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RESEARCH ARTICLE

Anticariogenic Activity of Mucuna Pruriens Mediated Titanium Dioxide Nanoparticles.

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ABSTRACT

Introduction: Dental caries which is the most common disease of the oral cavity are caused due to demineralization of the inorganic substance and the subsequent destruction of the organic substance of the tooth. They start with the adherence of bacteria to the structures of the tooth, which then will gradually lead to the formation of plaque, culminating in the demineralization of enamel caused by the fermentation of dietary carbohydrates. Mucuna pruriens has long been used as Ayurvedic medicine, as a means to treat Parkinsonism primarily. It is also known to have a variety of other activities which include antiepileptic, antidiabetic, anticariogenic, anti-inflammatory, antioxidative, and also cytotoxic effects.

Materials and Methods: 1g Mucuna pruriens was dissolved in distilled water and was boiled for 5 minutes, Titanium dioxide extract was prepared by dissolving the extract in 90ml of distilled water. The mixture was then placed on an orbital shaker for an hour.

Result: Maximum activity against all the three oral pathogens were observed at 100 µL.

Conclusion: From this study, we can conclude that the high potential of Mucuna pruriens mediated Titanium dioxide nanoparticles is evident on S. mutans and E. faecalis

KEYWORDS:
Mucuna pruriens, anticariogenic activity, Staphylococcus aureus; Staphylococcus mutans, Enterococcus faecalis.

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INTRODUCTION

Dental caries, which is the most common disease of the oral cavity are caused due to demineralization of the inorganic substance and the subsequent destruction of the organic substance of the tooth(1)(2,3). There is a formation of a plaque biofilm that protects the pathogenic microorganisms from the host's defense mechanism(4). They start with the adherence of bacteria to the structures of the tooth, which then will gradually lead to the formation of plaque, culminating in the demineralization of enamel caused by the fermentation of dietary carbohydrates(5)(6). There is the formation of initial caries that manifest as a white spot lesion and occurs in a subsurface beneath an area that relatively seems to be intact and is caused by both Staphylococcus mutans and Lactobacillus acidophilus(7).

Mucuna pruriens has long been used as traditional Indian medicine, which is better known as Ayurveda, as a means to treat Parkinsonism primarily. It is also known to have a variety of other activities which include antiepileptic, antidiabetic, anticariogenic, anti-inflammatory, antioxidative, and also cytotoxic effects. Ever since the dawn of time, we have been reliant on plants as a source of food and medicine. Yet we still are not in a state where the true potential of plants has not been explored and hence the knowledge about which still largely remains unknown. With countries like India having a high demand predominantly for herbal medicines and the increase seen in the demand for the same in the global market(8), we need to explore the potential that these unexplored plants have. There have been studies where antimicrobial activity has been reported against both Gram-Negative and Gram positive bacteria (9). It has shown to have efficacy against Staphylococcus aureus, Pseudomonas aeruginosa, and B. subtilis(10).

We live in an ever-improving and ever-progressing world, hence we need more effective means for every activity that we are performing. This is applicable for means of drug delivery and nanoparticles(11)(12)(13). Nanoparticles are defined as materials, manufactured or naturally occurring, that are in the size range of 1-100nm. They have incredible potential to serve as anticariogenic agents because of their enhanced physicochemical properties, large surface area to mass ratio, and increased chemical reactivity(14)(15–17). Our team has extensive knowledge and research experience that has translated into high quality publications(18–22),(23)-(24),(20,25,26),(27–31),(32)-(33)(34) (35) (36) (37) (38) (39) (40) (41) (42) (43) (44) (45) (46) (47)

The aim of this study is to find the anticariogenic activity of Mucuna pruriens mediated Titanium dioxide nanoparticles.

MATERIALS AND METHODS

Green synthesis of Nanoparticle

1g Mucuna pruriens was dissolved in distilled water and was boiled for 5 minutes. Titanium dioxide extract was prepared by dissolving the extract in 90ml of distilled water. The mixture was then placed on an orbital shaker for an hour.

Anticariogenic activity

Anticariogenic activity of respective nanoparticles against the strain staphylococcus aureus, Enterococcus faecalis and s.mutans . MHA agar was utilized for this activity to determine the zone of inhibition. Muller Hinton agar was prepared and sterilized for 45 minutes at 120lbs. Media poured into the sterilised plates were allowed to solidify. The wells were cut using the well cutter and the test organisms were swabbed. The nanoparticles with different concentrations were loaded and the plates were incubated for 24 hours at 37 ° C. After the incubation time the zone of inhibition was measured.

RESULT & DISCUSSION

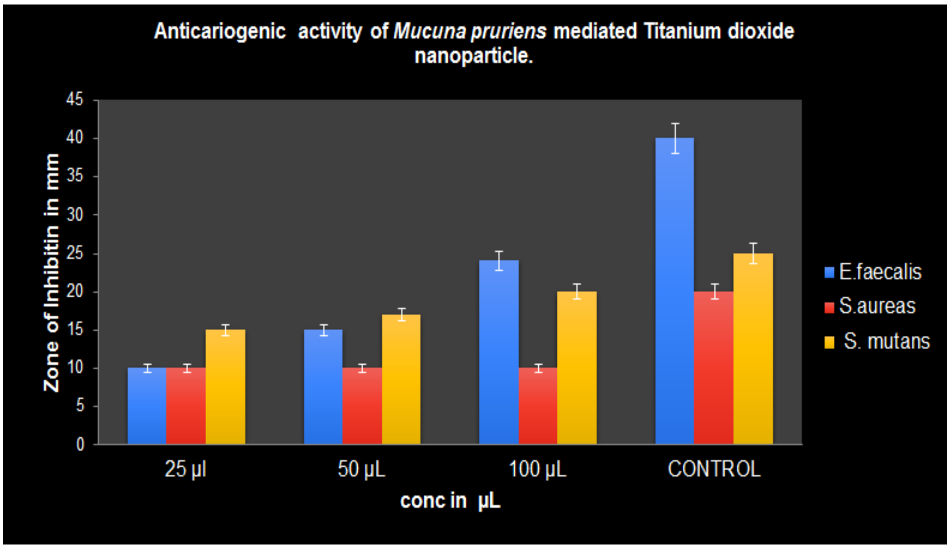

Fig.1: Graph representing Anticariogenic activity of.The bar graph depicts the Anticariogenic activity of Mucuna pruriens mediated Titanium dioxide nanoparticles. x axis represents the concentration and y axis represents the zone of inhibition in mm, data implies as mean±SEM

In the present study, a test for antimicrobial activity was carried out using the Agar well diffusion method. Three agar plates for identifying the inhibitory effect over Staphylococcus mutans, Staphylococcus aureus and Enterococcus faecalis respectively, were used . Each plate had four wells each with different nanoparticle concentrations being 25µL, 50 µL, 100 µL while the fourth was a standard. Against Enterococcus faecalis, the diameter of the zone of inhibition of the nanoparticles at 25 µL, 50 µL, 100 µL is observed to be 10mm, 15 mm and 24mm respectively. With Staphylococcus mutans, the diameter of the zone of inhibition of the nanoparticles at 25 µL, 50 µL, 100 µL was obtained as 15mm, 17mm and 20 mm respectively. For Staphylococcus aureus, the diameter of the zones of inhibition found at 25 µL, 50 µL, 100 µL was obtained at 10mm, 10mm and 10mm. Thus, maximum activity for all the three was observed at 100 µL. The control group against E. faecalis, had a diameter of 40mm, against S.aureus it was found to be at 20 and for S. mutans, was found to be at 20mm. While it is evident that at 100µL, the activity was found to be maximum for both Enterococcus faecalis and Staphylococcus mutans, Staphylococcus aureus did not have a differing diameter of the zones of inhibition around it.

This was also observed in a study by(48),(49)and (50,51), they compared the action of Mucuna pruriens against various cariogenic pathogens. They also found that the zone of inhibition found around S. mutans was measured the same diameter around them. When seen in the study by(52) and (53), we see that with the help of nanoparticles the method of delivery is far more efficient as the zone of inhibition found is larger in diameter.

This study also adds to the already existing knowledge regarding the effectiveness of nanoparticles against a variety of diseases. We already had preexisting knowledge about its effectiveness against cancer and its cytotoxic activity to add to that we can also mention its effectiveness against bacteria and microbes(11,54–57).

CONCLUSION

From this study, we can conclude that the high potential of Mucuna pruriens mediated Titanium dioxide nanoparticles is evident on S. mutans and E. faecalis (58-67). With this study we can find its use in making oral hygiene products such as toothpastes, mouthwashes which can help reduce the incidence of caries and be highly effective.

CONFLICT OF INTEREST

There was no conflict of interest

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