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Awareness Of Anticariogenic Activity Of Cerium Dioxide Nanoparticles Green Synthesized By Neem And Ginger Extract Among Undergraduate Dental Students

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ABSTRACT:

INTRODUCTION:

During the last decade green synthesized cerium oxide nanoparticles (CeO_2 NPs) attracted remarkable interest in various fields of science and technology. This study explores the vast array of biological resources such as plants, microbes, and other biological products being used in synthesis of CeO_2 NPs. It also discusses their biosynthetic mechanism, current understandings, and trends in the green synthesis of CeO_2 NPs. Novel therapies based on green synthesized CeO_2 NPs are illustrated, in particular their antimicrobial potential along with attempts of their mechanistic elucidation. Overall, the main objective of this review is to provide a rational insight of the major accomplishments of CeO_2 NPs as novel therapeutics agents for a wide range of microbial pathogens and combating other diseases.

AIM:

To determine and assess the Awareness of anticariogenic activity of cerium dioxide nanoparticles green synthesized by neem and ginger extract amongst dental students

MATERIALS AND METHODS:

The present study was conducted among 100 undergraduate dental students. A questionnaire was prepared consisting of 10 questions, and it was distributed to each of them, and they were evaluated individually. The results of the study were calculated statistically and analyzed both quantitatively and qualitatively.

RESULTS:

Among the study population, 1st year students are 27%, 2nd year students are 17%, 3rd year students are 29%, and 4th year students are 27%. Overall results of the study indicated that there is 40 % awareness regarding cerium dioxide nanoparticles among the undergraduate students.

CONCLUSION:

From the above study, it is found that the awareness level is average and needs to be increased regarding nanoparticles in general. The different extracts used to prepare various nanoparticles useful for treating many diseases as sources prove that there are medicinal effects of nanoparticles when combined with plant source extracts like neem, ginger etc. Also cariogenic activity known can help find a medicine which not only treats but also prevents oral cancer in the initial stages. Hence awareness must be improved among undergraduate students by conducting seminars and increasing their knowledge regarding cerium dioxide nanoparticles as a whole.

KEY WORDS: nanotechnology, green synthesis, cerium oxide, nanoparticles, antimicrobial, infections, biomedical,innovative.

INTRODUCTION:

Nanotechnology has got a remarkable interest in every field of science and technology and is presently considered among one of the leading research avenues. It has a multitude of applications in the field of electronics, imaging, industry, and healthcare. [1,2] Mostly, in healthcare it has been exploited in disease diagnostics, treatment, delivery, and formulations of novel drugs. [3–5] It exploits nano size structures with size ranges from 1–100 nm, known as nanoparticle (NPs). These nano-scale entities have unique physio-chemical properties and have been utilized in various fields of physics, biology, and chemistry. [6]

Among other NPs, Cerium Oxide (CeO_2) NPs have been mostly exploited due to their unique surface chemistry, high stability, and biocompatibility. [7], [8]. It is mostly used in the fabrication of sensors, cells, catalysis, therapeutics agents, drug delivery careers, and anti-parasitic ointments. [9], [10] Presently, CeO_2 NPs are mostly synthesized via two methods, such as physical and chemical.However, these methods utilize toxic reducing solvents posing several threats to the biodiversity and ecosystem. Moreover, the NPs obtained with such approaches are toxic and unstable, making them less efficient. [8]. Thus, recently a safe, less toxic method has been used by researchers known as Green Synthesis. This method utilizes various biological resources such as plants, microbes, or any other biological derivative. [11] These biological extracts have a rich source of phytochemicals such asketones, amines,

enzymes, and phenols, which are believed to be responsible for the reduction and stabilization of bulk salts into respective nanoparticles NPs. [11] To date various applications of green synthesized CeO_2 NPs have been reported such as antimicrobial, anti-cancer, anti-larvicidal, photo-catalysis, and antioxidant therapies. [12] Among other biomedical applications the antimicrobial potential is certainly the most exploited. Previously it has been reported that CeO_2 NPs display their antimicrobial actions through various mechanisms.

Awareness among the undergraduate dental students regarding any new update in their field which will be helpful in treating diseases by further research and understanding is for the betterment and the well being of the human race. Our team has extensive knowledge and research experience that has translate into high quality publications[13–23].

The objective of the study is to determine and understand the awareness level of anticariogenic activity of cerium dioxide nanoparticles green synthesized by neem and ginger extract among undergraduate dental students.

MATERIALS AND METHODS :

The study was conducted among 100 undergraduate dental college students studying in India. A questionnaire was prepared consisting of 10 questions, and it was distributed through an online platform to everyone. Sample size of 100 was recorded, the results were collected and they were evaluated individually. The results of the study were calculated statistically and analyzed both quantitatively and qualitatively.

RESULTS AND DISCUSSION:

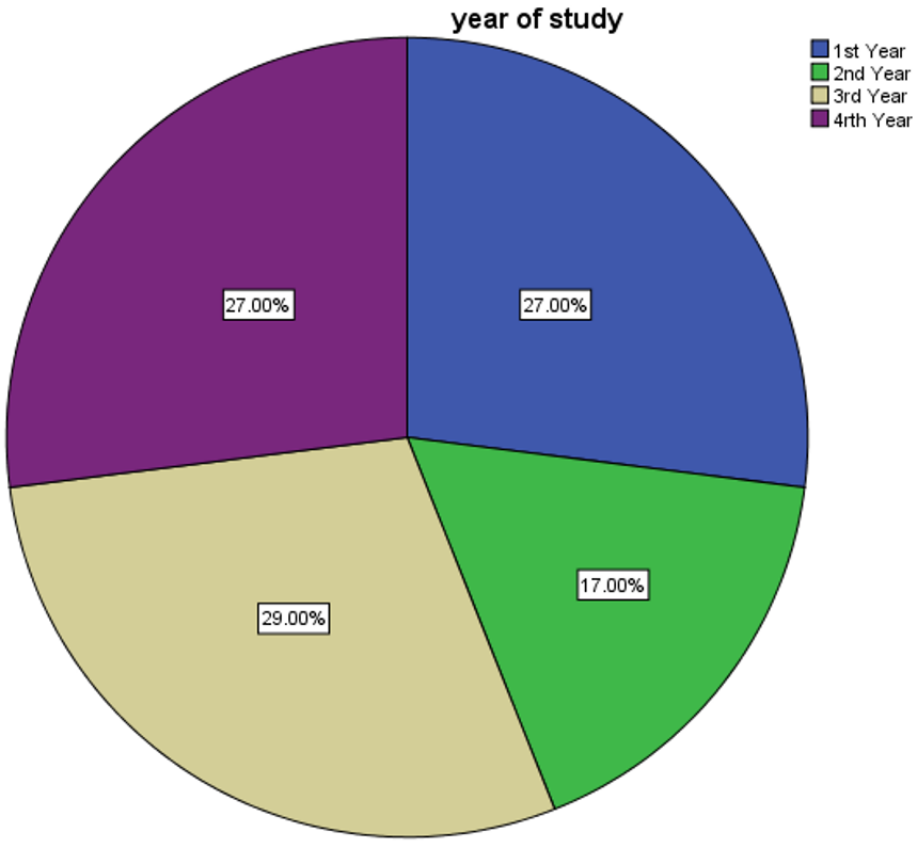

FIGURE 1 : The above chart represents the percentage distribution of participants based on the year of study involved in this research. Blue colour denotes 1st year with 27%. Green colour indicates 2nd year with 17%. Peach colour indicates 3rd year with 29% responses and purple colour denotes 4th year with 27%.

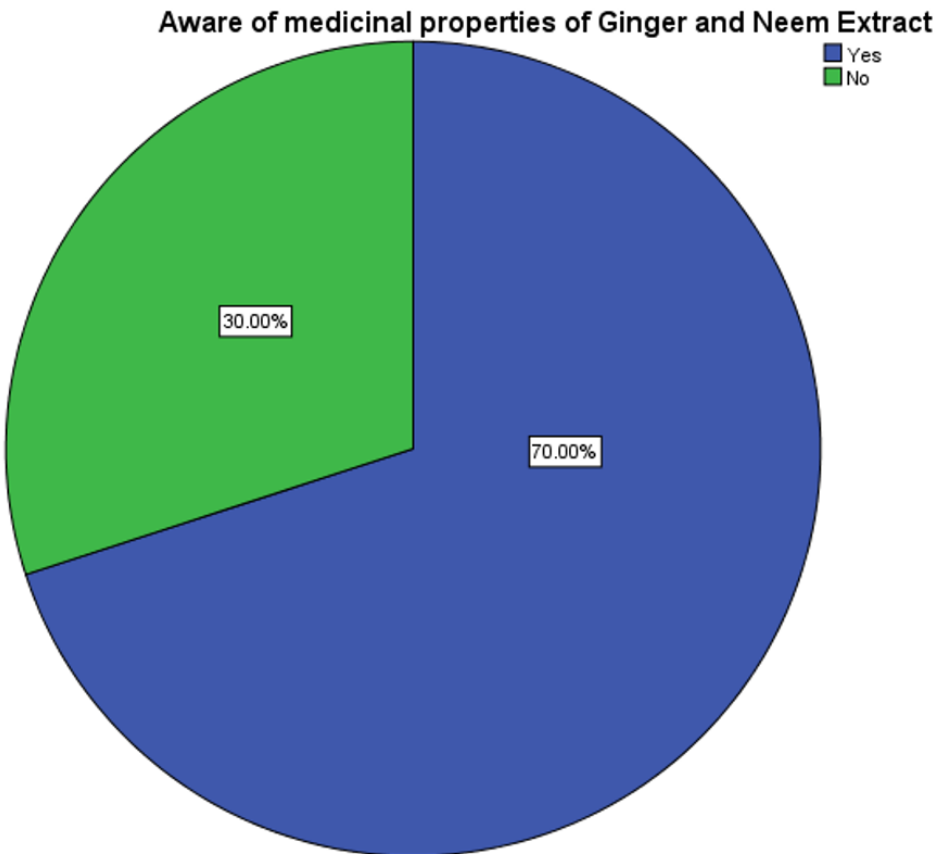

FIGURE 2: Represents the percentage of the awareness regarding the medicinal properties of ginger and neem extract. 30% responded to no, whereas 70% yes for being aware.

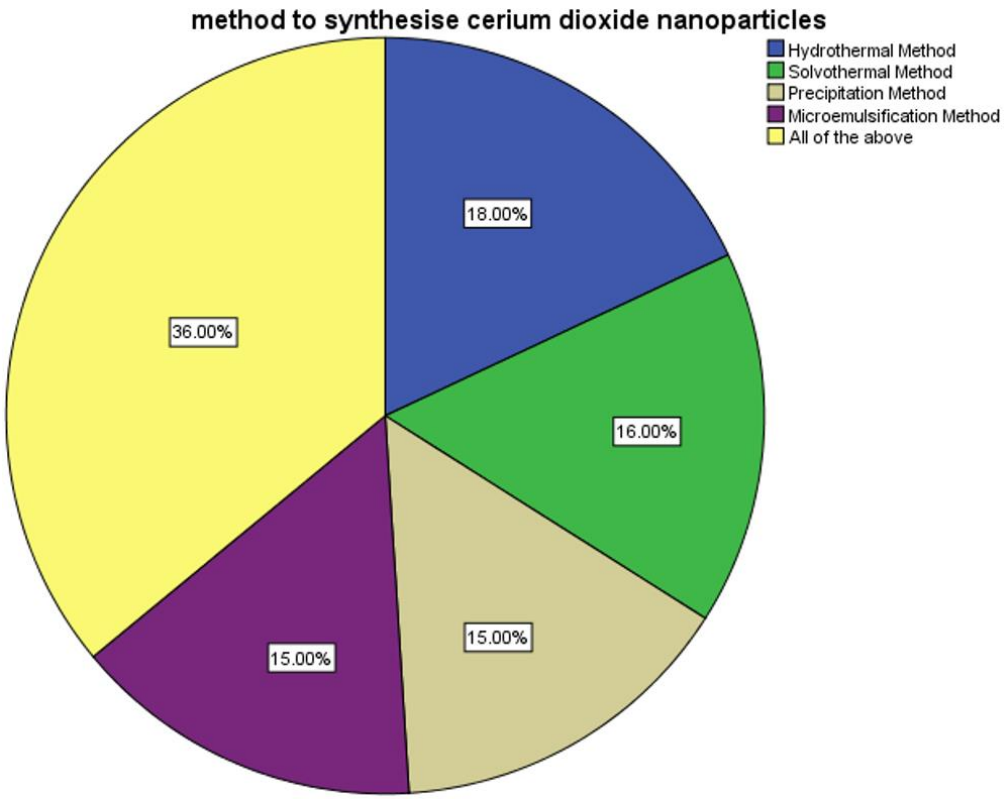

FIGURE 3 : Represents the percentage of individuals who have responded to hydrothermal method as a method to synthesize cerium dioxide nanoparticles (18%) depicted in blue colour, Solvothermal method (16%) denoted in green colour, Precipitation method denoted as peach colour (15%), Microemulsification method denoted in purple colour (15%). All of the above are denoted as yellow colour (36%).

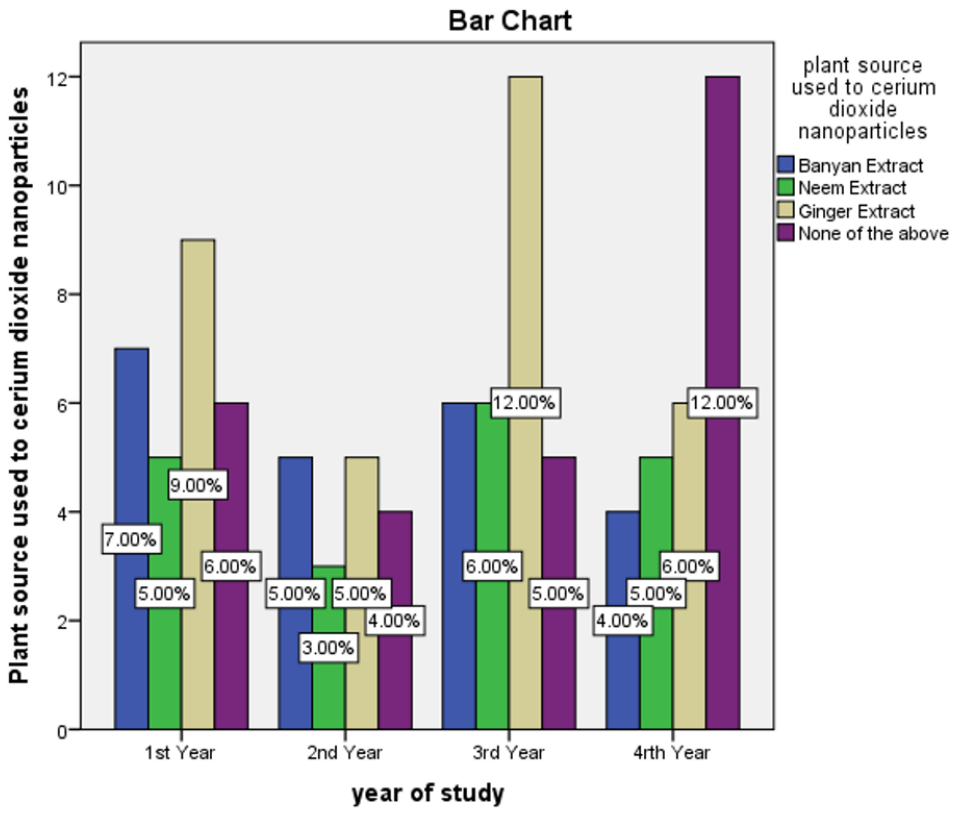

FIGURE 4 : Bar graph depicts the number of participants from different years of study who have responded for the plant source used to synthesize cerium dioxide nanoparticles. X axis represents the year of study, Y axis represents the plant sources used to synthesize cerium dioxide nanoparticles.

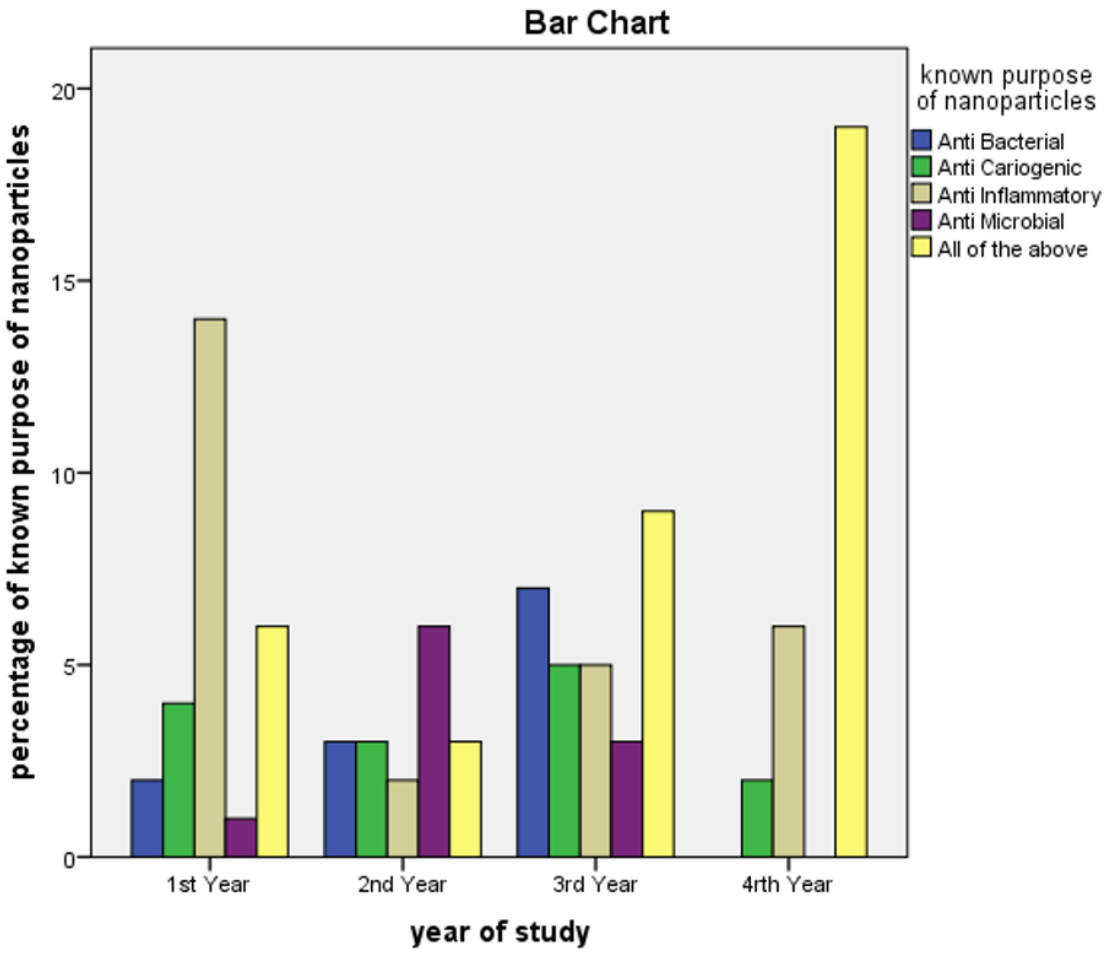

FIGURE 5 : Bar graph depicts the number of participants from different years of study who have responded for the known purpose of nanoparticles. X axis represents the year of study, Y axis represents the purpose of nanoparticles.

Nanoparticles are synthesized through various physico-chemical methods. [6] However, both methods require toxic solvents, high temperature, and pressure, which pose threats to the environment.Moreover, higher cost, laborious downstream processing, lesser biocompatibility, instability, and low yield make them further inefficient. [24] There is a growing need to fabricate nanostructures which have the potential to solve these problems. [6] Presently, researchers have exploited the green method to overcome all these challenges. [6] For instance, plants, microbes, and other biological products have been used as reducing and/or stabilizing agents in the fabrication of eco-friendly NPs. [25] CeO_2 NPs have also been synthesized using various physical, chemical, and biological methods.The latter is extensively utilized for its biomedical, pharmacological, and food applications due

to their safe and biocompatible nature. Moreover, features like high yield, everlasting stability, and better morphologies can be obtained using a greener approach. [8]

Green synthesis of CeO2NPs have been reported using plant extracts, microbial, and other biological derivatives. Plants in this regard have been the most efficient source due to their abundance, safe nature, and rich source of reducing and stabilizing agents. [26][27]Various parts of plants such as leaves, flower, and stem have been used for the synthesis of Ce02NPs. [28] Till date the majority of green synthesis studies have been conducted on leaves extracts, as it is a rich source of metabolites. A broad variety of metabolites/phytochemicals in plant extracts such as ketones, carboxylic acids, phenols, and ascorbic acid are used as reduction and stabilizing agents. Plants based Ce02 NPs are produced through a simple approach in which bulk metal salt is mixed with the extract and the reaction completes in minutes to a few hours in ordinary lab conditions. [27]The metallic salt solution is reduced into respective nanoparticles via the phytochemicals whose synthesis is confirmed firstly through color change from colorless to yellowish, brownish, or whitish, and then characterized through various spectroscopic and imaging techniques.

Microbes also have an intrinsic potential to synthesize nanoparticles, as they are a rich source of secondary metabolites. [29]Among other nanoparticles CeO2 NPs with various shapes and sizes have been synthesized in recent years from microbes. Green synthesis of CeO2 from microbial species is a simple, reliable, cost-effective, and eco-friendly approach. Microbial metabolites such as enzymes, proteins, and heterocyclic derivatives play a crucial role in reducing and stabilizing CeO2 bulk salt into respective NPs. Moreover, micro-biogenic CeO2 NPs exhibited improved stability, water dispensability, and showed high fluorescent properties and were less agglomerated.[30]

CONCLUSION:

After conducting this study and statistically analyzing the results collected. It is found that the awareness level is average and needs to be increased regarding nanoparticles in general. The different extracts used to prepare various nanoparticles useful for treating many diseases as sources prove that there are medicinal effects of nanoparticles when combined with plant source extracts like neem, ginger etc. Also cariogenic activity known can help find a medicine which not only treats but also prevents oral cancer in the initial stages. Hence awareness must be improved among undergraduate students by conducting seminars and increasing their knowledge regarding cerium dioxide nanoparticles as a whole.

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