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FORMULATION AND DEVELOPMENT OF NATURAL PRODUCT BASED ANTIMICROBIAL AND COSMETICS FROM SELECTED MEDICINAL PLANT IN TANZANIA

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ABSTRACT: This study aimed to utilize the phytoconstituents from medicinal plants; *Carissa spinarum* to generate herbal based antimicrobial and cosmetics to reduce the synthetic ingredients by incorporation of natural extracts whose functionality is comparable with their synthetic ingredients and compare its effectiveness with marketed antimicrobial and cosmetics products. The method used was the Soxhlet extraction to generate phytoconstituents, qualitative analysis of phytoconstituents for the presence of alkaloids, saponins, tannins and flavonoids, antimicrobial activity test by using disc diffusion sensitivity test. Three investigated herbal based shampoo formulations (F1, F2, and F3) were prepared by varying composition of *Carrisa spinarum* extracts and sodium laureth sulfate as a surfactant with a fixed amount of glycerine, EDTA and distilled water. F0 was containing all ingredients except *Carissa spinarum* extracts and was used as a negative control. Evaluation of physicochemical test including pH, solid content, wetting ability, foam volume and stability, and antimicrobial properties was conducted and compared to marketed shampoo. The result indicated that F2 and F3 produced clear shampoo and their averaged pH was in the range of 5.59-6.65, more overproduced stable foam, good cleaning and wetting effects. Antimicrobial activity against *Staphylococcus aureus* measured as a zone of inhibition of formulations; F0, F1, F2, F3 and marketed product each was conducted in triplicate and averaged as 22.4mm, 6.2mm, 9.4mm, 14.5mm, respectively. The formulations produced in this study can further be developed in the generation of good health care products.

INTRODUCTION: Due to the drastic increase in side effects posed by chemical ingredients in healthcare products, there is the need of incorporating natural ingredients as they convey the impression of having better purity, safety and efficacy [1]. Sodium Lauryl ether sulphate (SLES) is one of the common chemical detergency applied in health care products [2].

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The manufacturing of the SLES is limited by the possible presence of fatal residues including ethylene oxide, dioxane, and acetaldehyde which cause adverse reactions such as skin irritation [1]. Some chemical ingredients such as cationic polymers cause the production of carcinogenic agents such as nitrosamine [3]. Selected natural ingredients in this study were the saponins extracted from *Carissa spinarum* leaves extracts.

Other phytoconstituents from this plant included flavonoids and tannins which were incorporated for enhancement of antimicrobial activity. Saponin is one of the natural detergency that helps to absorb excess sebum without causing an adverse reaction and also producing emollient effect [1, 4].

Saponins also exhibit antibacterial and antifungal properties, hence are suitable in cosmetic applications [5].

In view of the above scenario, the present work was aimed at the development of different shampoo formulations by incorporation of natural detergency and reducing the synthetic detergency and evaluating the physicochemical and antimicrobial activities than to compare with marketed products.

MATERIAL AND METHODS:

Preparation of Plant Material: The leaves of *Carissa spinarum* L. were collected from Samunge village located in Loliondo district in northern Tanzania. Collected plant materials were shade dried at room temperature before packing into containers and stored for extraction.

Preparation of Extracts: One hundred grams of powdered leaves were soaked for 48 h with occasional shaking in 1.5 L of 95% ethanol. After 48 h the extracts were filtered off by using Whatman number 1 filter paper (Schar lab, Barcelona, Spain) and the concentrate evaporated to dryness under reduced pressure and temperature in respect to the boiling point of ethanol extracts at 78 ºC by using rotary evaporator [9]. The concentrated extracts were stored at room temperature until used.

Phytochemical Tests: Determination of the presence of alkaloids, flavonoids, tannins, terpenoids, and sterols was done qualitatively using the protocols previously described [6, 7, 8].

Preparation of Herbal Shampoo: *Carissa spinarum* shampoo formulation designated as F0, F1, F2, and F3 as shown in **Table 1** by incorporation of 5%, 10% and 20% w/w of *Carissa spinarum* extract in 10%, 5% and 0% of sodium laureth sulfate respectively. The concentration of EDTA, glycerin and distilled water were fixed.

TABLE 1: COMPOSITION OF THE PREPARED *CARISSA SPINARUM* SHAMPOO FORMULATIONS

Ingredient % w/w	F0	F1	F2	F3
Carissa spinarum extracts	0.00	5.00	10.00	20.00
Sodium Laureth Sulphate	15.00	10.00	5.00	0.00
Glycerine	1.00	1.00	1.00	1.00
EDTA	0.15	0.15	0.15	0.15

Determination of pH: The pH of shampoo solution (10% w/v) in distilled water was determined at room temperature. The pH was measured by a pH meter.

Wetting Time: The canvas was cut into 1-inch diameter discs having an average weight of 0.44 g. The disc was floated on the surface of shampoo solution 1% w/v, and a stopwatch was started. The time required for the disc to begin to sink measured accurately and noted as wetting time.

Percentage of Solid Content: Four grams of the prepared Shampoo was placed in a clean, dry evaporating dish. The weight of the dish and shampoo was determined. The liquid portion of the shampoo was evaporated by placing on hot plate. The weight of the solid shampoo content after complete drying was determined.

Foam Volume: The foam volume test was determined by mixing the prepared formulas with distilled water. The foam was produced by mixing in the kitchen blender. Forty milliliters of shampoo solution 10% w/v in distilled water was blended for five seconds in a kitchen blender. The height of the foam generated was measured immediately and after 5 min.

Antimicrobial Susceptibility Testing: Standard test bacteria (*S. aureus*) were inoculated onto the surface of sterile solidified MHA plates and sterile glass spreader was used for even distribution of the inoculums following the method developed by [9] Sterile filter paper discs (4 mm in diameter) were soaked in the extract solutions each at the concentration of 10 mg of formulation in 1ml of 5% DMSO. The discs were placed on different MHA plates inoculated with different test organisms. Then, the plates were left for 1 h to allow diffusion of the formulation. After 1 h the plates were incubated at 37 ºC for 24 h. The filter paper disc soaked in F0 was used as a negative control and the discs containing REF were used as positive controls. Antibacterial activity was determined by measuring the inhibition zone diameter (mm) against each test organism.

RESULTS AND DISCUSSION: The investigated physicochemical properties (pH, solid content, wetting ability) and antimicrobial properties of the formulations showed comparable trends **Fig. 1**.

The trends signify the incorporation of natural ingredients to the healthcare products, and replacement of the chemical ingredients can maintain the quality and performance, a phenomenon which makes the natural products valuable. In this study, the natural detergency from the leaves extracts of *Carissa spinarum* investigated to have good detergency ability due to the ability of foaming foam comparable to the synthetic detergency (Sodium Laureth Salphate). Monitoring of the pH of the shampoo is critical for improvement of the quality of hair and reducing the effect of eye irritation [1].

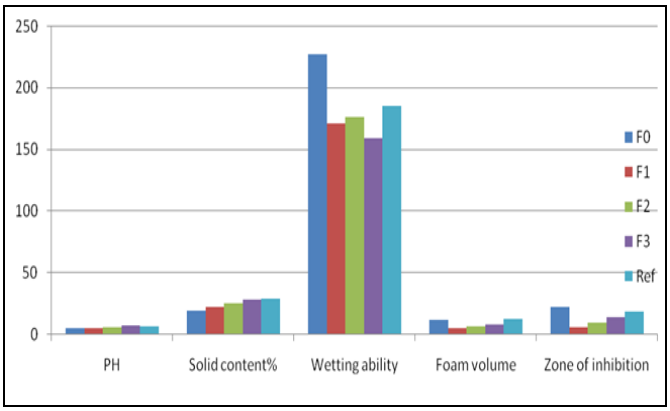

FIG. 1: *IN-VITRO* EVALUATION OF THE PREPARED OF *CARISSA SPINARUM* SHAMPOO FORMULATION

In shampoo formulation the low pH is more preferable because it prevents the swelling and promotes the tightening of the scalp, thereby inducing sheer [1]. The F3 formulation shows the pH values nearly the same as the commercial one. Assessment of solid content in shampoo products is also essential because if shampoo contains too many solids, practically it creates difficulty in washing out the hair. The prepared shampoos were in a range of 22-28%. Thus they can be considered easy to wash out the shampoo. Incorporation of antimicrobial in health care products is useful for prevention of infectious diseases affecting the skin.

In this study formulation, F3 produced antimicrobial activity near to the marketed product. The antimicrobial activity could be attributed to the presence of the compounds analyzed in the extracts (alkaloids, flavonoids, and tannins). Tannins can inactivate microbial adhesions, enzymes, cell envelope, transport protein and polysaccharides [10], while flavonoids exhibit antioxidant and chelating action due to the presence of hydroxyl moiety [11, 12].

Antimicrobial activity of saponins is attributed to by the ability to form a pore in cell membrane and hence giving the toxic material free access to the cell [13].

FIG. 2: FOAM PRODUCED BY *CARISSA SPINARUM* SHAMPOO FORMULATIONS

TABLE 2: PHYTOCHEMICAL ANALYSIS OF *CARISSA SPINARUM* SHAMPOO FORMULATION

Phytochemical	CSLM
Saponin	++
Alkaloids	-
Tannins	+
Flavonoids	+

CSLM; *Carissa spinarum* leave methanolic extract

CONCLUSION: Incorporation of natural detergency in marketed shampoo formulation is of paramount importance for reduction of risk posed by synthetic detergency. The formulations produced in this study can further be developed in the generation of good healthcare products.

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CONFLICT OF INTEREST: Nil

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