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RESEARCH ARTICLE

White Pepper Oleoresin Mediated Selenium Nanoparticles Its Antidiabetic and Cytotoxic Effects

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ABSTRACT

Introduction: White pepper from the Piperaceae family is a tropical berry. The phenolic amides in white pepper have significant antioxidant activities.Piperine present in it seems to reduce pain, improve breathing, reduce inflammation and improve brain function.

Aim: The aim of the study was to analyse the antidiabetic and cytotoxic effect of white pepper oleoresin with selenium nanoparticles.

Materials and methods: Initially white pepper oleoresin mediated selenium nanoparticles were synthesised and confirmed using UV-Visible spectrophotometer and the alpha-amylase inhibitory activity and brine shrimp lethality assay was conducted using different concentrations of the prepared white pepper oleoresin mediated selenium nanoparticles .

Results and Discussion: The different concentrations of white pepper oleoresin mediated selenium nanoparticles showed an increase in the alpha amylase activity with increased concentration and the maximum activity showed was 84 % at the maximum concentration used in the study,50µL was the highest concentration , more than 5 µL ,was found to be cytotoxic effect in Brine shrimps.

Conclusion: The synthesis of selenium nanoparticles using white pepper oleoresin was of reasonable cost and was convenient to carry out. Its alpha amylase inhibitory activity was promising to consider its antidiabetic potential ; Brine shrimp lethality assay showed its cytotoxic effect at higher concentrations. Hence, an appropriate quantity of white pepper oleoresin mediated selenium nanoparticles may be used for conditions such as diabetes .

KEYWORDS:
oleoresin; cytotoxic effect; ; antidiabetic activity; white pepper, nanoparticle; selenium

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INTRODUCTION

White pepper is a seed obtained from a pepper plant by solvent extraction of Piper nigrum, decorticated, ground dried with underlying pungency. White pepper developed from the Piperaceae family and it is a tropical berry (1). White pepper has the presence of an active compound called piperine which has the formula C17H19NO3. Compounds are made up of 4,6 - 9% piperine, 6% of pungent resin, 2.5% essential oil and starch (2). Oleoresin has anti inflammatory, anti depressant, analgesic, anti rheumatic and antidiabetic. It is also used as a bio-enhancer, it also has applications in insecticides, herbal medicine,and the cosmetic industry (3). It chemically contains lignans, alkaloids and flavonoids, aromatic compounds , amides (4). Phenolic compounds are naturally found in fruits, vegetables, cereals, legumes and beverages in abundant amounts. White pepper has all the phenolic amides having significant antioxidant activities that are more productive

than the naturally occurring antioxidant, alpha-tocopherol (5). Pepper has been widely described to have radical scavenging activities and phenolic compounds . The presence of plant polyphenols as functional compounds supplies dietary antioxidants and helps in human health by reducing disease risks (6). White pepper is better and useful when compared to black pepper, as it possesses mild flavour , pungency and light colour (7).

Nanotechnology is expected to be the basis of many main Technology innovations in the 21st century (8). Research and development is rapidly growing throughout the world in this field. Nanotechnology occupies tremendous application in diverse fixes such as chemistry,cosmetics,energy, catalyst,on-to-electronics,medicine and plasmonic (9). Nano biotechnology is undoubtedly future generation technology which offers potential application and multidisciplinary areas of Science and Technology (10). Nanoparticles are even used for treatment of many disease conditions such as diabetes,cancer,cardiovascular disease,etc.(11)

Selenium is an important element required in lesser amounts in humans for optimal function (12). Selenium nanoparticles are manufactured by several methods using the biological method as well as both chemical and physical methods. Selenium is a metalloid having the characteristics of both a metal and a nonmetal (13). Selenium is photo-electrically active and is a semiconductor where it is used for glass production and solar cell assembly (14). Many researchers have reported the synthesis of selenium nanoparticles using biological sources such as bacteria, fungi, yeasts and plants. Selenium nanoparticles reveal attractive anticancer activity and reduce toxicity concerns compared to different Se species (15). Selenium nanoparticles have been used in many disease conditions including cancer, diabetes, inflammatory disorders, liver fibrosis, and drug induced toxicities. Selenium nanoparticles have merits over other nanomaterials because of the favourable role of selenium in the stabilization of the immune system and activation of the shielding response.(16).Our team has extensive knowledge and research experience that has translate into high quality publications (17–21) (22)The aim of the study was to evaluate the antidiabetic and cytotoxic effect of white pepper oleoresin with selenium nanoparticles.

MATERIALS AND METHODS

Study setting

The study was conducted at the Nanomedicine lab of Saveetha Dental College after obtaining approval from Scientific Review Board (IHEC/SDC/UG-1967/21/143)

Plant material

White pepper oleoresin was obtained (Product code 4010000835) from synthite industries pvt limited, Kerala, by solvent extraction of the white pepper was prepared from ripe pepper berries by disintegration of the skin, decortication and drying.

Synthesis of Selenium nanoparticles

Selenium nanoparticles were synthesised by adding 0.346g of sodium selenite and 0.2 ml concentration of white pepper oleoresin 100 mL of distilled water and was kept in an orbital shaker for the formation of selenium nanoparticles. The formation of the nanoparticles were confirmed both visually and using a UV visible spectrophotometer. The nanoparticles were then centrifuged with the help of a lark refrigerated centrifuge at 8000 rpm for 10 minutes. The pellets were separated and stored in the eppendorf tubes.

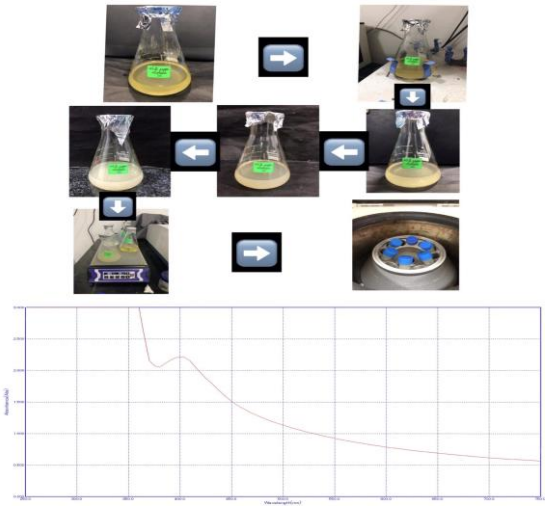

Fig.1: Picture representing the preparation of white pepper oleoresin with selenium nanoparticles and UV- Visible spectroscopy with the peak value of 350 nm.

Alpha-amylase inhibitory assay

alpha-amylase inhibition was determined by quantifying the amount of maltose liberated during the experiment. Different concentrations of nanoparticles (20µL, 40µL, 80µL, 100µL) were pre-incubated with 100 µL of starch solution added to it and the mixture was incubated at room temperature for 30

mins. 100 µL of 96 mM DNSA reagent was added to it to stop the reaction and the solution was heated in a water bath for 5 mins. Control was maintained ,where the equal quantity of enzyme extract was replaced by a sodium phosphate buffer. The study was carried out in triplicate.Acarbose was used as a positive control. % inhibition was calculated using the formulae - % inhibition = C - T/C*100.Reading was measured at 540 nm.

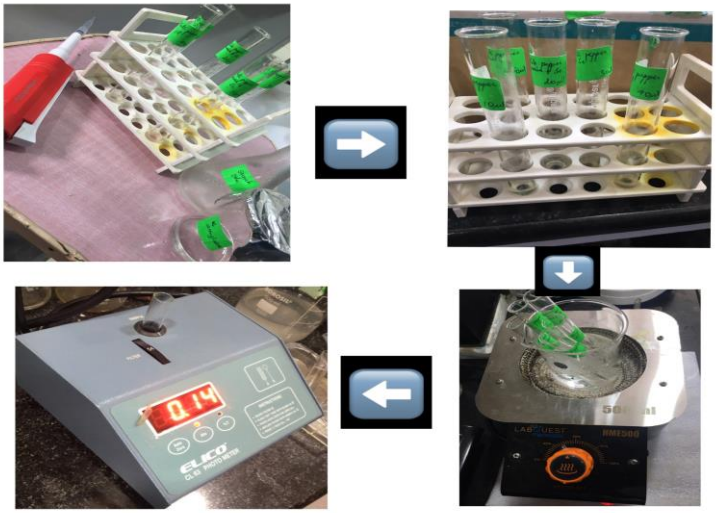

Fig.2: Picture representing the antidiabetic activity with white pepper oleoresin with selenium nanoparticles.

Cytotoxicity effect

Brine Shrimp Lethality Assay

Salt water preparation

2g of iodine free salt was weighed and dissolved in 200ml of distilled water. 6 well ELISA plates were taken and 10-12 ml of saline water was filled. To that 10 nauplii were slowly added to each well (20µL, 40µL, 60µL, 80µL, 100µL). Then the nanoparticles were added according to the concentration level. The plates were incubated for 24 hours. After 24 hours, the ELISA plates were observed and noted for the number of live nauplii present and calculated by using the following formula: number of dead nauplii/number of dead nauplii+number of live nauplii×100.

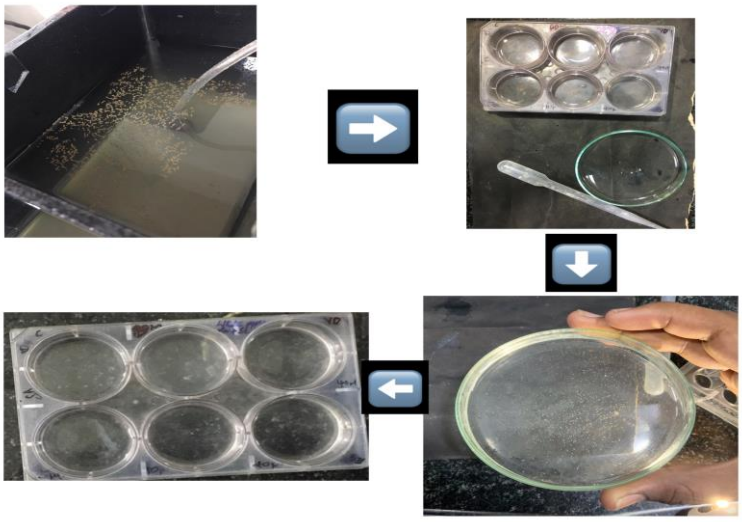

Fig.3: Picture representing the preparation of brine shrimp and cytotoxic activity with white pepper oleoresin with selenium nanoparticles.

RESULTS

Figure 4 depicts the percentage inhibition of alpha amylase activity of white pepper oleoresin mediated selenium nanoparticles compared with standard value in different concentrations. The reading was taken at 540 nm, and the percentage inhibition or the antioxidant activity was at 10 µL was 42%, at 20 µL it was 57% at 30 µL it was 59%, at 40 µL it was 72% and at 50 µL it was 86%, and the standard value at 10 µL was 47%, at 20 µL it was 60%, 30 µL it was 72%, at 40 µL it was 78%, and at 50 µL it was 84%.

Figure 5 depicts the cytotoxic effect of white pepper oleoresin with selenium nanoparticles among different concentrations. In where at day 1 there was 10 nauplii present after 24 hours at different concentration, nauplii count varied which include as at 5 µL concentration there was 9 nauplii present, at 10µL

concentration there was 7 present, at 20µL concentration there was 4 nauplii present, at 40µL concentration there was 2 nauplii present and at 80µL concentrations there was 1 nauplii present. Control was the same with 10 nauplius.

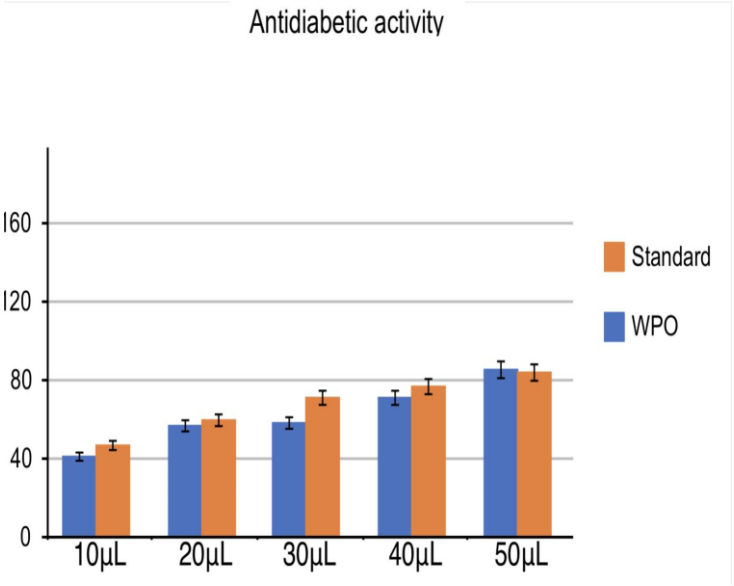

Fig.4: Graph representing the antidiabetic activity of white pepper oleoresin mediated selenium nanoparticles in different concentrations with standard .X-Axis represents different concentration of nanoparticle(blue) and standard (orange)the Y-Axis represents the percentage inhibition of alpha amylase activity mean +_ SD and n=3 .

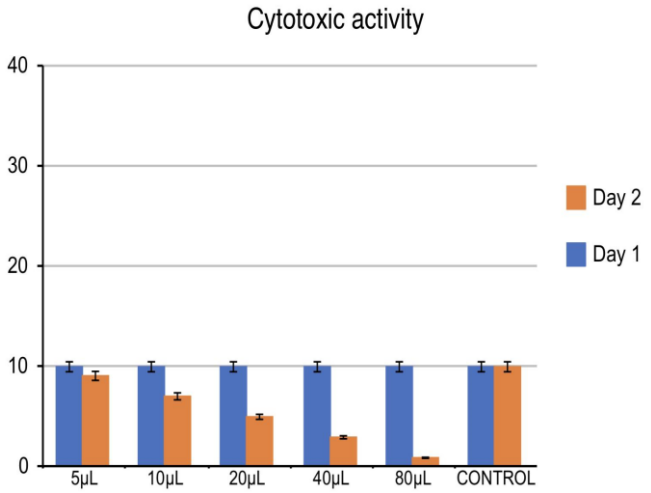

Fig.5: Graph representing the cytotoxic effect of white pepper oleoresin with selenium nanoparticles on live nauplii at different concentrations. X-axis represents the different types of concentration of andY- axis represents the number of live Nauplii. Blue represents the live nauplii on Day 1 and orange colour represents the live nauplii on Day2

DISCUSSION

White pepper compounds can function as free radical scavengers and promote human health by its anti-aging, antioxidant activity and anti-carcinogenic effects. Studies report the presence of ß-caryophyllene, sabinene, ß-bisabolene, limonene and α-pinene , which are responsible for the antioxidant activity of the essential oil (23) .Another study has concluded that the chemical structure of piperine and its derivatives is different from that of prototype antiepileptic drugs and it can be used as a new group of antiepileptic drugs (24) .

Selenium nanoparticles reveal attractive anticancer activity and reduce toxicity concerns compared to different Se species (15). Selenium nanoparticles have merits compared to other nanomaterials because of the promising role of selenium in the stabilization of the immune system and activation of the defense response (16). Colloidal selenium nanoparticles have emerged as exceptional selenium species with reported chemopreventive and therapeutic properties. In the article (25) it has reported that the study has sparked widespread interest in their use as a carrier of therapeutic agents with results displaying synergistic effects of selenium with its therapeutic cargo and improved anticancer activity. Selenium nanoparticles can open ways to new regular strategies for treating illnesses like malignancy, and this audit expresses the reasons why these nano-measured medications can be the following huge achievement as chemotherapeutic operators (26). In another study selenium nanoparticles showed a low cytotoxic effect when cultured with human dermal fibroblasts cells at a range of concentrations up to 1 ppm while showing

an anticancer effect toward human melanoma and glioblastoma cells

at the same concentration range (27).The study aims to provide information about the use of white pepper oleoresin mediated selenium nanoparticles in diabetes and in cancer .However , to note the limitations, the study has conducted only in few in vitro models and definitely it should be extended to higher level inorder to meet human use.

Our team has extensive knowledge and research experience that has translated into high quality publications (28) (29) (30) (31) (32) (33) (34) (35) (36) (37) (38) (39) (39,40) (41) (41,42) (43) (44)

CONCLUSION

The synthesis of selenium nanoparticles using white pepper oleoresin was cost effective and was favourable (45-54). The antidiabetic and cytotoxic effect results were good to consider for its use in the management of diabetes and cancer .However more studies are needed to confirm the use in human

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Jeevan clinic, Chennai, India

CONFLICT OF INTEREST

Nil

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