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# Comparative Effect of Commercial and Local Made Hair Cream Using Custard Apple (*Anonna squamosa* L) and Noni (*Morinda citrifolia*) seeds on *Malassezia globosa* and *Malassezia furfur*

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**Abstract**
The study investigates the comparative antifungal effects of a commercially available hair cream and a locally made hair cream using noni (*Morinda citrifolia*) seed and custard apple (*Anonna squamosa L*) seed on *Malassezia globosa* and *Malassezia furfur*. The antifungal activity was assessed through zone of inhibition tests at varying concentrations (100 mg/ml, 50 mg/ml, 25 mg/ml, and 12.5 mg/ml), with Econazole as control. The results revealed that the commercial hair cream exhibited superior antifungal efficacy, showing inhibition zones of up to 44 mm against *Malassezia furfur* at the highest concentration, compared to the maximum inhibition zone of 28 mm exhibited by the local hair cream. Additionally, the Minimum Inhibitory Concentration (MIC) and Minimum Fungicidal Concentration (MFC) tests showed that the commercial hair cream had MIC values of 25 mg/ml for *Malassezia globosa* and 12.5 mg/ml for *Malassezia furfur*, with MFC values of 50 mg/ml and 25 mg/ml, respectively. These findings indicate that the commercial hair cream is not only more effective in controlling fungal infections but also demonstrates a lower MIC and MFC, further confirming its potency. The study concludes that the local hair cream extracts offers a potent natural alternative for antifungal treatments in hair care products when improved appropriately. It is recommended to use the commercial hair cream for treating fungal scalp infections while improving the locally made hair creams to boost use of agro waste and to produce cost effective hair cosmeceuticals.

**Keywords:** Custard Apple, Noni Seeds, Antifungal, *Malassezia*, MIC

## Introduction

Of great social concern is the scalp disorder, though not among severe physical illness or morbidity, scalp and hair conditions have more of psychological impact in human societies. Among scalp disorders are fungal and bacterial infestations which causes problems like alopecia, seborrheic dermatitis, ring worm, scalp psoriasis, scalp folliculitis, head lice and dandruff. *Malassezia spp*. is a dimorphic fungus, which is associated with a lot of diseases including dandruff. Narshana, (2019) and other researchers have opined the importance of different factors including genetic and environmental factors, skin imbalance normal biota, and suppression in immunity *Malassezia* related infections.

Phytochemicals such as alkaloids, flavonoid, saponin, tannin, glycosides and so on are bioactive compounds found in plants which exert certain pharmacological effect, (Kumar, 2018). They may be non-polar to polar considering the suitability of the methods of extraction. The selection of solvent system and extraction temperature largely depends on the specific nature of the bioactive compound being targeted. Custard apple (*Annona squamosa*) also known as sugar apple or sweetsop is an evergreen tropical fruit-bearing tree which belongs to the *Annonaceae* family. The fruit is characterized by its round or heart-shaped appearance, covered in scaly protuberances, hence the name "sugar apple." When ripe, the thick, greenish or yellowish skin easily breaks open, revealing soft, white, and delectable flesh with unique, sweet, and custard-like mesocarp (Bajad, 2020). Noni (*Morinda citrifolia*) is a tropical evergreen tree or shrub belonging to the *Rubiaceae* family. Noni has gained attention for its traditional uses, nutritional value, and potential health benefits. The fruit is ovoid and has a knobby surface. When ripe, the fruit turns yellowish-white and emits a strong, pungent odor, which is sometimes described as unpleasant. The


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fruit is believed to possess antioxidant, anti-inflammatory and immune-boosting qualities (Khare, 2018).Noni has gained popularity in the wellness and alternative medicine communities, and its juice is often promoted as a health supplement. It is rich in various nutrients, including vitamins, minerals, and phytochemicals. The fruit's potential health benefits are attributed to compounds like flavonoids, and alkaloids.

Despite the growing demand for hair care products, there is a notable gap in comprehensive studies comparing the effectiveness of commercially available hair cream with those locally produced, specifically utilizing Custard Apple (*Annona squamosa* L) seeds and Noni (*Morinda citrifolia*) seed as active ingredients. Furthermore, the potential impact of these formulations on the growth inhibition of common scalp fungi, such as *Malassezia globosa* and *Malassezia furfur*, remains understudied. This research aims to address this gap by conducting a comparative analysis of the hair conditioning properties of selected commercial and locally made hair creams enriched with Custard Apple and Noni Seeds. The study will also investigate the anti-fungal properties of these formulations against *Malassezia globosa* and *Malassezia furfur*, providing valuable insights into the efficacy of natural ingredients in hair care products and their potential impact on scalp health.

## Materials and Methods

Sample Collection
Commercial hair cream and the reagents for hair cream formulation were purchased from different stores in Sabon gari market, Zaria Kaduna State. Custard apple seed was collected from a residential area at Kabama layout, Sabon Gari Local Government Area. Noni seed was collected from a farm around Wusasa Danmagaji Zaria Local Government. Both seeds were washed, air dried, ground with blender and sieved.

Sample Production
Paraffin oil (192 mL) was measured into a heating pot to which 100 g of Noni seed and 0.2 g of color was added. The mixture was then placed on a heater (hot plate) at a temperature of about 75 °C and stirred continuously until the Noni seed was well mixed. Then, 100 g of custard apple seed was added and stirred properly until completely mixed. As heating and stirring continued, 24 mL of lanolin was added followed by 7 g of glycerin. Perfume 1 mL was added after the wax had melted and the mixture temperature was about 35 °C. Vigorous mixing was done and the mixture was allowed to equilibrate at room temperature (Khare, 2018).

Preparation of Isolates
The test organisms used for this analysis were clinical isolates of fungi obtained from Department of Microbiology, Ahmadu Bello University, Zaria. The isolates were*: Malassezia globosa, Malassezia furfur*

Preparation of culture media
The culture media used include Potato dextrose agar (PDA), Potato dextrose broth (PDB). The media was used for sensitivity test, determination of minimum inhibitory concentration (MIC) and minimum fungicidal concentration (MFC). All media were prepared according to Manufacturer's instructions and sterilized by autoclaving at 121$^{o}$C for 15 minutes.

Determination of Inhibitory Activity (Sensitivity Test) of the Extract Using Agar Well Diffusion Method:
The standardized inoculum of the fungal isolates was streaked on sterile Potato dextrose agar plates with the aid of a sterile swab sticks. Four wells were punched on each inoculated agar plate with a sterile cork borer. The wells were properly labeled according to different concentrations of the sample prepared which were 100, 50, 25 and 12.5mg/ml respectively. Each well was filled up with approximately 0.2ml of the extract/synthesis. The inoculated plates were allowed to stay on the bench for one hour; this is to enable the extract/synthesis diffuse on the agar. The plates were then incubated at room temperature for about 3-5 days. Econazole was used as control (Garish, 2008).At the end of incubation period, the plates were observed for any evidence of inhibition which appears as a clear zone that was completely devoid of growth around the wells (zone of inhibition). The diameters of the zones were measured using a transparent ruler calibrated in millimeter and the results were recorded.

Determination of Minimum Inhibitory Concentration (MIC)
The minimum inhibitory concentration of the extract was determined using tube dilution method with potato dextrose broth (PDB) used as diluents. The lowest concentration of the sample showing inhibition for each organism when the Extract was tested during sensitivity test was serially diluted in the test tubes containing PDB. The standardized organisms were inoculated into each tube containing the broth and extract. The inoculated tubes


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were then incubated at room temperature. At the end of incubation period, the tubes were examined/observed for the presence or absence of growth using turbidity as a criterion, the lowest concentration in the series without visible sign of growth (Turbidity) was considered to be minimum inhibitory concentration (MIC) (Rathi, 2018).

Determination of Minimum Fungicidal Concentration (MFC)

The result from the minimum inhibitory concentration (MIC) was used to determine the minimum fungicidal concentration (MFC) of the sample. A sterilized wire loop was dipped into the test tubes that weren't turbid (clear) in the MIC test and a loopful was taken and streaked on sterile PDA plates. The plates were incubated at room temperature. At the end of incubation period, the plates were examined/ observed for the presence or absence of growth. This is to determine whether the antimicrobial effect of the sample is fungi static or fungicidal (Pierre, 2017).

**Results**

The rate at which the sample inhibit the growth of the test organisms in this study was observed to increase when concentration of sample increased with the commercially sold hair cream inhibiting *M. furfur* at 44mm while the hair cream produced inhibited both test organisms at 18mm as shown in the table 1.

Table 1: Zone of inhibition (mm) at varying concentration of hair cream (mg/ml)

| Sample | Test organism | Zone of inhibition (mm) at varying concentration of hair cream (mg/ml) | | | | |
|---|---|---|---|---|---|---|
| | | 100 | 50 | 25 | 12.5 | Control (Econozole) |
| Local hair cream | *Malassezia globosa* | 18 | 16 | 13 | 0 | 22 |
| Local hair cream | *Malassezia furfur* | 18 | 15 | 10 | 0 | 31 |
| Commercial hair Cream | *Malassezia globosa* | 28 | 19 | 14 | 12 | 22 |
| Commercial hair Cream | *Malassezia furfur* | 44 | 35 | 25 | 23 | 31 |

Table 2 showed the MIC and MFC for both samples, the least concentration at which the local hair cream inhibited the test organisms were 50mg/ml and the concentration at which the sample is fungicidal was 100mg/ml. the commercial hair cream had inhibitory properties at 25 and 12.5mg/ml against *M. globosa* and *M. furfur* respectively.

Table 2: Minimum Inhibitory Concentration (MIC) and Minimum Fungicidal Concentration (MFC) of the extract complex against the test organism

| Sample | Test organism | Concentration of the sample (mg/ml) | |
|---|---|---|---|
| | | (MIC) | (MFC) |
| Local hair cream | *Malassezia globosa* | 50 | 100 |
| Local hair cream | *Malassezia furfur* | 50 | 100 |
| Commercial hair cream | *Malassezia globosa* | 25 | 50 |
| Commercial hair cream | *Malassezia furfur* | 12.5 | 25 |

**Discussion**

Zones of inhibition (mm) at varying concentrations of locally made hair cream (mg/ml) against the test organisms were very close and activity increased with increase in concentration as shown in table 1. Similarity in effect on the test organism may be due to similar morphology of the organisms. This align with previous research by Smith, (2017), who reported moderate antifungal properties of *Anonna squamosa* extracts with inhibition zones ranging from 10-20 mm. The commercial hair cream demonstrated higher antifungal activity, with zones of inhibition measuring 44 mm at 100 mg/ml, 35 mm at 50 mg/ml, 25 mm at 25 mg/ml, and 23 mm at 12.5 mg/ml against *M. furfur*, however lesser activity was observed against *M. globosa*. The control (Econazole) showed a zone of inhibition of 31 mm, lower than that obtained at 100 mg/ml of commercial hair cream. Consequently, higher


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activity of the Commercial hair cream suggests the presence of more potent or higher concentrations of antifungal agents. Johnson (2019) also observed enhanced antifungal activity in commercial formulations due to optimized compound synergies and higher active ingredient concentrations. Furthermore, commercial products typically use more refined extraction and processing techniques, yielding more potent bioactive compounds compared to traditional methods used for the locally made hair cream. The result indicates that both hair creams are effective, but the commercial product is more potent.

Table 2 showed the Minimum Inhibitory Concentration (MIC) and Minimum fungicidal Concentration (MFC) of samples against the test organisms; *Malassezia globosa* and *Malassezia furfur*. MIC was 50mg/ml against both *Malassezia globosa* and *Malassezia furfur*, with MFC values recorded at 100mg/ml for both organisms. This suggests that Local hair cream has moderate inhibitory and fungicidal activity against these organisms. On the other hand, the commercial hair cream demonstrated significantly lower MIC and MFC values, indicating higher efficacy. Specifically, commercial hair cream exhibited MIC values of 25mg/ml and 12.5mg/ml against *Malassezia globosa* and *Malassezia furfur*, respectively, with corresponding MFC values of 50 mg/ml and 25 mg/ml, these results suggest that commercial hair cream is more potent than local hair cream in inhibiting and killing *Malassezia* species. Similar studies by other authors have reported varying MIC and MFC values depending on the type of extract and its concentration. For instance, a study by Smith (2020) reported MIC for commercial hair cream ranging from 20 mg/ml to 40 mg/ml for different plant extracts against *Malassezia furfur*, which is in line with the efficacy of commercial hair cream in the current study. Filatov et al. (2023) presented a high antifungal potential of a plant based substance against *M. furfur. However*, the high concentrations of local hair cream observed are consistent with reports by Krasteva et al. (2023), where higher MIC and MFC values were required for certain extracts with less potent/active compounds.

The result shows the importance of the specific extract and its concentration in determining the antimicrobial efficacy. The greater potency of commercial hair cream suggests it may contain more active compounds or a better synergy between its components compared to local hair cream. This is consistent with the concept that different extracts, even from the same plant, can exhibit varying levels of antimicrobial activity based on the method of extraction, phytochemical composition, and the target organism. The results also align with the broader understanding in the literature that *Malassezia* species, while sensitive to certain natural extracts, may require different concentrations for inhibition and eradication depending on the formulation of the extract.

**Conclusion**

The study demonstrates that the commercial hair cream exhibits superior antifungal activity against both *Malassezia globosa* and *Malassezia furfur* compared to the local hair cream. The commercial hair cream showed notable zones of inhibition, particularly against Malassezia furfur, with values reaching up to 44 mm at a concentration of 100 mg/ml. In contrast, the commercial hair cream exhibited a maximum inhibition zone of 28 mm against Malassezia globosa at the same concentration. These results indicate that the commercial hair cream is more effective in controlling fungal infections than the locally made hair cream. The study indicates that the commercial hair cream exhibits significantly stronger antimicrobial activity against *Malassezia globosa* and *Malassezia furfur* compared to local hair cream, as evidenced by its lower MIC and MFC values.

**Recommendations**

1. This study suggests that the commercial hair cream is more effective in both inhibiting and killing these test organisms, highlighting its potential as a more potent therapeutic agent for treating infections caused by *Malassezia* species.
2. However, the use of a more refined and improved method can be employed to upgrade/improve the locally made hair cream since it also has inhibitory properties.

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