**Original Research Article**

**Efficacy of Dracaena cinnabari as Tooth Whitening Natural Product:**

**A spectrophotometric Analysis.**

**ABSTRACT**

The aim of this  review in vitro study was to evaluate the efficacy of a homemade tooth-whitening recipe using Dracaena Cinnabari (DC) resin, which is traditionally used for tooth decay treatment and cleaning in Soqatra. The study investigated the antioxidant activity of the resin extracts and their solution in methanol due to their high phenolic content. A total of 40 bovine teeth with initial color B2 were selected and divided into four groups. One group was kept as a negative control, while the other three were stained with Yemeni coffee solution for one week. The first group was treated with 10% Carbamide peroxide (CP) home bleaching, the second group was treated with 10% DC gel with rubbing movement (DC Ru), and the third group was treated with 10% DC gel without rubbing (DC) for 6 hours daily for 14 days. Color measurements were taken at different time points using a spectrophotometer device.All experimental gels resulted in greater color change compared to the negative control, with DC Ru showing the greatest ΔE\* value (p<.000) compared to the DC group (p<.006) and the CP group (p<.001). The second reading of stabilization of all gels resulted in no greater ΔE\* values compared to the first reading of stabilization. The study suggests that the experimental gels containing phenolic content with strong antioxidant effects may hold significant clinical potential as active agents for tooth-whitening without using HP/CP.

Keywords: Dracaena , Tooth,Whitening

**INTRODUCTION**

One of the most prevalent aesthetic procedures in dentistry is bleaching. Bleaching is a more conservative choice or option for vital teeth whitening than other procedures like crowns and ceramic laminates (Meireles et al., 2008; Ribeiro et al., 2020). It is a well-established and confirmable technique, and it provides a high level of satisfaction and effectiveness.

The tooth-bleaching procedure with 10% CP gel has been considered the safest method for bleaching teeth with minimal adverse effects, however, since this tooth-bleaching modality is patient-applied, there is a risk of gel application overexposed dentine in patients with gingival recession and abfraction /abrasion lesions. Moreover, the inadequate and correct use of the tray may result in gel overflow, with extended soft-tissue exposure and likely material ingestion (Soares et al., 2014).

Herbal and natural products have been used in dental and medical practice for thousands of years and have become even more popular these days due to their high antimicrobial activity, biocompatibility, antioxidant, and anti-inflammatory properties (Parham et al., 2020).

Dracena  cinnabari    resin  and  approved  its  effectiveness  as  antimicrobial, antiviral (Mothana et al ., 2004)  , antioxidant (Juránek., et al,1993 )and anti-inflammatory (Alwashli et  al., 2012).According to our knowledge, none of the studies has steadily investigated the effects of Dracaena cinnabari (D. cinnabari) resin extract as a natural bleaching product. Therefore, the present study, which is aimed to highlight the potential possibilities of new material in the form of a bleaching agent, evaluates its antioxidant effect and compares it with other commercial bleaching materials.

**MATERIALS AND METHODS**

**Preparation of Dracaena *cinnabari* resin methanol extract:**

D. cinnabari resin was ground into powder form by using an electrical blender to ease the extraction process and produce finer powder , 50 g of the powdered resin of D. cinnabari placed into a 1 L conical flask and then macerated with methanol (500 ml methanol was added in 1 gram of dried and ground D. cinnabari is to 10 ml methanol) in the ratio of (1:10). The conical flask was left at room temperature for approximately 3 days on a shaker at 100 rpm, then placed in the sonicator at 45°C for 30 min to enhance the extraction of the active compounds from the resin. For separating the methanol from the extract, LABOROTA 4000 eco rotary evaporator was used under reduced pressure at 40 °C which produced a gummy red resin extract. (Annegowda et al., 2012).

**Preparation of *Dracaena cinnabari* Gel as Tooth Bleaching Agent.**

The gel composition presented in table 1 was prepared (Gadanha,,et al 2013)by mixing the sodium saccharin and the EDTA were previously dissolved in water and the methyl paraben and the menthol in ethanol.  The carbomer 940 was dispersed in water with the glycerin and the pH was adjusted to 7, In this study, the stock solution was prepared by using ethanol, it was found to be less toxic than the other solvents, hence it was safer, and favored to be used for preparing the bleaching gel, it contained 10% of resin extract.

Preparation of specimens

**Preparation of specimens:**

Forty freshly bovine incisors devoid of intrinsic stains, cracks, and fractures were selected with their initial color equal to B2, and had their roots sectioning using a carborundum wheel disk (Maxman, China), The dental pulp tissue was removed from the crown portions using an #80 K-file (Mani, Tokyo, Japan) The teeth received prophylaxis with Robinson brush (Escova, USA), under copious amounts of water until flat enamel surfaces were obtained (Haruyama et al., 2022). The prepared specimens from extraction until use and during the treatment process the teeth were kept in Distilled water at 37°C (Vieira et al., 2008).

**Artificial staining procedure**

Artificial staining was carried out according to the method of our earlier study to mimic natural staining in the oral cavity (Haruyama et al., 2022). All specimens numbered from 1- 40 in closed tubes and the samples were distributed into two groups according to the selected immersion solution (10 teeth in DW and 30 teeth in the Yemeni coffee solution (al-kbous Sana’a-Yemen) for 1 week and replaced with fresh solution every day. After seven days of staining, the samples were rinsed with tap water for 10 s, and the enamel was polished with a low-speed rubber cup and pumice stone/water solution, this procedure was performed to remove any undesirable external staining, All the teeth were fixed with a dense silicon paste (Zhermack, Italy) mold was made to standardize the angle of measurement on a wooden plate (10 mm x 8 mm x 10 mm).

**Bleaching procedure:**

Previous to the bleaching procedure, specimens were cleaned with an ultrasonic cleaner for 90 Seconds. Taking into consideration that the experimental groups (D. cinnabari and D. cinnabari Rubbing) had no standard application protocol, both materials were applied based on the manufacturer’s direction for use of the positive group, Carbamide peroxide (CP), after completing baseline measurements, All Specimens were randomly allocated into four groups (n = 10), According to the bleaching gel applied. The first group was treated with 10% CP Home bleaching (Whiteness Perfect 10% FGM, Brazil) (positive group) for 6 hours daily was bleaching gel was applied 1-mm a thick layer with a brush to the middle third of facial surfaces of the teeth, the gel then removed and the surface cleaned using gauze soaked in distilled water and then the specimen's surfaces were washed out and dried with absorbent paper. Samples were not air-dried with any system that could dehydrate the sample, after that stored in distilled water for the remaining time (18 h). This process was repeated each day for 14 days to simulate recommended home use, in addition, While the gel is in contact with the specimen, the latter is kept in a wet environment placing it over a cotton pellet embedded in distilled water. At the end of 14-day bleaching procedure, All the specimens removed from the bleaching gel, cleaned under running water and then stored in distilled water for 24 h, Then three measurements at the middle third of the facial surface of the specimen taken as previously described for the baseline measurement. The second group (experimental groups = 20) was treated with 10% D. cinnabari gel and divided into two subgroups (n=10). One group was applied by rubbing movement (D. cinnabari RU) on the central portion of the buccal surfaces and the specimen was brushed with hand pressure on an electrical brush (power flex- Jordan) for one minute. Third group applied without rubbing (D. cinnabari) only applied 1 mm of a thick layer of gel with the brush for 6 h daily as the same application of the positive group (CP) for 14 days.

The fourth group (negative group) did not receive any bleach treatments and was treated in the same manner as experimental groups 1 and 2 in terms of rinsing and drying. Instead of a bleaching agent, drops of distilled water are applied to the facial surface.

All of the procedure's steps are carried out by the same operator (specimen preparation, staining, and bleaching).

For color reading, a spectrophotometer was employed (Easy Shade, VITA Zahnfabrik, Bad Säckingen, Germany), and the specimen was placed over a black background, Three color readings were performed for each sample at identical positions using the CIE L\* a\* b\* coordinates and the mean of three color readings was considered the color value on the L\*, a\*, and b\* axis, at baseline (T0), one-day post-staining (T1), 7-days post-staining (T2), immediately after bleaching (T3), 7 days post-bleaching, (T4) and 14 days post-bleaching(T5).

**Statistical Analysis:**

The data were collected and statistically analyzed using IBM SPSS Version 25. The means and SD values of L\*, a\*, and b\*, will be statistically analyzed using a one-way analysis of variance (one-way ANOVA). Analysis of the variance of repeated measurements over time was employed in the assessment of color changes defined by ΔE, ΔL, Δa, and Δb. This analysis was complemented by multiple comparisons of means using the T-test with p-value adjustment which was set at the significance level of P ≤0.05%. An independent t-test was performed to identify significantly different group means when the ANOVA test was significant. Paired t-test was carried out between the baseline and each subsequent cycle.

**RESULTS AND DISCUSSION**

The duration of immersion time in coffee statistically significantly (P<0.05) increased the change in the color for experimental materials, DC Ru specimens were statistically significantly (P<.002) more stable in color than (CP and DC groups) with P-value (.054 and .038) respectively after 1 week of immersion in coffee. While in the DW group, there was an insignificant difference (.263) after 1 week of immersion in DW as shown in (Table 2). According to the statistical analysis with comparison as shown in (Figure 2), after one day of immersion in the coffee solution, DC Ru specimens discolored markedly from (1.74) to (3.44) after one week of immersion as same as CP specimens changing from (2.6) to (5.1) after one week of immersion, however, DC specimens in coffee showed slightly more color changes (3.73) compared to (2.57) after one day of immersion in the coffee.

Figure 1,2 shows the mean values and SD of all experimental groups according to the staining solution. In this study, ΔE values for the experimental groups were determined for DC Ru, CP, and DC specimens (7.09, 6.7, 4.6) respectively. Based on the perceptibility thresholds defined in the literature, the overall color difference between the experimental groups is considered moderately perceivable. All gels resulted in greater color change when compared to the negative group, the highest value occurred at DC Ru gel with (p < .000), then the positive group (CP) demonstrated greater ΔE\* values (p < .001). and after that DC experimental gels with (p < .006) when compared to negative group DW in table (2,3,4). The main purpose of this study was to evaluate the effect of D. cinnabari used by the population to obtain tooth whitening, the resin is widely used in traditional folk medicine in Yemen for the treatment of dental diseases, and it is readily widely spread in the market with low cost. Furthermore, it has been found to have several pharmacological properties such as antimicrobial, antioxidant, anti-inflammatory, cytotoxicity and anti-tumor activities (Al-Awthan et al., 2021). The D. cinnabari resin extract was prepared in this study by using absolute methanol (100%) as a solvent. Although there is no previous report of a natural bleaching agent containing D. cinnabari. The first null hypothesis was rejected because both experimental gels (DC and DC RU) groups were effective on tooth whitening. Considering D. cinnabari gel with the strong antioxidant activity of its high phenolic content (Gupta & Gupta 2011; Al-Fatimi 2018), they can break down macromolecules /stains into smaller parts, thus increasing light reflection from the tooth surface, thereby increasing the lightness and thereby resulting in a whitening effect. While the second null hypothesis was true (No differences in color change between D. cinnabari and CP), regarding our results, which demonstrated (DC RU) experimental gels produced color changes as same as the positive group (CP), this stain removal effect could be due to the mechanical rubbing of D. cinnabari.

Similar to our study Toothpastes containing activated charcoal showed better effectiveness in whitening teeth than toothpastes containing blue covarine and hydrogen peroxide (Aydin et al., 2022).

Another natural product resembles our study, miswak was administered in different forms, namely mouthwash, toothpaste, chewing stick, essential oil, aqueous extract, ethanol extract, probiotic spray, dental varnish, dental cement or chewing gum (Nordin et al., 2020). Antioxidants are substances that shield the body against free radical-induced oxidative stress. (Niazi et al., 2016) concluded that antioxidant enzymes in miswak (catalase, peroxidase, polyphenols oxidase) are attributed to the antioxidant properties of Salvadora. Persica (S. persica) paste has the potential of being an effective, alternative teeth-whitening product especially for removing extrinsic staining (Halib et al., 2017).

**Table 1  Formulation of the Dracaena cinnabari gel**

|  |  |
| --- | --- |
| Component | Amount |
| Dragon's blood extract | 10% |
| Carbomer 940 | 5% |
| Glycerin | 3% |
| Sodium saccharin | 1% |
| Methylparaben | 0.2% |
| EDTA | 0.1% |
| Menthol | 0.02% |
| Purified Water | 81.5% |

**Table 2 shows the mean values and SD of all experimental groups according to the staining solution.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| GROUP | N | Mean | SD | T-test | P-value |
| CP | Coffee | One Day | 10 | 2.656130 | 2.9361182 | 2.215 | .054 |
| One Week | 10 | 5.112230 | 4.4636632 |
| DC | Coffee | One Day | 10 | 2.572570 | 1.9435405 | 2.437 | .038 |
| One Week | 10 | 3.735810 | 2.2208448 |
| DC Ru | Coffee | One Day | 10 | 1.744360 | 1.2360171 | 4.344 | .002 |
| One Week | 10 | 3.448320 | 1.5729662 |
| DW | DW | One Day | 10 | 5.369750 | 3.4682066 | 1.193 | .263 |
| One Week | 10 | 6.453140 | 3.1471311 |

N = Number of specimens, SD = Standard Deviation, CP = Carbamide peroxide, DC = Dracaena cinnabari without rubbing, DC Ru = Dracaena cinnabari with rubbing, DW = Distilled water

Figure 1.Mean color changes (∆E\*) of the different experimental groups over time.



**Table 3: Multiple comparisons of mean color change (ΔE values) between all experimental groups and DW by using an independent t-test.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Group |  | N | Mean | SD |
| CP | T1\_T0 | 10 | 4.565030 | 3.9272792 |
| T2\_T0 | 10 | 5.369750 | 3.4682066 |
| T3\_T0 | 10 | 6.751030 | 2.8149650 |
| T4\_T0 | 10 | 6.121770 | 2.7157788 |
| T5\_T0 | 10 | 6.190390 | 3.0087140 |
| DC | T1\_T0 | 10 | 2.572570 | 1.9435405 |
| T2\_T0 | 10 | 3.206900 | 1.6220585 |
| T3\_T0 | 10 | 4.647570 | 1.2595474 |
| T4\_T0 | 10 | 4.266320 | 1.2653632 |
| T5\_T0 | 10 | 3.532910 | 1.2188543 |
| DC Ru | T1\_T0 | 10 | 4.744360 | 3.2360171 |
| T2\_T0 | 10 | 4.426730 | 3.1394743 |
| T3\_T0 | 10 | 7.093210 | 1.4872108 |
| T4\_T0 | 10 | 6.684370 | 1.5232603 |
| T5\_T0 | 10 | 5.893280 | 1.3320478 |
| DW | T1\_T0 | 10 | 2.654330 | 2.9367385 |
| T2\_T0 | 10 | 2.567670 | 1.6738546 |
| T3\_T0 | 10 | 3.395460 | 3.0504153 |
| T4\_T0 | 10 | 4.063950 | 3.6182684 |
| T5\_T0 | 10 | 4.991270 | 4.1195389 |

CP = Carbamide peroxide, DC = Dracaena cinnabari without rubbing, DC Ru = Dracaena cinnabari with rubbing, DW = Distilled water, N = Number of specimens, SD = Standard Deviation, T0 = baseline, T1 = after 24 hours post-staining, T2 = 7 days post-staining, T3 = immediately after bleaching, T4 = 7 days post-bleaching, T5 = 14 days post-bleaching.

**Figure 2. Mean color changes (∆E\*) of the different experimental groups over time.**



**Table 4: Multiple comparisons of mean color change (ΔE values) between all experimental groups and DW by using an independent t-test.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Group | N | Mean | SD | T-test | p-value |
| T3-T0 | CP | 10 | 6.751030 | 2.8149650 | 4.039 | .001 |
| DW | 10 | 2.567670 | 1.6738546 |
| DC | 10 | 4.647570 | 1.2595474 | 3.140 | .006 |
| DW | 10 | 2.567670 | 1.6738546 |
| DC Ru | 10 | 7.093210 | 1.4872108 | 6.391 | .000 |
| DW | 10 | 2.567670 | 1.6738546 |

T0 = baseline, T3 = immediately after bleaching, CP = Carbamide peroxide, DC = Dracaena Cinnabari without rubbing, DC Ru = Dracaena Cinnabari with rubbing, DW = Distilled water, N = Number of specimens, SD = Standard Deviation.

**CONCLUSION**

Within the limitations of this study, it could be concluded that successfully obtained Dracaena cinnabari gel extract with 10 % concentration using methanol as a solvent. The results showed that coffee was a statistically significant effect on the pigmentation of the teeth. Specimens treated with Dracaena cinnabari gel and its effectiveness in whitening the teeth, especially Dracaena cinnabari RU specimen by rubbing, as is popularly known were significantly as same as affect those treated with Carbamid Peroxide due to the experimental gels (Dracaena cinnabari) containing phenolic content with strong antioxidant effects.

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