free fatty acids, monoesters,

diesters, triesters, hydroxy monoesters, hydroxy polyesters, fatty acid polyesters, and some unidentified compounds (Maia and Nunes, 2013) [20]. These natural ingredients help retain moisture in the skin and reduce dryness.

Beeswax also contains small amounts of natural antibacterial agents and can help prevent a painful inflammation that comes with an infection. Beeswax is vitamin-rich, containing plenty of vitamin A, which helps to improve wound healing, reduces wrinkles, protects the skin against UV radiation, and stimulates skin cells turnover (Fratini *et al.*, 2016) [10]. Beeswax has anti-inflammatory and healing properties, which is one of the reasons why it is widely used in cosmetic and pharmaceutical products (Al-Waili, 2003., Fratini *et al.*, 2016) [2, 10]. Beeswax has an irritation potential of zero, and a comedogenicity rating of 0 – 2. This means that when beeswax is used in cosmetic formulations in correct proportions, it will facilitate general healing and softening, and will add antiseptic and emollient properties to the cosmetic product and will not cause clogging of the pores (Bogdanov, 2011) [5].

Increasing health consciousness of people and consumer spending on cosmetic products made of natural substances or ingredients for proper nourishment of skin and hair is anticipated to propel the demand for virgin coconut oil based health care products. Emulsions and lotions offer the researcher a great degree of formulation flexibility in modification of characteristics such as viscosity, feel and appearance. Lotions allow otherwise incompatible ingredients such as butters, oils, fats and fragrance to be brought together in the same product to be applied to the skin in an aesthetically pleasing fashion. Body lotion prepared using natural raw materials like virgin coconut oil as base with a combination of bee wax, cocoa butter, *Aloe vera* and other ingredients can achieve these objectives. By combining these ingredients we can develop an excellent lotion which will be a great natural skincare product that will be beneficial for the consumers. Keeping these points in view, the present study was undertaken to develop virgin coconut oil based body lotion at the NAHEP- CAAST project centre of Regional Agricultural Research Station, Kerala Agricultural University, Pilicode, Kasaragod district, Kerala, India.

Materials and Methods

The purpose of this study was to determine the ideal combination of constituents and their proportion in the formulation for development of a natural body lotion. The raw materials selected for development of body lotion consists of Virgin coconut oil, *Aloe vera*, Bee wax, cocoa butter, and fragrance principles. The fragrance principles tried in the combinations are essential oils from rose, lavender and peppermint. Among the raw materials, VCO was collected from the centre of excellence in value addition, RARS Pilicode, Kasaragod. *Aloe vera* was collected from RARS farms. Bee wax was procured from local bee keeping farmers. Cocoa butter was collected from Cocoa Research Centre, Kerala Agricultural University, Vellanikkara, Thrissur. Essential oils like rose, lavender and peppermint oil were collected from M/S Synthite industries Pvt. Ltd. Kolenchery, Kochi., Kerala.

Combination of ingredients for body lotion

The ingredients used for body lotion are blended in different combinations and proportions. Various ingredients used for body lotion and their formulations tried are provided in Table1.

Table 1: Ingredients used in body lotion blend and formulations

Sl. No.	Ingredients	Abbreviation	Formulation (%)					
			T1	T2	T3	T4	T5	T6
1	Virgin coconut oil	O	66	68	70	72	74	76
2	<i>Aloe vera</i>	A	2	4	6	8	10	12
3	Beeswax	B	18	16	14	12	10	8
4	Cocoa butter	C	12	10	8	6	4	2
5	Fragrance	F	2	2	2	2	2	2

Body lotion was prepared in 6 Combinations. VCO levels tried were 66, 68, 70, 72, 74 and 76 percentage. The fragrances included in the trial were F1: Lavender oil, F2:

Peppermint oil, and F3: Rose oil (as shown in Table 2.) with a uniform 2 percent in all the treatment combinations.

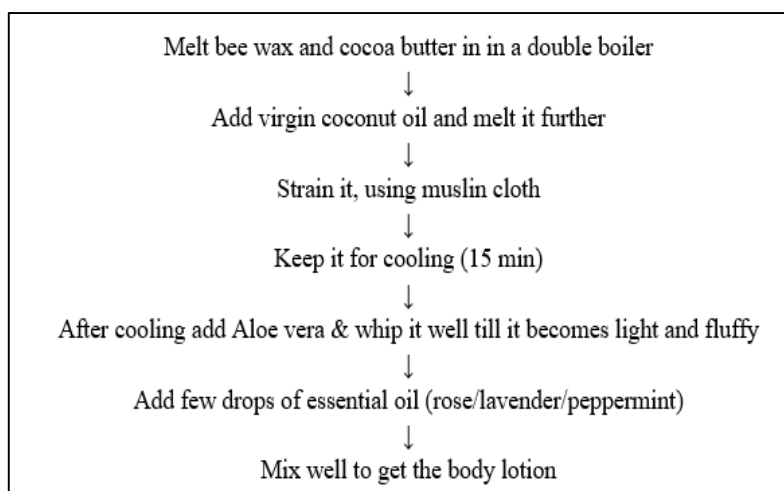
Table 2: Combination treatments for body lotion

Combinations	VCO	<i>Aloe vera</i>	Beeswax	Cocoa butter	Fragrance (F)		
	(O)	(A)	(B)	(C)	F1	F2	F3
T1	66	2	18	12	2	-	-
T2	68	4	16	10	-	2	-
T3	70	6	14	8	-	-	2
T4	72	8	12	6	2	-	-
T5	74	10	10	4	-	2	-
T6	76	12	8	2	-	-	2

Preparation procedure

Flow chart for preparation of body lotion is provided in Fig 1. Place bee wax and cocoa butter in a bowl. Bee wax and coco butter are melt in a stainless-steel vessel adopting double boiling method. When it melts, virgin coconut oil is added to the mixture and melt it further. This molten mixture is strained using muslin cloth still when it is warm and keep it

for cooling for about 15-20 min. When it is cool, add *Aloe vera* and whip it well (using electronic hand beater) till it becomes light and fluffy. Add few drops of essential oil (rose/lavender/peppermint oil) to the resultant lotion. At last give a final mix and body lotion is ready. Fill in transparent containers.

**Fig 1:** Flow chart for preparation of body lotion

Sensory evaluation

The prepared body lotion samples were evaluated for sensory characteristics. A semi-trained panel of 12 judges evaluated the prepared products for colour, appearance, fragrance, texture and overall acceptability on a 9-point hedonic scale.

Statistical analysis

Factorial completely randomised design (FCRD) was adopted for analyzing the data by using Design-Expert software. Statistical significance was examined by analysis of variance (ANOVA) for each response.

Results and Discussion

Different formulations of the body lotion were prepared as per the procedure laid out in the flow chart and all of them are

white in colour and their texture differ from thick to soft based on the combination percentages of the ingredients. Their fragrance also varied according to the essential oils added. The overall appearance was homogenous in nature for all formulations with no visible spots.

The treatments were subjected to sensory analysis for consumer's acceptance. The quality and acceptability of body lotion was judged by a consumer panel team consisting of twelve semi-trained members. The sensory evaluation of the product was performed based on a nine-point hedonic scale for colour, appearance, fragrance, texture and overall acceptability of the developed samples. The result revealed that there were significant differences among the treatment combinations for the organoleptic qualities. Overall acceptability of body lotion varied from 6.83 to 7.98. Analysis

of variance reveals that the overall acceptability of various samples was significant ($p < 0.0001$).

The average scores of body lotion for each parameter were given in Table 3. The best treatment selected by sensory panel

was T6 with an overall acceptability of 7.98 having a combination of O₇₆: A₁₂: B₈: C₂: F(3)₂ i.e., Virgin coconut oil (76%), *Aloe vera* (12%), Bee wax (8%), Cocoa butter (2%) and rose oil (2%).

Table 3: Sensory analysis of body lotion

Combinations	Colour	Appearance	Texture	Fragrance	Overall Acceptability
T1	7.14	6.41	6.11	6.41	6.88
T2	6.05	6.82	6.52	7.24	6.83
T3	6.38	6.52	6.76	6.77	7.21
T4	6.95	7.21	6.69	6.83	6.92
T5	6.72	7.57	6.82	6.41	7.16
T6	7.65	7.75	7.98	7.76	7.98

Attempts were made to develop a product which would have highest score in sensory acceptability so as to get a better market acceptability, Under these criteria, T6 i.e., Virgin coconut oil: *Aloe vera*: cocoa butter: Bee wax: virgin coconut oil: Cocoa butter: rose oil in the ratios of 76:12:8:2:2 was found as optimum (Fig 2). The response was predicted by the Design-Expert 7.0.0 software. Based on optimization and sensory evaluation, T6 sample is selected as a best combination out of all combinations under concern. The prepared lotion formulations were light, non-greasy and liquid dosage form and appears as soft, free flowing with uniform consistency and adhere over the skin as a film. Developed body lotion does not show any sedimentation stored at the room temperature up to three months and has good stability.

Skin contamination is one of the most probable risks with potential health consequences for the people having occupational exposure to various hazards. Many of the skin care products that are available in the market based on chemical formulations are harsh and irritating, even toxic which underlines the need to identify and develop a research protocol for natural products. In this context, the topical body lotion formulation developed in this study assumes significance in reducing the danger of human health risk and polluting the environment. Virgin coconut oil which constitutes a major proportion of the formulation itself acts as a preservative increasing the shelf-life of body lotion and prevents it from microbial degradation. The body lotion developed is free from skin irritancy, has long self-life and is quiet stable and safe.

natural body lotion employing VCO and the ingredients mentioned could be applied in industrial scale and adopted for mass production.

Reference

1. Agero AL, Verallo-Rowell VM. A randomized double-blind controlled trial comparing extra virgin coconut oil with mineral oil as a moisturizer for mild to moderate xerosis. *Dermatitis* 2005; 15(3):109-116.
2. Al-Waili NS. Topical application of natural bee wax and olive oil mixture for atopic dermatitis or psoriasis: partially controlled, single-blinded study. *Complementary Therapies in Medicine*. 2003; 11(4):226-234.
3. Aziz A, Sarmidi M, Aziz R, Norhayati MN. The Effect of Virgin Coconut Oil Loaded Solid Lipid Particles (VCO-SLPs) on Skin Hydration and Skin Elasticity. *Jurnal Teknologi*. 2013; 62:39-43.
4. Barcroft A, Myskja A, Reynolds T. Properties of Stabilized *Aloe vera*. In: Barcroft, A., Myskja, A. and Reynolds, T., Eds., *Aloe vera: Nature's Silent Healer*, BAAM Publishing Ltd., London. 2003, 1-16.
5. Bogdanov S. Functional and Biological Properties of the Bee Products: a Review. *Bee Product Science*, 2011; 1:1-12. www.bee-hexagon.net.
6. Byeon S, Pelley R, Ulrich SE, Waller TA, Bucana CD, Strickland FM. *Aloe Barbadensis* Extracts Reduce the Production of Interleukin-10 after Exposure to Ultraviolet Radiation, *Journal of Investigative Dermatology*, 1988;110:811-817.
7. Che QM, Akao T, Hattori M, Kobashi K, Namba T. Isolation of Human Intestinal Bacteria Capable of Transforming Barbaloin to Aloe-Emodin Anthrone, *Planta Medica*. 1991; 57(1):15-19.
8. Esquenazi D, Wigg MD, Miranda MM, Rodrigues HM, Tostes JB, Rozental S *et al*. Antimicrobial and antiviral activities of polyphenolics from *Cocos nucifera* Linn. (*Palmae*). *Res. Microbiol*. 2002; 153:647-652.
9. Evangelista MTP, Flordeliz AC, Lillian Lopez V. The effect of topical virgin coconut oil on SCORAD index, trans-epidermal water loss, and skin capacitance in mild to moderate paediatric atopic dermatitis: a randomized, double-blind, clinical trial. *International journal of dermatology*. 2014; 53(1):100-108.
10. Fratini F, Cilia G, Turchi B, Felicioli A. Beeswax: A mini review of its antimicrobial activity and its application in medicine. *Asian Pacific Journal of Tropical Medicine*. 2016; 9(9):839-843.
11. Goudarzi M, Fazeli M, Azad M, Seyed Javadi SS, Mousavi R. *Aloe vera* Gel: Effective Therapeutic Agent

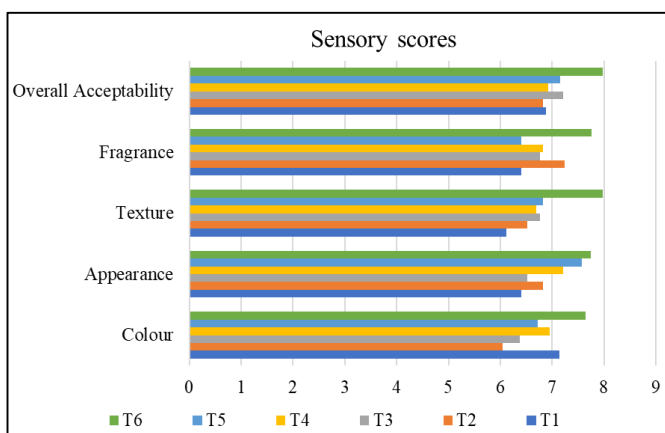


Fig 2: Sensory scores of body lotion

It can be concluded that one of the formulations of the lotion ranked as excellent with a content of VCO at 76 percent along with other ingredients devoid of any preservatives is acceptable. This process technology and formulation for

- against Multidrug-Resistant *Pseudomonas aeruginosa* isolates Recovered from Burn Wound Infections Chemother Res Pract. 639806. Published online 2015 Jul 22. doi: 10.1155/2015/639806.
12. Jiang WG, Bryce RP, Horrobin DF. Essential fatty acids: Molecular and cellular basis of their anti-cancer action and clinical implications. Crit. Rev. Oncol. Hematol., 1998; 27:179-209.
 13. Joseph B, Raj SJ. "Pharmacognostic and Phyto-chemical Properties of *Aloe vera* Linn -An Overview," International Journal of Pharmaceutical Sciences Review & Research. 2010; 4(2):106-110.
 14. Kabara JJ. Antimicrobial agents derived from fatty acids. Fatty Chemical Applications and Analysis, American oil chemists Society. 1984; 61(2):397-403.
 15. Kang L, Ho PC, Chan SY. Interactions between a skin penetration enhancer and the main components of human stratum corneum lipids. J Therm. Anal. Calorim. 2006; 83:27-30.
 16. Korać RR, Khambholja KM. Potential of herbs in skin protection from ultraviolet radiation. Pharmacogn. Rev. 2011; 5(10):164-173.
 17. Kumar GP, Lakshmi NVSS, Deena C, Bhavani B, Kumar PR. Facts about Virgin Copra Oil: Chemistry, Production - A Review on Potential Applications and Functional Properties. Haya: The Saudi Journal of Life Sciences, 2018, 624-633.
 18. Maenthaisong R, Chaiyakunapruk N, Niruntra S. The Efficacy of *Aloe vera* for Burn Wound Healing: A Systematic Review. Burns. 2007; 33(6):713-718.
 19. Mahor G, Ali SA. Recent update on the medicinal properties and use of *Aloe vera* in the treatment of various ailments. Biosci. Biotech. Res. Comm. 2016; 9(2):273-288.
 20. Maia M, Nunes FM. Authentication of beeswax (*Apis mellifera*) by high-temperature gas chromatography and chemometric analysis. Food Chemistry. 2013; 136(2):961-968.
 21. Mandawgade SD, Vandana BP. Formulation and Evaluation of Exotic Fat Based Cosmeceuticals for Skin Repair. Indian J Pharm Sci. 2008; 70(4):539-542.
 22. Weheida SM, Riad NA, Masry SE. The Effect of Skin preparation by Using *Aloe vera* Gel on Incidence of Skin Reactions among Breast Cancer Patients Undergoing Radiation Therapy. Biology, Agriculture and Healthcare, 2013; 3(15):130-145.
 23. Nayak B, Kumar V. Cocoa Butter and Its Alternatives: A Review. Journal of Bioresource Engineering and Technology. 2014; 1:7-17
 24. Oyi AR, Onaolapo J, Obi RC. Formulation and Antimicrobial Studies of Coconut (*Cocos nucifera* Linne) Oil. Res. J Appl. Sci. Eng. Technol., 2010; 2:133-137.
 25. Pandiselvam R, Ramarathinam M, Beegum S, Mathew AC. Virgin Coconut Oil infused healthy cosmetics. Indian Coconut Journal. 2019; 13:30-32.
 26. Pathak D, Sharma R. Review On *Aloe vera*- Medicinal Plant. International Journal of Advance Research and Innovative Ideas in Education (IJARIE), 2017; 3(1):661-671.
 27. Preuss HG, Echard B, Enig M, Brook I, Elliott TB. Minimum inhibitory concentrations of herbal essential oils and monolaurin for gram-positive and gram-negative bacteria. Mol. Cell. Biochem. 2005; 272:29-34.
 28. Ramaswamy N, Vilvarayanallur N, Kumar G. Human resource and skill requirements in beauty and wellness sector (2017-2022), KPMG, National skill development corporation, Govt of India, 2018.
 29. Rawlings AV, Harding CR. Moisturization and skin barrier function. Dermatologic Therapy. 2004; 17(1):43-48.
 30. Sahle FF, Gebre-Mariam T, Dobner B, Wohlrab J, Neubert RH. Skin diseases associated with the depletion of stratum corneum lipids and stratum corneum lipid substitution therapy. Skin Pharmacol. Physiol., 2015; 28:42-55.
 31. Sahu PK, Giri DD, Singh R, Pandey P, Gupta S, Shrivastava AK *et al.* Therapeutic and Medicinal Uses of *Aloe vera*: A Review Pharmacology & Pharmacy. 2013; 4:1-13.
 32. Serrano M, Valverde JM, Guillen F, Castillo S, Martinez-Romero D, Valero D. Use of *Aloe vera* gel coating preserves the functional properties of table grapes. Journal of Agriculture and Food Chemistry. 2006; 54(11):3882-3886.
 33. Sethi A, Kaur T, Malhotra SK, Gambhir ML. Moisturizers- the slippery road: Indian Journal of Dermatology. 2016; 61(3):279-287.
 34. Shamim S, Ahmed S, Waseemuddin, Iqbal A. Anti fungal activity of *Allium*, *Aloe*, and *Solanum* species". Pharmac. Biol. 2004; 42:491-498.
 35. Shireen F, Manipal S, Prabu D. Anti-fungal activity of *Aloe vera*: *In vitro* study. SRM Journal of Research in Dental Sciences. 2015; 6(2):92-95.
 36. Surjushe A, Vasani R, Saple DG. *Aloe vera*: A Short Review- Indian J Dermatol. 2008; 53(4):163-166.
 37. Lin TK, Zhong L, Santiago JL. Anti-Inflammatory and Skin Barrier Repair Effects of Topical Application of Some Plant Oils. International journal of molecular sciences. 2018; 19(1):70 doi:10.3390/ijms19010070.
 38. Varma SR, Thiyagarajan O, Ilavarasu S, Arumugam N, Dilip M, Raghuraman K *et al.* *In vitro* anti-inflammatory and skin protective properties of Virgin coconut oil. J Tradit. Complement Med. 2019; 9(1):5-14.
 39. West DP, Zhu YF. Evaluation of *Aloe vera* gel gloves in the treatment of dry skin associated with occupational exposure. Amer. J Infect. Control. 2003; 31:40-2.