SKIN BALMS: A SMALL STEP TOWARDS CLEAN AND GREEN SKIN AND BODY CARE

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Abstract

Moisturizers are available in different forms ranging from creams, lotions, gels, ointments to balms. They help strengthen the skin and serve as a protective barrier to shield the skin against dryness, itchiness, and irritation as they contain wax. The present study provides an overview of the process of formulating and analyzing skin balms. The main objective was to create, study and analyses various properties of skin balm formulation and their impact on the skin. This was an experimental study on the formulation of five different skin balms using jojoba oil, olive oil, beeswax and emulsifying wax and analyzing the changes that occurred by manipulating the quantities of the ingredients added. Changes in the skin elasticity, moisture content of the skin and overall skin appearance were tested with the use of different laboratory equipment such as cutometer, moisture meter and visiometer respectively. pH and viscosities of various formulations were also noted. Their effects on the skin were recorded after ten minutes and one hour.

Keywords: *Skin Balm. Jojoba Oil, Olive Oil, Beeswax, Emulsion Wax, Cutometer, Moisture Meter, Visiometer.*

Introduction

Skin is the body's largest organ, constantly exposed to environmental conditions, and is a crucial defense allowing survival in the desiccating terrestrial environment. The primary function of the skin is to protect the body against exogenous substances and excessive water loss. Urbanization, pollution, longer life expectancy, and the decline of traditional oil massages and baths are causing a significant rise in dry skin conditions. Dryness results from change in the epidermis chemistry and morphology variations due to internal and external stresses. (Loden M, 2005) Recently, there has been a surge in demand for holistic skin care products, with moisturizers being a popular recommendation in dermatology. It is common for individuals to utilize various types of moisturizers at different stages of their life. (Sethi et al.,2016)

Applying oily substances to the skin has been a human instinct for centuries. Many moisturizers are available nowadays, ranging from creams, lotions, gels, and ointments to balms. These products have a common purpose, their formulas and intensities may vary. Oils, balms, and lotions help to strengthen and protect the skin's natural barrier. Healthy fats and lipids are essential for building strong, moisturized skin cells because they act as emollients and occlusives, filling crevices between cells and retaining moisture. The harmonious blend of water and oil in creams effectively nourishes and moisturizes the skin, enhancing the epidermis's overall health. Balms on the other hand primarily serve as a protective barrier to shield the skin against dryness, itchiness, and irritation through the wax they contain.

Skin balms designed for moisturizing are superior to lotions or creams. They offer a richer and more luxurious texture, delivering deep hydration, nourishment, and a protective layer that soothes and smooths dry and rough skin. Vegetable oil is expertly blended with wax or natural butter when crafting balms to create an anhydrous formula. Due to the lack of water, balms do not need preservatives and can stay fresh for up to a year. (or longer if refrigerated) (Gaia Herbs, n.d.).

Many cosmetic industries are trying to make skin balms from organic products with natural preservatives. Hence, this study was carried out to evaluate the physical properties of five different formulations of skin balms and their effects on the skin. These balms were formulated using organic natural products like jojoba oil, olive oil, vitamin E, beeswax, emulsion wax, water, and papaya banana fragrance.

Material and Methodology

These skin balms were formulated with carefully selected ingredients, such as jojoba oil, olive oil, vitamin E, beeswax, emulsion wax, water, and papaya banana fragrance. Each component was chosen for its unique characteristics to ensure the desired results in a product that sets, is viscous, and has a smooth consistency.

In the present study five different formulations of skin balm were prepared. Through meticulous consideration, every ingredient in the skin balm was selected to ensure it possesses the optimal characteristics for promoting healthy skin. The aim of this study is to select the best formulation out of the 5.

Method

S.No.	Ingredient	Function	Sample 1 / 100 g	Sample 2 / 100 g	Sample 3 /100 g	Sample 4 / 100 g	Sample 5 / 100 g
1	Jojoba oil	Hydrating and moisturizing agent	85	60	42.5	32.5	60
2	Olive oil	Hydrating and moisturizing agent	-	15	42.5	32.5	15
3	Emulsifying wax	Thickening agent	-	5	5	13	5
4	Beeswax	Smoothing agent /thickener	-	15	5	7	15
5	Vitamin E	Antioxidant	1.5	1.5	1.5	1.5	1.5
6	Water	Solvent	2	2	2	2	2
7	Papaya banana fragrance	Fragrance	1.5	1.5	1.5	1.5	1.5
8	Span 80	Emulsifying agent thickening agent	10	-	-	-	-
Total			**100**	**100**	**100**	**100**	**100**

Table: Master table for all the Sample's Formulation

Equipment Required:

1. Weighing balance
2. Measuring plates
3. Spatula (large and small)
4. Weighing scale
5. Plastic droppers
6. 20 ml, 100 ml and 200 ml breakers
7. Glass rods
8. 100 ml plastic or glass jars
9. Hand blender

Method:
Step 1: All the ingredients were measured according to the specified amount using a well calibrated scale.
Step 2: Both weighed waxes are added to an evaporating dish and then were melted in a Water bath and added to the Phase B beaker.
Step 3: The ingredients from Phase B were combined and added to the 200 ml beaker.
Step 4: Phase A was added to a 200ml beaker along with Phase B.
Step 5: The combination was then blended with a hand blender until both phases were Homogenized.
Step 6: The homogenized mixture was poured into a plastic jar and left to solidify.

A descriptive analysis of the data collected was made and it was found that the five formulations of skin balm had variable effects on the skin.

Organoleptic Evaluation:
It is the testing of organoleptic characteristics, such as their external appearance, color, texture, phase separation, homogeneity, and initial skin sensation in this case for a topical formulation. This is a subjective analysis based on the testers perception and is therefore biased.

Formulation	Physical Appearance	Color	Texture	Phase Separation	Homogeneity	Immediate Skin Feel
Sample 1	Transparent	Yellow	Smooth	No	Homogeneous	Very oily and heavy
Sample 2	Opaque	Yellow	Smooth	No	Homogeneous	Moisturizing, no grittiness
Sample 3	Opaque	Yellow	Smooth	No	Homogeneous	Moisturizing, no grittiness
Sample 4	Opaque	Yellow	Smooth	No	Homogeneous	Moisturizing, no grittiness
Sample 5	Opaque	Yellow	Smooth	No	Homogeneous	Moisturizing, no grittiness

Table: Organoleptic Evaluation of all formulated Samples

All samples were yellow and smooth in texture with no phase separation and were also homogenous. Except for sample 1, which was transparent in appearance and appeared very oily and heavy all other samples were opaque, less oily and not gritty. (Table 6)

Spreadability:
Spreadability can only be calculated in a semisolid formulation, the values refer to the extent to which the formulations readily spread on the application surface by applying a small amount of shear.

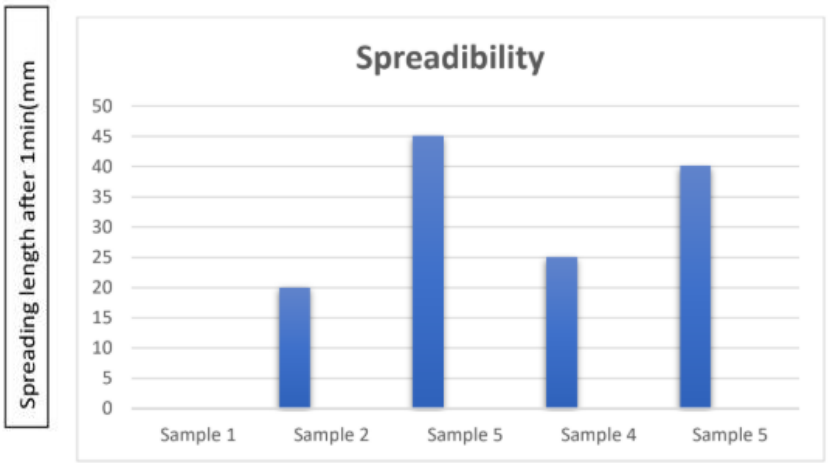

Figure: Spreadability values for the formulated skin balms

The samples were placed between two slides and the speadibilty was calculated with help of a ruler.
As sample 1 was very oily and did not set spreadibility could not be calculated. Spreadibility of sample 3 was the highest (45mm) followed by Sample 5 (40mm) Sample 4(25mm) and Sample 2 (20mm).

pH Values:
The pH of the skin normally ranges from 4 to 6. The pH of any balm ideally should be between 4 to 6. The pH of sample 5 was the lowest (5.05) followed by Sample 4(5.13) then by Sample 1 (5.32), Sample 3 (5.38) and sample 2 (5.53) had the highest pH. All the pH records were within the set limits.

Formula	pH
Sample 1	5.32
Sample 2	5.53
Sample 3	5.38
Sample 4	5.13
Sample 5	5.05

Table: pH of all formulated samples

Viscosity:
Viscosity values are plotted in the graph below. All product behavior as expected Sample 1 has the lowest viscosity since it didn't set like a balm others had varied viscosities measured with 65-gauge spindle. Sample 5 was the most viscous followed by sample 3, sample 4 and sample 2.

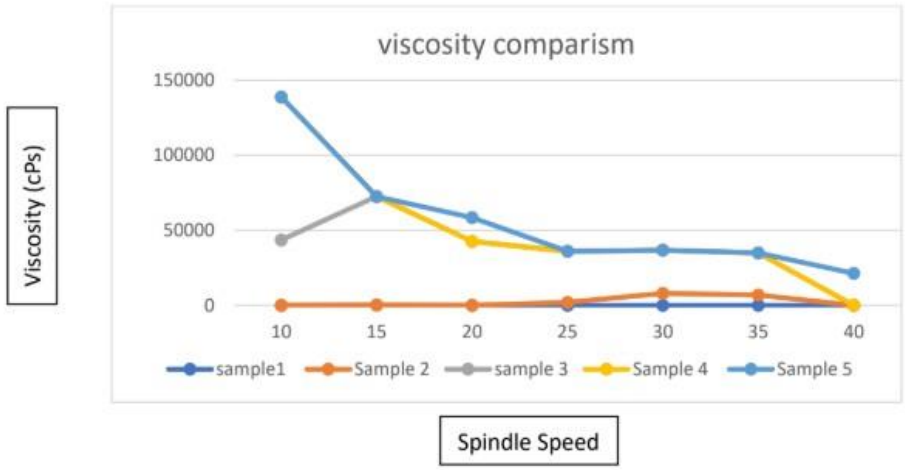

Figure: Viscosity comparison of 5 sample viscosity calculated by Brookfield viscometer

Cutometer:
The cutometer measures many aspects of skin elasticity but the present study focuses on 3 factors:
R0 = Uf (mm): This parameter correlates to skin firmness.
R7 = Ua/Ua (%): This parameter correlates to the skin elasticity.
R2 = Ur/Uf (%): This parameter correlates to elastic recovery.
The closer to the 1 the value better the condition of the skin.

The test was conducted on the forearm, where 4 square boxes were created and labelled C A B E. the forearm was washed and dried and then the samples were applied. All the different samples were applied 1 day after the other and no other products were used in between the tests. The above mentioned parameters were then observed immediately after application 10 min after application and 1 hour after application.

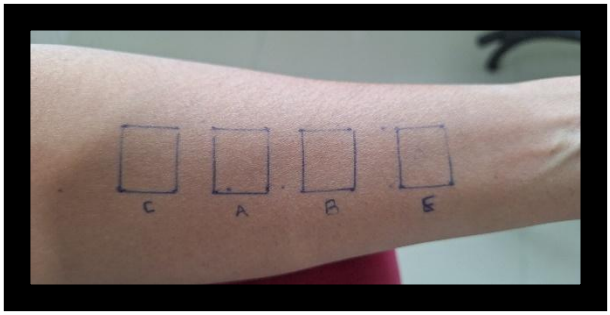

Figure: Forearm test

The results are as follows:
Sample 1
Sample 1(before)

R0	0.678	0.6490	0.6230	**0.65**
R7	0.9218	0.7996	0.8299	**0.8504**
R2	0.9587	0.8675	0.8989	**0.9083**

Table: Cutometer reading before application of Sample 1

Sample 1 (after 10 min)

R0	0.753	0.871	0.755	**0.793**
R7	0.8429	0.9288	0.9228	**0.8961**
R2	0.935	0.939	0.933	**0.93553333**

Table: Cutometer reading after 10 minutes of application of Sample 1

Sample 1(after 1hour)

R0	0.936	0.985	1.069	**0.99666667**
R7	0.8606	0.9116	0.9046	**0.8922**
R2	0.765	0.886	0.901	**0.8507**

Table: Cutometer reading after 1 hour of application of Sample 1

Sample 1	**% change after 10 min**	**% change after 1 hour**
R0	+22%	+53.32%
R7	+5.37%	+4.41%
R2	+2.99%	-0.8507%

Table: Percentage change calculation of change seen in reading after 10 minutes and 1 hour of application of sample 2

As seen in the tables for sample 1 it shows improvement in skin firmness i.e. **R0** increased but **22%** within 10 minutes after application and further increased to **53.32%** 1 hour after application.

For skin elasticity i.e**. R7** there was an increase in elasticity but not very significantly after 10 minutes of application it increase by a menial **5.37%** and after an hour it reduced to a mere **4.41%** overall.

For the elastic recovery **R2** elastic recovery of the skin even though there was an increase in elastic recovery by **2.99%** but then reduces to **0.857%** which is a reduction from the original elastic recovery.

Sample 2:

Sample 2 (before)

R0	0.936	0.985	1.069	**0.99666667**
R7	0.6250	0.8765	0.8589	**0.7868**
R2	0.765	0.886	0.901	**0.8507**

Table: Cutometer reading before application of Sample 2

Sample 2(After 10 min)

R0	0.812	0.804	0.774	**0.79666667**
R7	0.8966	0.8831	0.8127	**0.8641**
R2	0.945	0.952	0.917	**0.9378**

Table: Cutometer reading after 10 minutes of application of Sample 2

Sample 2 (After 1 hour)

R0	0.944	0.887	0.941	**0.924**
R7	0.9333	0.9391	0.9330	**0.9351**
R2	0.96	0.972	0.967	**0.9662**

Table: Cutometer reading after 1 hour of application of Sample 2

Sample 2	**% change after 10 min**	**% change after 1 hour**
R0	+15.98%	+25.96%
R7	+9.82%	+18.84%
R2	+10.23%	+13.57%

Table: Percentage change calculation of change seen in reading after 10 minutes and 1 hour of application Sample 2

Sample 2 gave promising results for skin firmness **R0** was increased by **15.98%** after 10inutes of application and further increased to **25.96%** after 1hour application which is an overall increase.

For **R7** which relates to skin elasticity which showed an increase of **9.82%** and after an hour increased to **18.84%** in skin elasticity which is a good overall improvement.

Lastly for **R2** which is elastic recovery of skin which also showed increase by **10.23%** with 10 minutes and further increased to **13.57%** overall after an hour of application.

Sample 3

Sample 3 (before)

R0	0.996	0.662	0.658	0.772
R7	0.8645	0.8958	0.9134	0.8912
R2	0.887	0.944	0.959	0.93

Table: Cutometer reading before application of Sample 3

Sample 3 (After 10 min)

R0	0.987	0.925	0.961	0.95766667
R7	0.9256	0.8971	0.8877	0.9034
R2	0.985	0.969	0.974	0.9758

Table: Cutometer reading after 10 minutes of application of Sample 3

R0	0.987	0.925	0.961	0.95766667
R7	0.9256	0.8971	0.8877	0.9034
R2	0.985	0.969	0.974	0.9758

Sample 3 (After 1 hour)

Table: Cutometer reading after 1 hour of application of Sample 3

Sample 3	**% change after 10 min**	**% change after 1 hour**
R0	+23.96%	+7.12%
R7	+1.3%	+6.05%
R2	+4.92%	+2.322%

Table: Percentage change calculation of change seen in reading after 10 minutes and 1 hour of application Sample 3

For sample 3 the increase in the values was not very significant even though the **R0** was increased **23.96%** with 10 minutes of application the number reduced after that after 1 hour o truces to an overall to **7.12%.**
The **R7** value after 10 minutes of application it increases by just **1.3%** and after an hour it increased to **6.05%** overall in skin elasticity and the **R2** value after 10 minutes was increased to **4.92%** but after an hour it reduced to an **2.32%** overall increase which is not very significant.

Sample 4

Sample 4 (before)

R0	0.731	0.789	0.719	0.74633333
R7	0.9371	0.9620	0.9263	0.9418
R2	0.966	0.984	0.958	0.9692

Table: Cutometer reading before application of Sample 4

Sample 4 (after 10 min)

R0	0.935	0.874	0.856	0.88833333
R7	0.9024	0.8624	0.9077	**0.8908**
R2	0.97	0.962	0.958	**0.9634**

Table: Cutometer reading after 10 minutes of application of Sample 4

Sample 4 (After 1 hour)

R0	0.822	0.865	0.802	**0.82966667**
R7	0.9412	0.9336	0.9276	**0.9341**
R2	0.943	0.93	0.953	**0.9416**

Table: Cutometer reading after 1 hour of application of Sample 4

Sample 4	% change after 10 min	% change after 1 hour
R0	**+19.03%**	**+11.20%**
R7	**-5.41%**	**-0.81%**
R2	**-0.59%**	**-2.84%**

Table: Percentage change calculation of change seen in reading after 10 minutes and 1 hour of application Sample 4

Sample 4 didn't show promising results even though the **R0** showed improvement by an increase in skin firmness by **19.03**% and after an hour it showed an **11.20%** increase in firmness overall. But for the **R7** and **R2** reduced by **5.41%** and **0.59%** with 10 minutes of application respectively and **0.81%** and **2.84**% reduction in skin elasticity and elastic recovery respectively.

Sample 5:

Sample 5 (before)

R0	0.864	0.91	0.835	0.86966667
R7	0.9410	0.9615	0.9557	**0.9527**
R2	0.964	0.978	0.974	**0.97193333**

Table: Cutometer reading before application of Sample 5

Sample 5 (after 10 min)

R0	1.043	0.974	0.885	**0.96733333**
R7	0.9034	0.9444	0.9381	**0.9286**
R2	0.966	0.961	0.968	**0.96526667**

Table: Cutometer reading after 10 minutes of application of Sample 5

Sample 5 (After 1 hour)

R0	0.818	0.864	0.84	**0.84066667**
R7	0.9444	0.9384	0.9469	**0.9432**
R2	0.941	0.968	0.963	**0.95733333**

Table: Cutometer reading after 1 hour of application of Sample 5

Sample 5	% change after 10 min	% change after 1 hour
R0	**+11.2%**	**-3.33%**
R7	**-2.52%**	**-0.99%**
R2	**-0.68%**	**-0.95%**

Table: Percentage change calculation of change seen in reading after 10 minutes and 1 hour of application Sample 5

The results for sample 5 were not great. There was an **11.2%** increase in the **R0** value after 10 minutes of application was reduced by **3.33%** and the **R7** value was reduced by **2.52%** after 10 min of application and **0.99%** after 1 hour. The **R2** value was also reduced by **0.68%** after minutes and **0.95%** after 1 hour.

Moisture meter

The Moisture MeterSC is a skin moisture measuring device that utilizes a capacitive structure.

Temperature: 23.5 C; Humidity: 24%

Before sample 1			
Reading 1	**Reading 2**	**Reading 3**	**Mean**
47.8	**33.4**	**45.7**	**42.3**

Table: Moisture meter reading before application of sample 1

Before sample 2			
Reading 1	**Reading 2**	**Reading 3**	**Mean**
35.0	**35.1**	**38.6**	**36.23**

Table: Moisture meter reading before application of sample 2

Before sample 3			
Reading 1	**Reading 2**	**Reading 3**	**Mean**
30	**32.5**	**36.7**	**33.06**

Table: Moisture meter reading before application of sample 3

Before sample 4			
Reading 1	**Reading 2**	**Reading 3**	**Mean**
35.1	**35.1**	**38.2**	**36.13**

Table: Moisture meter reading before application of sample 4

Before sample 5			
Reading 1	**Reading 2**	**Reading 3**	**Mean**
28.9	**30.2**	**35.2**	**31.4**

Table: Moisture meter reading before application of sample 5
Temperature: 22.8; Humidity: 30%

After 10 min sample 1			
Reading 1	**Reading 2**	**Reading 3**	**Mean**
37.4	**42.4**	**39.6**	**39.8**

Table: Moisture meter reading after 10 minutes of application of sample 1

After 10 min sample 2			
Reading 1	**Reading 2**	**Reading 3**	**Mean**
50.7	**39.8**	**32.8**	**41.1**

Table: Moisture meter reading after 10 minutes of application of sample 2

After 10 min sample 3			
Reading 1	**Reading 2**	**Reading 3**	**Mean**
36.8	**34.2**	**32.4**	**34.46**

Table: Moisture meter reading after 10 minutes of application of sample 3

After 10 min sample 4			
Reading 1	**Reading 2**	**Reading 3**	**Mean**
34.1	**36**	**37.1**	**36.4**

Table: Moisture meter reading after 10 minutes of application of sample 4

After 10 min sample 5			
Reading 1	**Reading 2**	**Reading 3**	**Mean**
38.4	**30.2**	**29.8**	**32.8**

Table: Moisture meter reading after 10 minutes of application of sample 5

After 10 min of application the change in moisture percentage was:
Sample 1 the moisture content decreased by **5.91%.**
Sample 2 the moisture content was increased by **31.44%.**
Sample 3 the moisture content was increased by **4.23%.**
Sample 4 the moisture content was increased by **0.74%**
Sample 5 the moisture content increased by **4.45%.**
The formula used for calculation these **percentage** used the **mean of the 3-reading** taken for **reducing errors:**
V2: the reading after 10 min
V1: readings before application
$$(V2-V1)|V1|\times 100$$

Temperature: 21.7; Humidity: 31%

After 1 hour sample 1			
Reading 1	**Reading 2**	**Reading 3**	**Mean**
35.4	**39.4**	**43.5**	**39.4**

Table: Moisture meter reading after 1 hour of application of sample 1

After 1 hour sample 2			
Reading 1	**Reading 2**	**Reading 3**	**Mean**
40.3	**39.9**	**38.2**	**39.46**

Table: Moisture meter reading after 1 hour of application of sample 2

After 1 hour sample 3			
Reading 1	**Reading 2**	**Reading 3**	**Mean**
32.9	**32.8**	**32.8**	**32.8**

Table: Moisture meter reading after 1 hour of application of sample 3

After 1 hour sample 4			
Reading 1	**Reading 2**	**Reading 3**	**Mean**
26	**24.3**	**37.2**	**29.1**

Table: Moisture meter reading after 1 hour of application of sample 4

After 1 hour sample 5			
Reading 1	**Reading 2**	**Reading 3**	**Mean**
29.1	**34.4**	**32.8**	**32.1**

Table: Moisture meter reading after 1 hour of application of sample 5

After 1 hour of application the change in moisture percentage was:
Sample 1 the moisture content was decreased by **7.36%.**
Sample 2 the moisture content was increased by **8.91%.**
Sample 3 the moisture content was decreased by **0.78%.**
Sample 4 the moisture content was decreased by **11.97%**
Sample 5 the moisture content was increase by **2.22%.**
The formula used for calculation these **percentage** was used the **mean of the 3 reading** taken for **reducing errors:**
V2: the reading after 1 hour.
V1: readings before application.
(V2−V1)|V1|×100

Visiometer:

This test is used to identify skin topography directly from the skin using a special UV-A light video camera with high resolution. It has been developed specifically to study the skin surface directly.
Sample 1 was applied to the skin in patches and was scanned before application, after 10 minutes of application and after 1 hour of application.
After completion of the test, the percentage change was also calculated.

Sample 1	Ser	SEsm	SEsc %	SEw
Before	**0.69**	**67.94**	**0.39**	**34.383**
After (10min)	**0.26**	**117.12**	**0.37**	**33.998**
After 1hr	**1.13**	**88.79**	**0.38**	**52.852**
Change in % in 10 min	**-62.32%**	**+72.39%**	**-5.13%**	**-1.12%**
Total % change	**+63.77%**	**+30.69**	**-2.56%**	**+53.72**

Table: Visio scan Reading for Sample 1

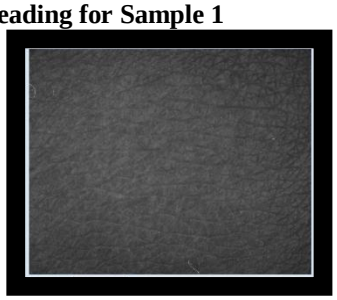

Figure: Sample 1 Scan before application

Figure: Sample 1 Scan after 10 min of application

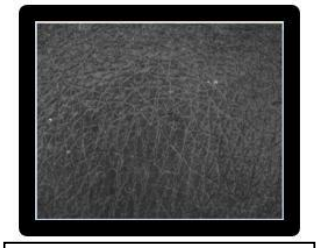

Figure: Sample 1 Scan after 1Hour of application

The smaller the value of **SEr** rougher the skin. The numbers mentioned in the table show that before application **0.69** and 10 min after application, it decreased to **0.26** which indicates a decrease in roughness of about 62.32%, After 1 hour of application the value increased to **1.13** and increased by 63.77% which is a good result.
The smaller the **SEsm** the smoother the image. The numbers mentioned in the table show that before application **67.94** and after 10 min of application it increased to **117.12** which is a 72.39% increase which is not a good result, After 1 hour the number decreased to **88.79** which is better than the previous result but again a 30.69% from the original value which is not ideal.
The higher the value **SEw** of more visible wrinkles. The number mentioned in the table shows that before application the value was **34.38** and after 10 min of application it decreased to **33.99** which is a menial 1.12 decrease but after 1 hour of application the number increased to **52.85** which is a significant increase which was again not a good result with a total increase of 53.72%.
The lower the value of **SEsc** the lesser the scaliness of the skin. the numbers mentioned in the table before the application the value was **0.39** after 10 minutes of application the number decreased to **0.37** which is a **5.13%** decrease, after 1 hour of application the number went up to **0.38** which was an increase from the previous value but was an overall increase by **2.56%.**
The overall result for sample 1 was not ideal, since the balm was not set it did not improve the skin by any amount.

Sample 2	**SEr**	**SEsm**	**SEsc %**	**SEw**
Before	0.77	76.04	0.40	42.573
After (10min)	0.14	102.89	0.58	30.667
After 1hr	0.46	78.44	0.36	40.854
Change in % in 10 min	-81.82%	+35.31	+45%	-27.97%
Total change in %	-40.26%	+3.16%	-10%	-4.04%

Table: Visio scan Reading for Sample 2

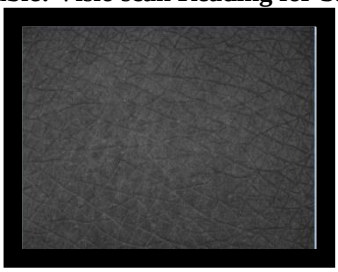

Figure: Sample 2 Scan before application

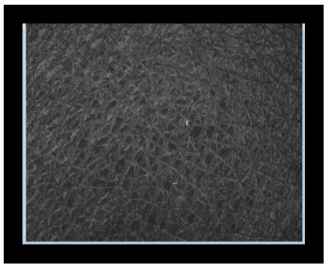

Figure: Sample 2 Scan after 10 min of application

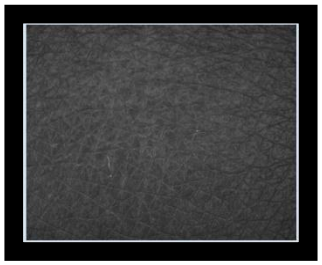

Figure: Sample 1 Scan After 1hour of application

As seen above the Lower value of **SEr** the **0.77**, After 10 minutes of application the number decreased to **0.14** which increased the roughness of the skin which is an **81.82%** increase in the roughness. After 1 hour of application, it increased to 0.46 but the overall roughness of the skin was increased by **40.26%** which is not ideal for the formulation.
The smaller **SEsm** the smoother the skin with the figure of **102.89** 10 minutes after application and **78.44** after 1 hour of application an increase of **35.31%** and **3.16%** respectively, The smoothness was decreased by **3.16%** overall which indicates formulation didn't promote much smoothness in the skin.
For SEw the higher the value more the visible wrinkles after **10** of application the visible wrinkles were decreased to **30.66** which is a **27.97%** decrease and after 1 hour of application the visible wrinkles were decreased to **40.85** which a minimal decrease by just **4.04%** from but a decreased value nevertheless.
The smaller the value of **SEsc** the less scaliness of the skin the value before the application was **0.04**, but after 10 minutes of application the value was increased to **0.58** which is a significant increase of **45 %** but after 1-hour application, the value decreased to **0.36** which is **10 %** decrease of **10 %** which is a promising number.

Sample 3	**SEr**	**SEsm**	**SEsc %**	**SEw**
Before	0.69	90.79	0.46	41.121
After (10min)	0.87	112.65	0.73	36.209
After 1hr	0.62	85.37	0.60	38.717
Change in % in 10 min	+26.09%	+26.08%	+58.7%	-11.95%
Total change in %	-10.14%	-5.97	+30.43%	-5.85%

Table: Visio scan Reading for Sample 3

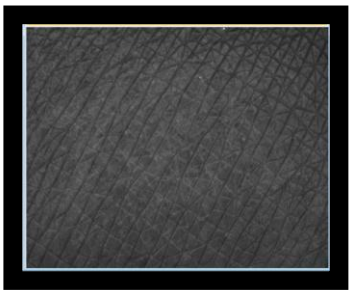

Figure: Sample 3 Scan before application

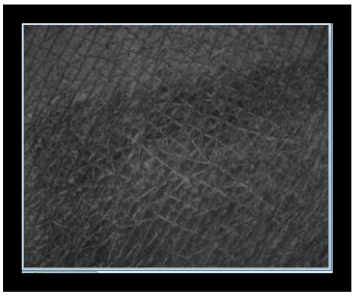

Figure: Sample 3 Scan after 10 min of application

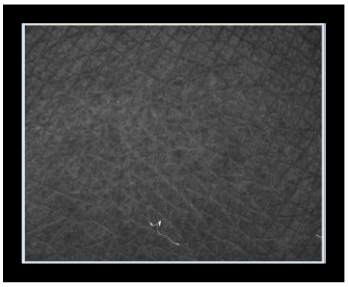

Figure: Sample 3 Scan After 1hour of application

The value of **SEr** before application was **0.69** which was increased to **0.87** which is a **26.09%** decrease in roughness but after 1 hour the value decreased by **0.62** which decreased the value by **10.14%** which is a **10.14%** increase in roughness. The **SEsm** value should be lower for smoother skin. The value before application was **90.79** but after 10 minutes of application increased to **112.65** which is a **26.08** decrease in smoothness After 1 hour of application the smoothens increased to **85.38** which is a **5.97%** increase in overall smoothness.

The value of **SEw** the more wrinkles higher than the value before the application was **41.121**. After 10 minutes of application, the value decreased to **36.209 which is an 11.95** decrease in wrinkles but after 1 hour of application was decreased **to 38.71** which resulted in an overall decrease in wrinkles by **5.858%.**

The **SEsc** value should be lower to show less scaliness. The value before application was **0.46**, 10 minutes after application the value increased to **0.73** and after 1 hour of application it increased to **0.60** which increased scaliness.

Sample 4	**SEr**	**SEsm**	**SEsc %**	**SEw**
Before	0.77	90.13	0.38	44.532
After (10min)	0.55	134.09	0.39	39.661
After 1hr	0.36	99.92	0.58	39.217
Change in% in 10 min	-28.57%	+48.77	+2.63%	-10.94
Total change in %	-53.25%	+10.86	+52.63%	-11.94

Table: Visio scan Reading for Sample 4

Figure: Sample 3Scan before application

Figure: Sample 3 Scan After 10min of application

Figure: Sample 3Scan After 1 hour of application

The value of **SEr** before the application was **0.77** which was increased to 0.55 which is a **28.57%** increase in roughness but after 1 hour the value decreased by **0.36** which decreased the value by **53.25%** which is a **53.25%** increase in roughness. The **SEsm** value should be lower for smoother skin. The value before application was **90.13** which was unfortunately increased to 134.09 which is a 48.77% increase. After 1 hour of application, it decreased from the previous value which was 99.92 with a 53.25% decrease in smoothness overall. Higher the value of SEw the more visible wrinkles. Before application the value was **44.53**.fortunetly the number decreased to **39.661** which is **10.94%.** After 1 hour of application, there was not much of a difference the value was **39.21** which gives the overall decrease of **11.94%** in wrinkles. The lower **SEsc** value needs to lower to have less scaliness. The scaliness was increased by **2.63%** after 20 min of application and increased again to **52.63%** after an hour which are not promising results.

Sample 5	SEr	SEsm	SEsc %	SEw
Before	1.31	156.02	0.27	76.667
After (10min)	0.44	144.37	0.35	44.834
After 1hr	0.85	103.49	0.51	32.483
Change in% in 10 min	-66.41%	-7.47	+29.63%	-41.42%
Total change in %	-35.11%	-33.67%	+88.89	-57.56%

Table: Visio scan Reading for Sample 5

Figure: Sample 5 Scan before application

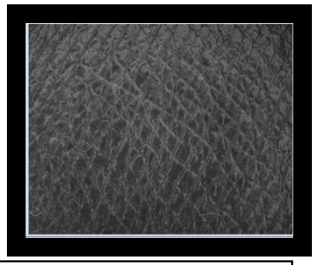

Figure: Sample 5 Scan After 10min of application

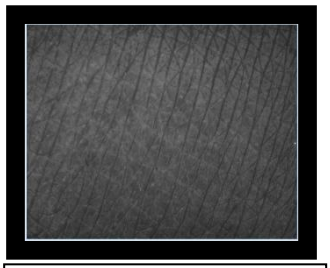

Figure: Sample 5 Scan after 1 hour of application

The smaller the value of **SEr** rougher the skin. There was increase in roughness after 10 min by **66.41%** after an hour it shows an increase in roughness by **35.11%.**
The smaller the **SEsm** the smoother the image. The smoothness was increased by **7.47%** after 10 min of application and after 1 hour it increased to **33.67%** overall.
The higher the value **SEw** of more visible wrinkles. There was a significant reduction in wrinkles with **41.42%** decrease within 10 min of application and after an hour it reduced to **57.56%.**
The lower the value of **SEsc** the lesser the scaliness was increased by 29.63% after 10 min of application and increase 88.89% though not significant increase reading the numbers in the table it is not a good sign.

Discussion

For ease of understanding and concluding the experimental study. The table below summarizes the complete data. To simply further each test and each reading was compared for all 5 samples and ranked. Number 1 was the best in the row and 5 the last for that particular row/test/observation. At the end average was calculated for each sample and a final rank was given to the studied samples. These ranks are only for this study and doesn't represent the sample to be the best. Therefore overall first rank is for sample 2 followed by sample 5, sample 3, and sample 4 and last being sample 1.

		Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
PH		5.32	5.53	5.38	5.13	5.05
Spreadability		0mm	20 mm	45 mm	25 mm	40 mm
Viscosity (highest value recorded)		79.98	7998.29	72464.54	117454.9	35992.32
Elasticity (10 min;1 hr)		+22% +53.32%	+15.98% +25.96%	+23.96% +7.12%	+19.03% +11.20%	+11.2% -3.33%
R0						
	R7	+5.37% +4.41%	+9.82% +18.84%	+1.3% +6.05%	-5.41% -0.81%	-2.52% -0.99%
	R2	+2.99% -0.85%	+10.23% +13.57%	+4.92% +2.32%	-0.59% -2.84%	-0.68% -0.95%
Moisture	**10 min**	-5.91%	+13.44 %	+4.23%	+0.74%	+4.45%
	1 hour	-7.36%	+8.91%	-0.78%	-11.97%	+2.22%
Viseometer	**Roughness**					
	10 min	-62.32%	-81.82%	+26.09%	-28.57%	-66.41%
	1 hour	+63.77%	-40.26%	-10.14%	-53.25%	-35.11%
	Smoothness					
	10 min	+72.39%	+35.31	+26.08%	+48.77%	-7.47%
	1 hour	+30.69	+3.16%	-5.97	+10.86%	-33.67%
	Wrinkles					
	10 min	-5.13%	+45%	+58.7%	+2.63%	+29.63%
	1 hour	-2.56%	-10%	+30.43%	+52.63%	+88.89%
	Scales					
	10 min	-1.12%	-27.97%	-11.95%	-10.94%	-41.42%
	1 hour	+53.72	-4.04%	-5.85%	-11.94%	-57.56%

Table: Sample values for all tests

Sample Ranking

Number 1 was the best in the row and 5 was the last for that particular row/test/observation. At the end average was calculated for each sample and a final rank was given to the studied samples. These ranks are only for this study and don't represent the sample to be the best. Therefore overall first rank is for sample 2 followed by sample 5, sample 3, sample 4 and last being sample 1.

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
PH	4	5	3	2	1
Spreadability	5	4	1	3	2
Viscosity	5	4	3	2	1
Elasticity R0	1	2	4	3	5
R7	3	1	2	4	5
R2	3	1	2	5	4
Moisture 10 min	5	1	3	4	2
1 hour	4	1	3	5	2
Viseometer Roughness					
10 min	3	1	5	4	2
1 hour	5	2	4	1	3
Smoothness					
10 min	1	4	5	2	3
1 hour	5	3	1	4	2
Wrinkles					
10 min	1	4	5	2	3
1 hour	2	1	3	4	5
Scales					
10 min	5	2	3	4	1
1 hour	5	4	3	2	1
Average	3.5625	2.5	3.125	3.1875	2.625
RANKS	5	1	3	4	2

Table: Sample rankings for each test.

Conclusion

The present study provides an overview of the process of formulating and analyzing a skin balm. The main objective was to create, study and analyze the physical properties of the skin balm formulation and their impact on the skin. The skin balm was created using organic and biodegradable ingredients such as jojoba oil, olive oil, vitamin E, beeswax, emulsion wax, water, and papaya banana fragrance. The organoleptic properties, spreadability, viscosity, skin elasticity after application, and hydration and moisturizing effects on the skin were analyzed. Additionally, a vision scan was performed to evaluate the overall quality of the formulation. Within the limitations of the study formulation 2 had overall best results. The quantity of beeswax has the physical-biological properties the most along with olive oil. Further studies are required to substitute some of the ingredients and alter the percentages of others.

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