Enhancing Potential Impact on Publicising use of Micro Diamond for Stop the Spread of Breast Cancer

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Abstract

There have been reports of anonaceous acetogenins having anti-cancer abilities but poor viability. In this work, we looked into the efficacy of nanodiamonds as annonacin carriers to help boost their viability and slow the growth of breast cancer cells. In the entire world, cancer is the main cause of sickness and mortality. From 2.4% (2009-2013) to 5%, the rate of annual drop in total cancer mortality more than doubled (2014-2018). In the United States in 2021, 1,898,160 new cancer cases and 608,570 cancer deaths are anticipated, despite a trend of decreased cancer mortality. Among the world, breast cancer is one of the most prevalent cancers in women. In the United States, it was predicted that there would be 284,200 new cases of breast cancer in 2021, and that 15.5% of those cases would die from the disease. The body generates oxidants called free radicals as part of routine metabolic activities. Cells feature an antioxidant system, including enzymes that eliminate free radical molecules, despite the fact that oxidants are constantly created.

Keywords: Annonacin • Breast cancer • Nano diamonds • Sickness • Free radical molecules

Introduction

This procedure is crucial because oxidative stress accelerates the development of cancer by destroying DNA, proteins, lipids, and carbohydrate molecules when there are too many oxidants present or when the antioxidant system is compromised. By creating genomic instability, activating numerous signaling pathways involved in cancer cell promotion, or activating various oncogenes and suppressor genes, oxidative stress speeds up cancer cell proliferation, angiogenesis, and metastasis. Reactive Oxygen Species (ROS) play a significant role in the development of cancer and have an impact on a variety of biological processes, including cell survival, differentiation, and resistance to apoptosis. Lipid peroxidation, which is frequently tracked by measuring Malondialdehyde (MDA) levels, can be caused by ROS. In many different forms of cancer, ROS sensitive signaling pathways, such as the MAPK/ERK, NF-B, and PI3K/Akt pathways, are frequently increased. It was discovered that the PI3K signalling pathway is activated by the production of ROS during the metabolism of estrogen and other possible breast carcinogens Members of the Annonaceae family produce an acetogenin called anonacin. By stopping the cell cycle, it has the potential to block cell division and reduce cell growth. Annonacin caused cytotoxicity and cell cycle arrest in T24 bladder cancer cells through a mechanism involving Bax and caspase-3. By promoting the p21 protein, annonacin was able to stop the cell cycle in N-nitroso-N-Methylurea (NMU) induced malignancies at the G_1 phase. Additionally, it was noted that the substance reduced the expression of ER, cyclin D1, and Bcl2 to prevent the proliferation of MCF-7 breast cancer cells. Although annonacin has the potential to be an anti-cancer drug, a pharmacokinetics study revealed that it has a low bioavailability and Solubility and a limited capacity to pass the blood brain barrier. According to Gutirezz, et al., the use of Supramolecular Polymer Micelles (SMPM) as nanocarriers for annonacin in a drug delivery system boosted the drug's bioavailability and solubility, proving that using a carrier increases annonacin's bioavailability. A nanodiamond is a carbon allotrope nanoparticle, typically with a diameter between 2 mm and 100 nm. It has recently been employed as a carrier to deliver medications to particular target cells. Because they are risk free, efficient, induce a powerful response, and cannot be detected by the immune system, nanodiamonds have gained a lot of interest in therapy. A nanodiamond interacts with molecules of interest due to the unsaturated carbon bonds on its surface as well as its exceptional sorption and chemical bonding abilities.

Description

Both developed and developing nations are seeing an upsurge in the deadly disease known as cancer. Chemotherapy, radiation, and surgery are the three most often utilised cancer treatment modalities. Conventional cancer treatments, however, are ineffective and cause inherent damage. Cytotoxic chemicals are used in chemotherapy to destroy cancer cells, but because the treatment is non-specific, normal cells may also be killed in the process. As a result, it may result in a number of side effects both during and after therapy. Recently, scientists have concentrated on creating strategies that can target cancer cells only. Because tumours blood vessels have an abnormal shape, using drug delivery systems is anticipated to be a way to eliminate cancer cells without harming healthy cells. The effectiveness of annonacin, a bioactive substance found in *Annona muricata*, as an anti-cancer agent and its potential as a carrier for annonacin were examined in this study. A Nanodiamond (ND) is a carbon based nanoparticle that can be employed in drug delivery systems because of its high chemical surface biocompatibility. Earlier research has suggested that plant bioactive chemicals as ciproten, quercetin, and curcumin may be transported *via* nanodiamonds to be used as a cancer treatment. According to pharmacokinetic studies, annonacin has a poor survivability. Anonacin's bioavailability may be increased by using Supramolecular Polymer Micelles (SMPM) as a carrier, according to a prior study. The annonacin was linked into nanodiamond in this study and had an average size of 150 mm-300 nm. The characteristic properties of nanodiamond and annonacin are visible in the FT-IR spectra of NDAN, indicating that the coupling of an annonacin treatment did not change the structure of the nanodiamonds. The zeta potential value is essential for interacting with cells and for regulating electrostatic interactions with target sorbent molecules (cell membrane surfaces are negatively charged). In contrast to nanodiamond, the complex of annonacin nanodiamond displayed negative zeta potential (65.8 0.1 mV). The zeta potential was accompanied by an increase in the electrostatic repulsion forces between the particles. By increasing the distance between the suspended particles, this repulsion lessens the aggregation/flocculation brought on by van der Waals interactions. However, nanoparticles have a lower zeta potential, which causes them to assemble and enlarge. Additionally, the stability of the nanodiamond complex was studied by incubating it in various media, including DMEM, 10% complete DMEM and FBS. The zeta potential of the nanoparticles in the stable colloidal suspension system that prevents nanoparticle aggregation is assumed to be

more than or equal to +30 mV or less than -30 mV. The announcing Nano diamond complex's zeta potential ranged between -67.4 mV and -58.6 mV on various media, indicating that it was stable.

Conclusion

Overall, this study shows the new potential of nanodiamonds as an annonacin carrier. Additionally, we showed that annonacin inhibits the PI3K/Akt signalling pathway in breast cancer cells, which is a unique method. Future clinical studies should examine the mechanisms by which anonacin helps breast cancer cells avoid metastasizing.

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