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## Investigation of the antibacterial efficiency of toothpastes used against dental pathogens

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### Abstract

Toothpastes are dental as well as oral hygiene determiners, quality and quantity of toothpaste being the two cardinal points to control the dental health and also the oral hygiene. Dental health deteriorated for dental plaque, dental caries, and periodontal diseases caused by pathogenic bacteria. Toothpaste kill and erase the bacteria from the surface of the teeth and oral cavity but all the toothpastes have not similar antibacterial activity. Four types of toothpaste: Colgate, Close-up, Dabur-Red and Glistar were used to observe the comparative antibacterial efficiency considering quality and quantity or doses concentration in an investigation. Experiments were done several times, sound the effective results were observed from Dabur-Red toothpaste in comparison to other toothpastes. Future details research will also open a new avenue to formulate the quality and the dose's concentration of the best toothpaste for next generation.

**Keywords:** Dental health, dental plaque, Dental caries, periodontal disease, zone of inhibition, toothpastes

### 1. Introduction

Dental problem is a global problem of human beings due to dental biofilms which are generally a complex community of microorganisms grow on the surface of teeth<sup>[1]</sup>. Near about 500 bacterial strains have been reported to deteriorate the dental health<sup>[2]</sup>. The most common dental health problem occurring human communities are dental plaque, dental caries and periodontal diseases<sup>[3]</sup>. Dental plaque is a sticky, colorless films composed of 300-500 cells thick the bacterial cells from the surface of teeth<sup>[4]</sup>, damage the tooth enamel and subsequently causes severe gum disease gingivitis. Streptococcus mutants and Streptococcus sanguinis the two bacterial strain mainly involved for dental plaque formation. Dental carries are due to the destruction of calcium enamels of teeth by the organic acids formed during the carbohydrate metabolism in presence of pathogenic oral bacteria resulting the appearance of black spots on the teeth and also causes severe pain on the gum and emit bad order<sup>[5]</sup>. Periodontal diseases caused by bacteria affect the supporting structure of teeth like gingival, cementum, periodontal membrane and alveolar bone. Streptococci, Actinomycetes, Spherocytes and Bacteroides are responsible for this. Eradication of oral microbes is the only means to maintain oral hygiene and dental health. In the ancient past there was no concept about the maintenance of the oral hygiene. In the medieval ages fine sand and pumice were used by the Arabians to clean the teeth. During mid-nineteenth century human beings used different abrasives, green lead and incense to clean the strain from the teeth. In 1950, Dr. Washington Wentworth Sheffield a dental surgeon and chemist first discovered toothpaste to remove the oral microbes after which a great revolution occurred in the path of evolution of modern toothpastes up till now<sup>[2]</sup>. The credit of the toothpaste depends upon its efficiency to eliminate pathogenic oral microflora, inhibitory role on plaque formation, ability to prevent caries initiation, the power to prevent the initiation of periodontal disease, high cleaning property and can improve the shiny nature of the teeth<sup>[6]</sup>. So many herbal and non-herbal toothpastes have been developed by adding different ingredients time to time but many of them are under a matter of interrogation regarding the efficiency and quality in terms of various components<sup>[7-14]</sup>. We have an attempt to investigate the comparative efficiency of antimicrobial activity of four branded quality of toothpastes (Colgate, Close-Up, Dabur-Red, and Glistar) available in the

local area of West Bengal, India so far.

**2. Materials and Methods**

**2.1 Collection of Sample**

Two types of different samples were collected from 8 patients in Panskura Banamali College. Samples were collected by sterilised cotton buds. Then it transferred in nutrient broth immediately.

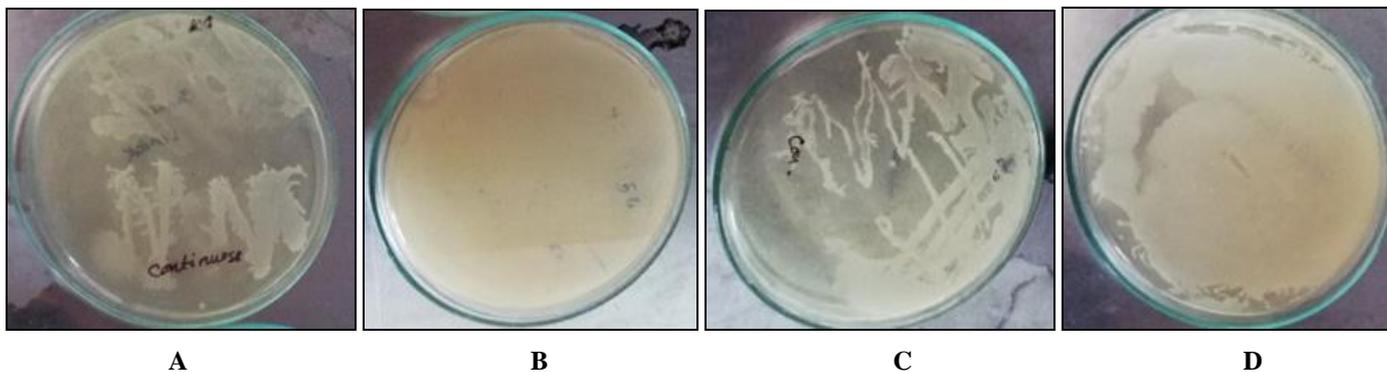
**2.2 Isolation of Bacterial Culture**

The samples were enriched in nutrient broth at 37 °C for 48 hours in bacterial incubator.



**Fig 1:** Samples in nutrient broth after 48 hours in incubation

Then cultured on nutrient agar plate by spread plate and stick plate method. Corresponding pure culture was obtained by stick plate and spread plate methods. Its Shown in Figure 2.

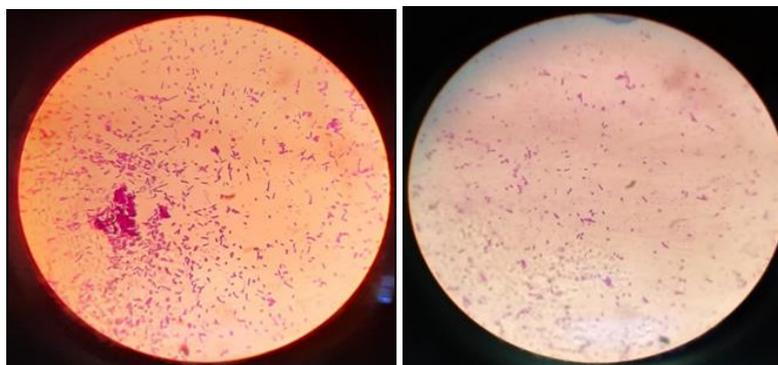


**Fig 2:** (A) Caries bacterial colonies in stick plate, (B) Caries bacterial colonies in spread plate, (C) Plaque bacterial colonies in stick plate (D) Plaque bacterial colonies in spread plate.

**2.3 Identification**

The organisms that were used identified by standard

microbiological techniques including colonial characteristics, morphological characteristics and biochemical characteristics.



**Fig 3:** (A) Dental caries under 100x (B) Dental plaque under 100x

**Table 1:** Characterisation of figure A

1. Magnification	100x
2. Shape	Bacillus, coccus
3. Colour	violet
4. Arrangement	Chain, single

**Table 2:** Characterisation of figure B

1. Magnification	100X
2. Shape	Coccus
3. colour	Violet
4. Arrangement	Single

**2.4 Selection of Toothpastes**

Four toothpastes were selected for the study. These are

1. Colgate
2. Dabur-Red
3. Close-Up
4. Glister.

Among those toothpastes Dabur-Red is herbal and others are regular. The products were commonly used in local area and bought from the local market in *Kanakpur, Panskura RS*. The composition of the toothpastes is shown in Table 3.

**Table 3:** Ingredients of the Toothpastes used in this analysis

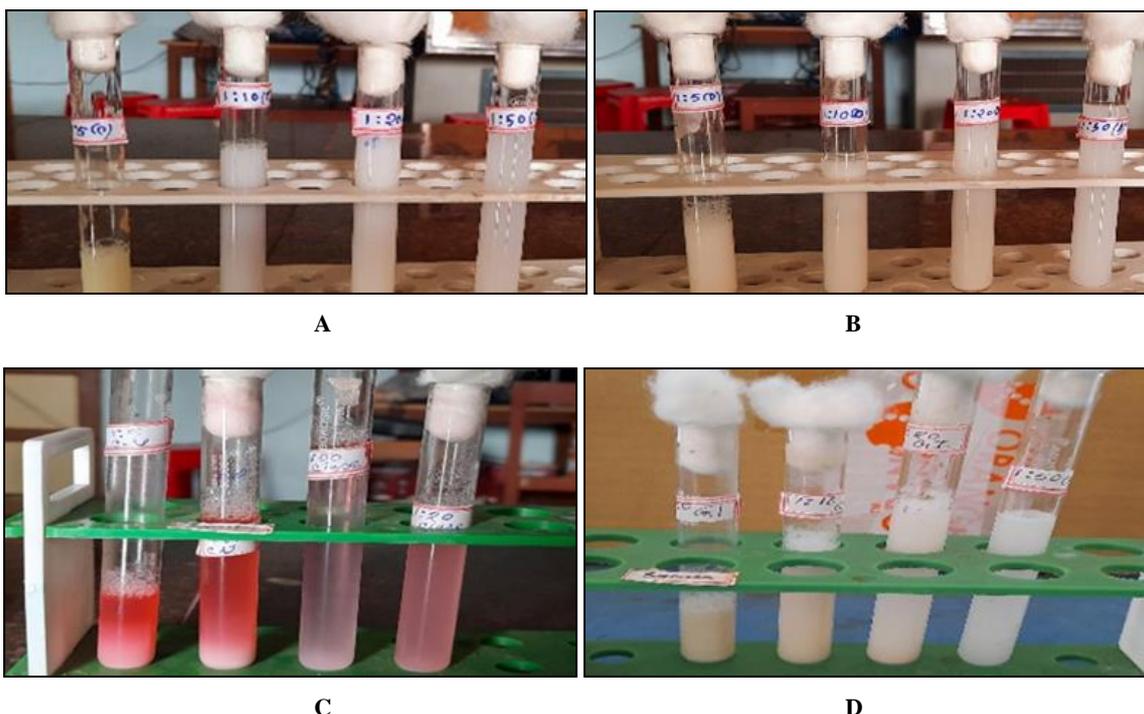
Components	Brand Name			
	Coalgate	Close -UP	DABUR red	Glister
Water	+	+	+	+
Hydrated Silica	+	+	-	+
Glycerin	+	+	-	+
Sorbitol	+	+	-	-

copolymer,	+	-	-	-
Sodium Lauryl sulfate	+	-	-	+
Cellulose Gum,	+	-	-	+
Carrageenan	+	-	-	-
Sodium Hydroxide	+	+	-	-
Sodium Fluoride	+	+	-	+
Sodium Saccharin	+	+	-	+
Triclosan	-	-	-	-
Zinc Sulfate	-	+	-	-
Cocamidopropyl Betain	-	+	-	-
MicalCI 77019	-	-	-	-
CI 16255, CI 17200, CI 77491, CI 77891	-	+	-	-
PEG-32	-	+	-	-
PVM/MA copolymer	+	-	-	-
Maricha	-	-	+	-
Pippali	-	-	+	-
Sunthi	-	-	+	-
Totnar, Lavanga	-	-	+	-
Pudina, Gairic Powder	-	-	+	-
Xanthan Gum	-	-	-	+
Propylene Glycol	-	-	-	+
xylitol	-	-	-	+
PEG-8	-	-	-	+
Methylparaben,	-	-	-	+
Titanium Dioxide	-	-	-	+

**2.5 Dilution of Toothpaste**

Toothpastes were diluted in 1:05, 1:10, 1:20, 1:50 ratio by mixing the calculated amount of toothpaste in distilled water.

The mixing of solvent is followed by continuous stirring in vortex.



**Fig 4:** (A) dilution of Colgate, (B) dilution of Dabur, (C) dilution of Close-Up, (D) dilution of Glister

**2.6 Antibacterial Assay**

Here we used agar well diffusion method as described by Agu [15] and Adindu [16] to determine antimicrobial activity of toothpaste in different dilution. Exactly 0.5 ml of each caries and plaque bacterial culture, was spread on nutrient agar plates. The plates were allowed to dry for 1hr. Four wells each having diameter 6 mm were made using sterile corkborers in the already seeded nutrient agar media. The holes were marked according to the dilution of toothpaste 1:05, 1:10, 1:20 and 1:50 respectively. Then 0.2 ml of the respective serially diluted toothpastes concentrations were

introduced into each of the four wells. The assay plates were held at 37° C for 1 hour to repress the growth of the seeded culture while promoting diffusion of the oral agents. The plates were incubated at 37 °C for 24 hrs. The antimicrobial activity of the sample toothpastes was determined by measuring the diameter of the zones of inhibition in millimetre.

**3. Results and Discussion**

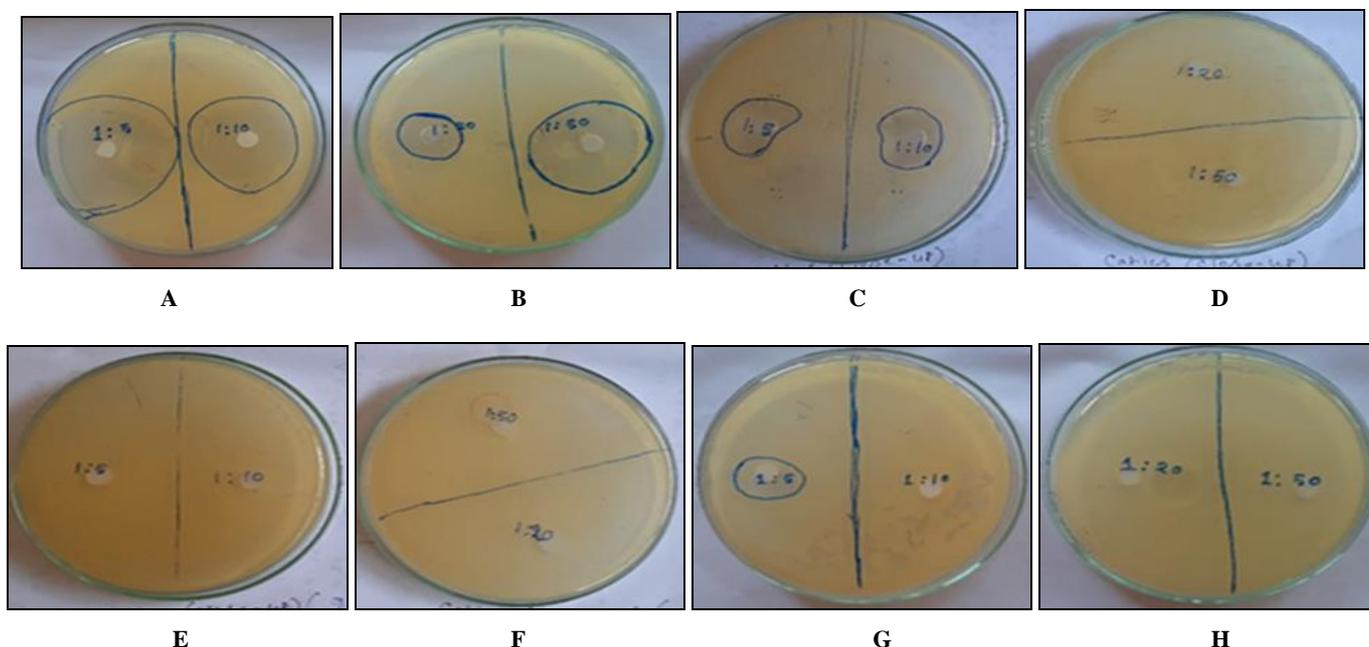
From the experimental finding it has been cleared non-herbal toothpastes are inefficient for antimicrobial activity in

comparison to herbal one. Dabur-Red being the herbal toothpaste showed prominent zones of inhibition in every replica of experimental sets of different concentration for dental caries as well as dental plaque whereas Colgate, Close-Up, and Glister being the non-herbal toothpastes showed zone of inhibition only in few sets of experiments. Dabur-Red, showed maximum inhabitation in 1:05 concentration, 45.7 mm in dental caries sample, 43 mm in dental plaque and gradually declined its inhibitory performance to the higher grader of dilution i.e. minimum inhibition in 1:50 concentration. Expect in the sets of 1:20 and 1:50 concentration for dental plaque no other experimental sets of dental plaque and dental caries Glister paste is totally unable to inhibit the pathogen. Close-Up, and Colgate pastes showed inhibition only in 1:05 concentration in dental caries sample, whereas Colgate showed inhibition in all sets of experiment of dental plaque sample [Table: 4 & Table: 5]. Again, considering the efficiency of Colgate and Dabur-Red, better and commendable results exhibited by the Dabur-Red in all respects and that will be highly appreciated in the business world so far. Herbal components from *Piper nigrum*, *Piper*

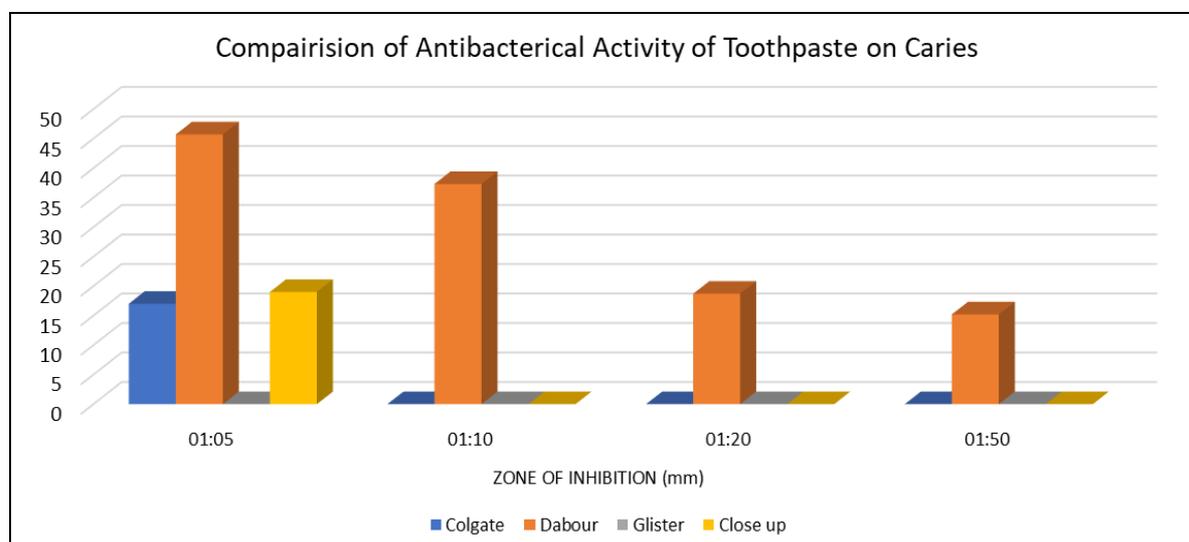
*longum*, *Mentha spicata*, *Curcuma zedoarea*, *Cinnamomum camphora*, *Zingiber officinale*, *Xanthoxylum armatum*, *Syzygium aromaticum* etc. in Dauber-Red increase the hundred percent antimicrobial activity rather than sodium-fluoride, sorbitol, lauryl sulphate, triclosan, and other chemicals present in the Colgate, Close-Up, and Glister toothpastes. Besides fluoride may cause fluorosis and triclosan has many side effects. From the investigation of comparative efficiency of the selected toothpastes a ranking scale may be drawn where Dabur-Red be placed at the first position, Colgate at the second, Close-Up at the third position and Glister at the end.

**Table 4:** Antimicrobial activity of different toothpaste against dental pathogens isolated from dental caries

Name of the toothpaste	Zone of inhibition (mm)			
	1:05	1:10	1:20	1:50
Colgate	17	0	0	0
Dabur	45.7	37.3	18.7	15.2
Glister	0	0	0	0
Close up	19	0	0	0



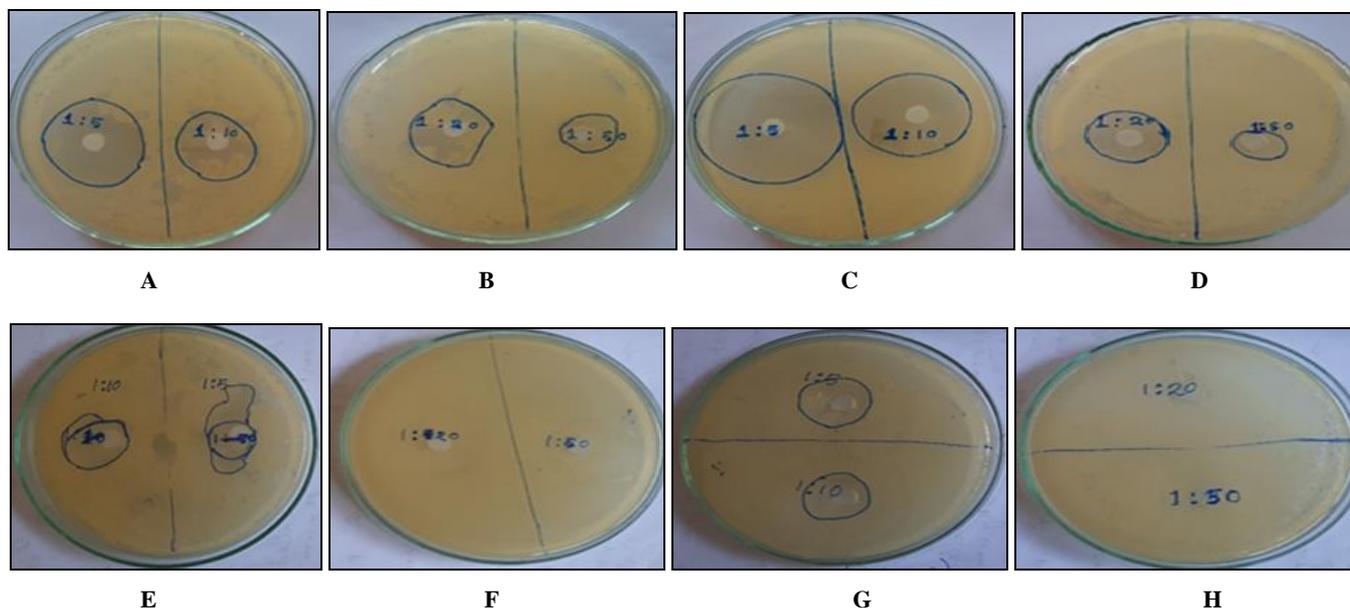
**Fig 5:** (A) Dabour caries (1:05 & 1:10) (B) Dabour caries (1:20 & 1:50) (C) Close-up caries (1:05 & 1:10). (D) Close-up caries (1:20 & 1:50) (E) Glister caries (1:05 & 1:10) (F) Glister caries (1:20 & 1:50) (G) Colgate caries (1:05 & 1:10) (H) Colgate caries (1:20 & 1:50).



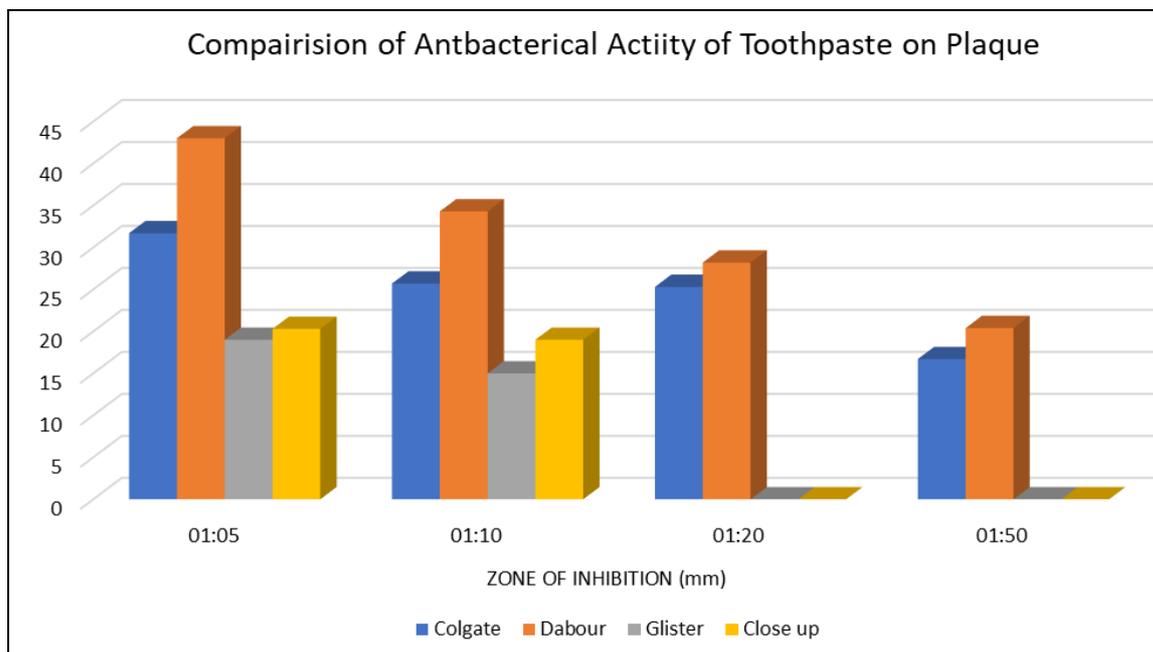
**Fig 6:** The graphical representation of the comparative study of toothpaste on caries

**Table 5:** Antimicrobial activity of different toothpaste against dental pathogens isolated from dental Plaque

Name of toothpaste	Zone of inhibition (mm)			
	1:05	1:10	1:20	1:50
Colgate	31.7	25.7	25.3	16.7
Dabur	43	34.3	28.2	20.4
Glistler	19	15	0	0
Close up	20.3	19	0	0



**Fig 7:** (A) Colgate plaque (1:05 & 1:10) (B) Colgate plaque (1:20 & 1:50) (C) Dabour plaque (1:05 & 1:10) (D) Dabour plaque (1:20 & 1:50). (E) Glistler plaque (1:05 & 1:10). (F) Glistler plaque (1:20 & 1:50) (G) Close-up plaque (1:05&1:10) (H) Close-up plaque (1:20& 1:50)



**Fig 8:** The graphical representation of the comparative study of toothpaste on plaque.

**4. Conclusion**

Experimental findings boost up the mind set and increase the faith of human beings to use the natural or herbal products for healthy life and also to build up the eco-friendly environment.

**5. Acknowledgments**

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**6. Conflict of Interest**

Authors have no conflict of interest

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