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RESEARCH ARTICLE

FABRICATION AND EVALUATION OF HERBAL OINTMENT FORMULATIONS OF *MORINGA OLIFERA* FOR TOPICAL DELIVERY

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ABSTRACT

Traditional medicine is an important source of potentially useful new compounds for the development of chemotherapeutic agents. *Moringa oleifera* Lam. is a multipurpose and exceptionally nutritious vegetable tree with a variety of potential uses. It is distributed in many countries of the tropics and subtropics. Ointments are semisolid systems which behave as viscoelastic materials when shear stress is applied. They contain medicaments and are intended to be applied externally to the body or to the mucous membrane. In present study the *Moringa oleifera* leaves extract was used to formulate four different ointment formulations with different bases like cetostearyl alcohol, hard paraffin, and liquid paraffin. Formulations were evaluated for different parameters such as general appearance, spreadability, pH, extrudability, centrifugation, irritancy, loss on drying, stability study etc.

Keywords: Herbal ointment, leaves extract, *Moringa oleifera* Lam, semisolid systems.

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INTRODUCTION

Ointments are topical formulations that offer better patient compliance and hence become more acceptable to patients¹. It is a semisolid dosage form that contains < 20% water and volatiles and > 50% hydrocarbons, waxes or polyethylene glycols as the vehicle for external application to the skin². Ointments are used topically for several purposes, e.g., as protectant, antiseptics, emollients, antipruritic, kerolytic, and astringents³.

Plants had been used for medicinal purposes long before recorded history. According to survey report by WHO, about 25 per cent of prescribed human medicines are derived from plants and 80 per cent people still depend on traditional system of medicines⁴. The World Health Organization (WHO) has appreciated the importance of medicinal plants for public health care in developing nations and has evolved guidelines to support the member states in their efforts to formulate national policies on traditional medicine and to study their potential usefulness including evaluation, safety, and efficacy⁵. Herbal

medicine, also called botanical medicine or phytomedicine, refers to the use of any plant's seeds, berries, roots, leaves, bark, or flowers for medicinal purposes. Long practiced outside of conventional medicine, herbalism is becoming more main stream an up-to-date analysis and research shows their value in the treatment and prevention of disease⁶.

Moringa oleifera is one of the vegetables of the Brassica order and belongs to the family Moringaceae. *Moringa* trees have been used to combat malnutrition, especially among infants and nursing mothers⁷. *Moringa oleifera* is a small native tree of the sub-Himalayan regions of North West India, which is now indigenous to many regions in West India, Africa, Arabia, South East Asia, Islands and South America⁸. Traditionally, besides being a daily used vegetable among people of these regions, the *Moringa* is also widely known as 'the miracle tree' and used for its abilities for various ailments and even some chronic diseases including anemia, skin infections, blackheads, anxiety, bronchitis, catarrh, chest congestion, asthma, blood impurities, cholera, glandular, swelling, headaches, conjunctivitis, cough, diarrhea, eye and ear

infections, fever, abnormal blood pressure, hysteria, pain in joints, pimples, psoriasis, respiratory disorders, scurvy, semen deficiency, sore throat, sprain, tuberculosis, for intestinal worms, lactation, diabetes and pregnancy⁹. The healing properties of *Moringa* oil have been documented by ancient cultures. *Moringa* oil has tremendous cosmetic value and is used in body and hair care as a moisturizer and skin conditioner. *Moringa* oil has been used in skin preparations and ointments since Egyptian times. *Moringa* is especially promising as a food source in the tropics because the tree is in full leaf at the end of the dry season when other foods are typically scarce. They contain high amount of vitamin C, vitamin A, calcium, potassium, and proteins, the basic building blocks of all our body cells. Another important point is that *Moringa* leaves contain all of the essential amino acids in a good proportion, which are the building blocks of proteins¹⁰. Leaves can be eaten fresh, cooked, or stored as dried powder for many months without refrigeration, and reportedly without loss of nutritional value. Leaves were also used for food fortification. Spoonful of the powder can then be added to baby food, soups, and vegetables, adding nutrition but not changing the taste. The delivery of drug through the skin has long been a promising concept because of the ease of access, large surface area, vast exposure to the circulatory and lymphatic networks and non-invasive nature of the treatment. In present study four different ointment formulations of *Moringa oleifera* were prepared and evaluated for different parameters¹¹.

MATERIALS AND METHODS

Fresh leaves of *Moringa oleifera* was collected from local Area Buldana, Maharashtra, India and transported to laboratory, authenticated from Center for Biodiversity Jijamata Mahavidyalaya, Buldana, Maharashtra, India.

Extraction of Plant Material

Collected leaves are washed in running tap water till the removal of dirt. After this leaves are soaked in 1% saline solution (NaCl) for 5 minutes to remove microbes. Leaves are further washed with 70 % ethanol followed by twice washing with distilled water. This step plays a substantial role in removal of dust, pathogens as well as microbes present on the leaf surface. The excess water can be removed by spreading the leaves in sunlight for a brief period till the removal of water present on the leaf surface¹²⁻¹⁵.

The leaves (1 kg) were crushed with little amount of water to obtain the leaf juice. The leaf juice was filtered through a muslin cloth and later through Whatman filter paper to obtain a greenish brown juice. The juice was shade dried and a little amount of absolute alcohol was added to the juice to prevent the growth of microorganisms. The dried leaf juice was collected as a brown colored powder (about 30 g). It was refluxed at 50°C for 5-6 hours with absolute alcohol. The alcohol fraction was separated from the residue and dried to obtain the alcoholic fraction of *Moringa oleifera* leaf juice.

Preparation of Ointment

Four topical ointment formulations were prepared by means of different ingredients as shown in Table 1. The constituents of the base were placed together in a melting pan and allowed to melt together at 70°C. After melting, the ingredients were stirred gently maintaining temperature of 70°C for about 5 minutes and then cooled with continuous stirring. Formulation of ointment was done by incorporating 10 % w/w of the semisolid extract of *Moringa oleifera* into the various bases by triturating in a ceramic mortar with a pestle to obtain 100g of herbal ointments containing 10 % w/w of *Moringa oleifera*. The prepared herbal ointments were put in ointment jars, labelled and were stored at room temperature pending the evaluation¹⁶⁻¹⁸.

EVALUATION OF FORMULATIONS

Prepared *Moringa oleifera* ointment formulations were evaluated for the following parameters.

1. Organoleptic Parameters

Moringa oleifera ointment formulations were evaluated based on their appearance, texture and consistency. Texture was determined on the basis of grittiness / smoothness. Texture was found to be smooth; it can be spreadable and washable easily.

2. pH

2.5gm *Moringa oleifera* ointment formulations sample of each batch was taken in 100 ml dry beaker, 50 ml water was added to it. Beaker was heated on water bath maintained at about 60°C to 70°C for 10 minutes, cooled to room temperature, and then centrifuged at 3000 rpm for 10 minutes. The pH of water extract was measured by using pH meter. The pH measurements were done by using a digital type pH meter by dipping the glass electrode into the ointment formulation¹⁹.

3. Spreadability

The spreadability is expressed in terms of time in seconds taken by two slides to slip off from ointment, placed in between two slides under the direction of certain load. Lesser the time taken for separation of two slides, better the spreadability of ointment²⁰.

Spreadability of *Moringa oleifera* ointment formulations was determined by using the formula-

$$S = \frac{M \times L}{T}$$

Where S = spreadability, M = Weight tied to upper slide, L = Length of glass slides and T = Time taken to separate the slides.

4. Viscosity

The measurement of viscosity of prepared ointments was carried out with Brookfield Viscometer (model LV -DV-II, Helipath spindle type S-96). The values of each *Moringa oleifera* ointment formulation were done in triplicate²¹.

5. Extrudability

Extrudability test is the measure of the force required to extrude the material from a collapsible tube when certain amount of force has been applied on it in the form of weight. In the present study the quantity in percentage of ointment extruded from the tube on application of certain load was determined. The

extrudability of prepared *Moringa oleifera* ointment formulations was calculated by using following formula²².

$$\text{Ext.} = \frac{\text{Amount of ointment extruded from the tube} \times 100}{\text{Total amount of ointment filled in the tube}}$$

6. Loss on drying

The loss in weight, in the sample so tested, principally is due to loss of water and small amount of other volatile material from it. Loss on drying was determined by placing the 1gm of *Moringa oleifera* ointment formulations of different batches in a petri dish on a water bath and dried until constant weight was obtained²³.

7. Centrifugation

It is believed to be a unique tool for the evaluation of accelerated deterioration of ointments. It was determined by using Remi centrifuge in 10 ml-graduated cylinder at 10,000 rpm for 10 min²⁴.

8. Washability

Moringa oleifera ointment formulations were applied on the skin and then ease extend of washing with water was checked. Washability was checked by keeping applied skin area under the tap water for about 10 min²⁵.

9. Stability study

Moringa oleifera ointment formulations were evaluated for their stability at an ambient condition of pressure and temperature for two weeks. Formulations were observed for phase separation and particle agglomeration²⁶.

10. Acute skin irritation study

This test was performed on albino rats weighing between 150-200g. The animals were given standard animal feed and had free access to water *ad libitum*. The total mass was separated into four groups, each batch containing five animals. Dorsal hair at the back of the rats were removed one day prior to the commencement of the study and kept individually in cages to avoid contact with the other rats. Two groups of each were used for control and standard irritant. Other two groups were used as test. The 50mg of *Moringa oleifera* ointment formulations were applied over one square centimeter area of whole and abraded skin to different animals. Aqueous solution of 0.8 % formalin was used as standard irritant. The animals were observed for seven days for any signs of oedema and erythema²⁷.

RESULTS AND DISCUSSION

Four different ointment formulations were prepared using *Moringa oleifera* extract in different ratio (Table 1). All formulations were found to be free of grittiness, homogeneous, without phase separation with green colour with a smooth homogeneous texture and glossy appearance (Table 2).

The mechanical evaluation parameters are important tests to evaluate pharmaceutical ointment formulations. Formulations complied with the physical evaluation parameters like pH, physical stability, centrifugation, viscosity, spreadability, extrudability was found to be acceptable.

The pH of the formulations was in the range of 5.5 to

6.5, which lies in the normal pH range of the skin and would not produce any skin irritation. There was no significant change in pH values as a function of time for all formulations. Loss on drying was determined by placing the 1gm of *Moringa oleifera* ointment formulations was found to be in the range of 20-38%.

The results of viscosity gives an idea about measurement of strength and the result of spreadability denote the extent of area to which the prepared formulations readily spreads on application to skin or affected part and homogeneity confirms no lumps. Viscosity of the ointment formulations was in the range of 32.21±0.51 to 35.3±0.4. As per results of spreadability studies, the spreading area was found to decrease with increase in viscosity, as spreadability and viscosity are inversely proportional.

All the formulations did not produce any skin irritation, i.e. erythema and oedema for about a week when applied over the skin. All formulations were found to be safe for clinical practice. No phase separation was observed during centrifugation among all ointment formulations. Formulations were found to be stable at different temperature i.e. 20°C, 25°C, 37°C.

CONCLUSION

Since ancient time, herbs plays major role in the treatment because of less side effects, low cost and easy availability. The *Moringa oleifera* leaves extract was used to formulate four different ointment formulations with different bases like cetostearyl alcohol, hard paraffin, and liquid paraffin. Formulations evaluated for physical parameters and standardize as per pharmacopoeial standards. The results of the physical evaluation of ointment preparations with extract of *Moringa oleifera* leaves indicated the suitability of method for the production of ointments. Further investigations are necessary to determine the therapeutic efficiency of the prepared *Moringa oleifera* ointment formulations.

CONFLICT OF INTEREST

No conflict of interest is associated with this work.

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Figure 1: Leaf of *Moringa oleifera*Figure 2: *Moringa oleifera* Leaf PowderTable 1: Composition of *Moringa oleifera* ointment formulations

| Ingredients (% w/w) | Formulation code | | | |
|------------------------|------------------|----|----|----|
| | F1 | F2 | F3 | F4 |
| Extract | 10 | 10 | 10 | 10 |
| Cetostearyl alcohol | 5 | 5 | - | - |
| Chlororesol | - | - | 5 | 5 |
| Wool fat | - | 5 | 5 | - |
| Liquid Paraffin | 20 | 20 | - | - |
| Hard Paraffin | 5 | - | - | 5 |



Figure 3: *Moringa oleifera* ointment formulation of batch F1

Table 2: Evaluation of Formulation

| S. N. | Parameters | F1 | F2 | F3 | F4 |
|-------|---------------------|------------------------|---------------------|------------------------|---------------------|
| 1 | Colour | Green | Green | Green | Green |
| 2 | Odour | Characteristic | Characteristic | Characteristic | Characteristic |
| 3 | Consistency | Smooth, soft semisolid | Soft semisolid | Smooth, Soft semisolid | Soft semisolid |
| 4 | Viscosity (cps) | 34.5±0.8 | 35.3±0.4 | 33.5±0.21 | 32.21±0.51 |
| 5 | pH | 5.5 | 6.5 | 5.0 | 5.6 |
| 6 | Spreadability (sec) | 9 | 10 | 8 | 7 |
| 7 | Extrudability (gm) | 0.5 | 0.4 | 0.9 | 0.8 |
| 8 | Centrifugation | No phase separation | No phase separation | No phase separation | No phase separation |
| 9 | Loss on drying | 20% | 35% | 38% | 25% |
| 10 | Washability | Good | Good | Good | Good |
| 11 | Non irritancy | Non irritant | Non irritant | Non irritant | Non irritant |
| 12 | Stability study | Stable | Stable | Stable | Stable |