

Anticandidal efficacy of denture cleansing tablet, Triphala, *Aloe vera*, and Cashew leaf on complete dentures of institutionalized elderly

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ABSTRACT

With an increase in the number of dependent elderly, there is a need to introduce few natural products for denture cleansing, which are easily and economically available. Hence the aim of this study was to compare the anticandidal efficacy of denture cleansing tablet (sodium bicarbonate and sodium perborate monohydrate), Triphala (*Phyllanthus emblica*, *Terminalia chebula* and *Terminalia bellerica* fruits powders in equal proportion), cashew leaf, *Aloe vera* and water (control) on complete dentures of institutionalized elderly. Study population consisted of 50 institutionalized elderly of Mangalore, Karnataka, with 10 in each group. Swabs were collected from the dentures before and after the use of denture cleansing tablet, Triphala, cashew leaf, *Aloe vera*, and water (control). Thereafter, the swabs were cultured on Sabouraud dextrose agar and the total candida counts were determined. Denture cleansing tablet and Triphala Churna showed a statistically significant reduction in Candida counts ($P < 0.05$). Denture cleansing tablet and Triphala Churna were found to be more effective.

Key words: *Aloe vera*, candida, cashew leaves, denture cleanser, Triphala Churna

INTRODUCTION

In India, as a result of the change in the age composition over the decades, there has been a progressive rise in the number and proportion of elderly, aged 60 years and above.^[1] Today India is home to one out of every ten senior citizens of the world where 75% reside in rural areas. Inadequate income is a major problem of elderly in India with nearly half of them fully dependent on others for their maintenance.^[1,2] As the size of the dependent elderly population is fast growing; there is an emerging need to pay greater attention to aging-related oral health issues.

According to the National Oral Health Survey, the prevalence of subjects wearing prosthesis in upper and lower dental arches in the age group of 65-74 years was 10.2% and 11.1%, respectively, and the most prevalent prosthesis was complete dentures.^[3] Candida-associated denture stomatitis is a common inflammatory process affecting around 60-65% of denture wearers and is usually found on the palatal mucosa beneath the fitting surface of the upper denture. It has multifactorial etiology but deficient denture hygiene habit is one of the most prominent contributing factor.^[4-10] There are many specialized products on the market for denture cleansing, but the dependent elderly population using dentures have decreased access to a continuous supply of such materials. Hence there is a need to introduce a few natural products to clean dentures, which are easily and economically available.

Triphala (*Phyllanthus emblica*, *Terminalia chebula* and *Terminalia bellerica* fruits powders in equal proportion), *Aloe vera*, and cashew leaves known for their medicinal properties have been traditionally used in India as therapeutic and antimicrobial aids in various ailments and are potent antifungal products effective against Candida.^[11-16] Aqueous, ethyl acetic, and ethanolic fractions of *Terminalia Chebula* has shown a significant inhibitory effect on Candida species.^[11] *Aloe vera* contains six antiseptic agents as lupeol, salicylic acid, urea nitrogen, cinnamonic acid, phenols, and sulfur, and have inhibitory action on fungi, bacteria, and viruses.

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Aloe vera tooth gel has also shown a significant anticandidal activity.^[14] Cashew leaves extracts have shown significant inhibitory action against *Candida*.^[16]

There is a need to test the anticandidal efficacy of these easily available products as denture cleansers. Hence the objective of this study was to compare the anticandidal efficacy of denture cleansing tablet, Triphala, *Aloe vera*, and cashew leaves on complete dentures of institutionalized elderly.

MATERIALS AND METHODS

The study population consisted of 50 institutionalized elderly wearing maxillary complete dentures residing in Old Age Homes of Mangalore City. They were divided into five groups; each group having ten participants each. Five groups were given either of the five measures: Denture cleansing tablets (sodium bicarbonate and sodium perborate monohydrate), Triphala churna, *Aloe vera*, cashew leaves, or water for cleaning their dentures. Participants using water for cleaning their dentures formed the control group.

Selection of the study participants were based on the following inclusion and exclusion criteria:

Inclusion criteria

Volunteers consenting to participate in the study and those who had a complete acrylic upper denture were included in the study.

Exclusion criteria

Participants with partial dentures or lower dentures; those who had used a denture cleanser within the previous 2 weeks; participants taking antifungal agents or antiseptic mouthwashes; those with systemic diseases or conditions making them prone to *Candida* infections and patients with denture stomatitis were excluded from the study.

In the denture cleansing tablet group, the participants were advised to put the tablet into water and place denture into effervescent solution and leave it in solution for 30 min.

In the Triphala group, the participants were advised to clean the dentures using Triphala Churna. In the *Aloe vera* group, the participants were provided with a freshly cut piece of the leaf, which was trimmed on the sides, and they were advised to clean the denture using the cut surface. In the cashew leaf group, the participants were advised to remove the midrib, and fold the leaf lengthwise with glossy surfaces facing each other, rolled into a cylindrical pack and one end was frayed off 2-3 mm to create a raw surface, which was used to clean the denture. In the control group, the

subjects were advised to clean their dentures under running tap water using a toothbrush.

Swabs for culture were taken from the palatal surface of the upper denture according to a 2 × 2 cm template collected before and after use of the cleanser. The swabs were placed in a test tube containing 1 ml sterile distilled water, vortexed for 1 min. Then using a 4-mm loop, the sample was spread in Sabouraud dextrose agar medium, incubated at 37°C for 48 h. Swabs for culture were taken from the palatal surface of the upper denture according to a 2 × 2 cm template collected before and after use of the cleanser. The swabs were placed in a test tube containing 1 ml sterile distilled water, vortexed for 1 min. Then using a 4-mm loop, the sample was spread in Sabouraud dextrose agar medium, incubated at 37°C for 48 h. The colonies were identified using:^[17]

1. Colony morphology: In Sabouraud dextrose agar medium, the Candidal colonies appear as cream, pasty, and smooth colonies
2. Microscopy: In 10% potassium hydroxide mount, the Candidal colonies appear oval, budding, and yeast like cells
3. On Gram staining: They appear as Gram-positive oval yeast like budding cells
4. Urease test: *Candida* gives a negative test on carrying out Urease test.

Colony counts were determined using colony counter. Numbers of colony forming units were multiplied by the dilution factor to obtain the number of colony forming units/4 cm². Colony counts were determined using colony counter.

The investigator and the microbiologist were blinded to the allocation of participants to different groups. The difference in the number of colony forming units of microorganisms between first swab (baseline before use of cleanser) and second swab (after use of cleanser) was noted to assess the effectiveness of cleansers in reducing the total *Candida* count.

Statistical analysis

The results were analyzed using SPSS version 17. One way analysis of variance (ANOVA) followed by Tukey's test were used to compare the reduction of *Candida* count between different denture cleansers. A difference was considered to be of statistical significance if the *P* value was <0.05.

RESULTS

A total of 50 volunteers participated in the study out of which 82% were females and 18% were males. The mean age of the participants was 72.2 years.

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Figure 1 shows the mean reduction in Candida count obtained after using different denture cleansers. This value was obtained by calculating the difference in the number of colony forming units of microorganisms between the first swab (baseline before use of cleanser) and second swab (after use of cleanser).

The mean reduction in total Candida count after using denture cleansing tablet was the highest, followed by Triphala, aloe vera, cashew leaves, and water, with a reduction of 319.25×10^2 CFU/4 cm², 292.5×10^2 CFU/4 cm², 103.67×10^2 CFU/4 cm², 68.75×10^2 CFU/4 cm², 13.75×10^2 CFU/4 cm², respectively.

Table 1 shows the comparison of different denture cleansers analyzed using one way ANOVA followed by Tukey’s test, and a ‘P’ value of <0.05 was considered to be statistically significant. There was no significant difference between the effectiveness of denture cleansing tablet and Triphala ($P > 0.05$), and a significant difference between Triphala and water ($P < 0.05$). There was no significant difference between the effectiveness of *Aloe vera*, water, and cashew leaf ($P > 0.05$).

DISCUSSION

The requirements of ideal denture cleansers are that they

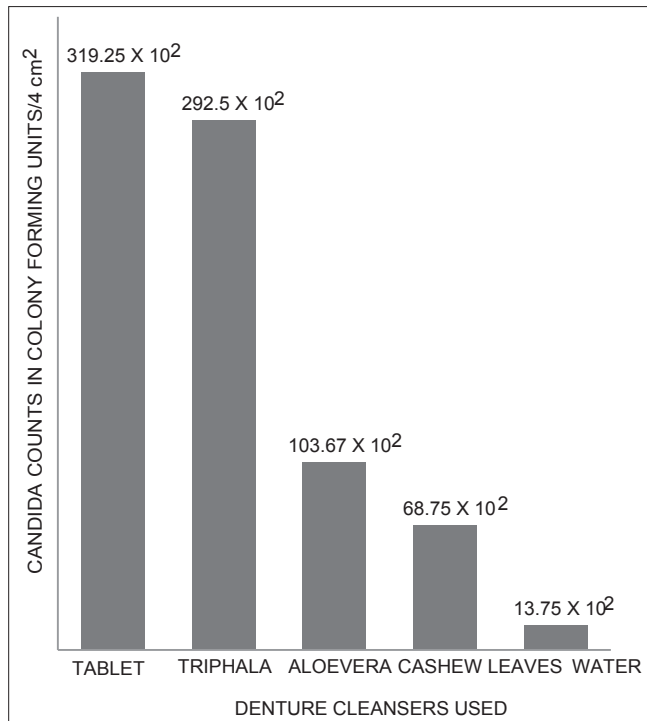


Figure 1: Graph showing mean reduction in total candida count after using denture cleansers in colony forming units/4 cm²

should have antibiofilm activity, exhibit bactericidal and fungicidal effects; should be non-toxic, compatible with denture materials, short acting, easy to use; should have an acceptable taste; and should be cost effective.^[18]

Review of literature suggests that though the antifungal and antimicrobial activity of Triphala, *Aloe vera*, and cashew leaves have been established, the potential use of these products as denture cleansers have not been evaluated.^[11-16] In the present study, though all the denture cleansers showed a reduction in total Candida count compared with control, only denture cleansing tablet and Triphala showed a statistically significant reduction. Triphala was found to be as effective as denture cleansing tablet against Candida.

Triphala, which is an important therapeutic and antimicrobial aid in various ailments, is a combination of three tropical fruits preparation, which has been established as potent antimicrobial and antifungal agents.^[14] The anticandidal activity may be attributed to the gallic acid components present in Triphala.^[19,20]

The natural products used in the present study were nontoxic, inexpensive, easy to use, and readily available. More studies are required to evaluate the long-term effects of these natural-based products as denture cleansers.

CONCLUSION

In the present study, though *Aloe vera* and cashew leaves showed a reduction of total Candida count, only denture cleansing tablet and Triphala showed a significant reduction in comparison to control (water). People with less access

Table 1: Tukey’s test showing the comparison between different denture cleansers in reducing total candida count

Denture cleansers	P value
Triphala (<i>Phyllanthus emblica</i> , <i>Terminalia chebula</i> and <i>Terminalia bellerica</i> fruits powders in equal proportion)	
Tablet	0.99
Water	0.02
<i>Aloe vera</i>	0.21
Cashew leaf	0.09
Tablet	
Water	0.01
<i>Aloe vera</i>	0.12
Cashew leaf	0.04
Water	
<i>Aloe vera</i>	0.84
Cashew leaf	0.97
<i>Aloe vera</i>	
Cashew leaf	0.99

P<0.05 was considered statistically significant

to oral hygiene measures will be benefitted by the use of these products. The potential use of such natural products should be further explored to reduce the microbial load and improve the overall oral health of the people.

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