

**NANOTECHNOLOGY – AN ANTIDOTE FOR CANCER TREATMENT IN
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Nigeria**ABSTRACT**

Nanotechnology is the technology for design, fabrication and manipulation of nanometer scale systems, in the scale of 1-100nm, with vast potential applications but the greatest values of nanotechnology is in the development of new and effective medical treatments. This study focuses on awareness of the potential of nanotechnology in medical treatment of malignant illnesses in the Nigeria. Application of mathematical models such as Cronbach Alpha was used in analyzing data for the evaluation on the awareness of the application of Nanotechnology in medical practice from medical doctors and pharmacists from selected teaching hospitals and federal medical centers across the country. Questionnaires in a five Likert scale format was deployed to gather responses required to evaluate the awareness of medical practitioners on the application of Nanotechnology to improve treatment of malignant illnesses. Primary data were collected from medical doctors and pharmacists and utilized in computing the Cronbach Alpha in order to evaluate internal consistency of collated data. From the index of association, $\alpha \geq 0.82$ was considered good and the percentage of respondents that strongly agrees on the application of nanotechnology in medical practice in the country was very low at 111 out of 126 with 88% response with a value of Cronbach alpha recorded at 0.82 indicating that the questions were internally consistent. Therefore, over 80% of the medical practitioners supported the drive to increase awareness on the application of nanotechnology to medical practice in the country.

Keywords:

Nanotechnology, Nanoparticles, Nanoscale, Health care, Engineering Innovation

INTRODUCTION

Nanotechnology is a multidisciplinary field that covers a vast and diverse range of devices derived from engineering, physics, chemistry, and biology. It involves manipulation of particles smaller than 100 nanometers (1 Nano meter is equivalent to one billionth of a meter). It is a technology that involves developing materials or devices within the size that is invisible to the human eye, often hundred times thinner than the width of human hair.

Because materials physical, chemical properties change in nanoscale, they exhibit some difference in Nano scale than what they can show in their real state, their physics and chemistry are radically different when they are reduced to the nanoscale, meaning that they'll show different strength, conductivity, and reactivity, and engineers can exploit the opportunity found in nanotechnology to revolutionize medicine.

When materials are reduced to nanoscale, the quantum confinement effect dominate the electrical and optical properties of materials or systems and also render new opportunities for manipulating the response of the system; that is why in nanoscale materials are smaller, lighter, cheaper, faster and more powerful.

The major challenge in medical science has always been that the body doesn't absorb the entire drug dose given to patient, and greater percentage of the drugs administered to the patients are destroyed or removed in the kidney or the liver inside the body and as such little of the drugs gets to the actual site of the disease, so nanotechnology application will certainly be a question answered in the direction of eliminating and managing malignant diseases in human body.

For instance, when you take the size of a baseball bat (1m long). Divide it by 10, you'll get the size of a fingertip (1cm or 0.01m), divide it again by 10, you'll get the size of a needle eye (1mm or 0.001m), divide it again by 10, you'll get size of human hair (100 μ m or 0.0001m), divide it again by 10, you'll get the size of 1 blood cell 10 μ m or 0.00001m); divide it again by 10 you'll get size of a bacteria (1 μ m or 0.000001m); divide it

again by 10, you'll get size of a virus (100nm or 0.0000001m), and divide it again by 10, you'll get size of half a DNA (1nm or 0.000000001m)

These concepts of Nanotechnology are being used for the treatment of different diseases like cancers, cardiac failure, fractures, deep skin injuries, etc. The introduction of nanomaterials provides a big hope for a better and an affordable healthcare. Technological advancements are underway for the development of continuous monitoring and regulating glucose levels by the implantation of sensor chips. Lab-on-a-chip technology is expected to modernize the diagnostics and make it easier and more regulated. Other area which can improve the tomorrow's healthcare is drug delivery

Nanotechnology is a growing field of technology that has evolved and can be a springboard for advancing medical sciences and providing opportunities for malignant disease diagnosis and treatment in healthcare sectors of any economy in the world. Applications of nanotechnology to medicine and physiology imply that medicinal materials and devices can be designed to interact with the body at molecular scales with a high degree of specificity and as such can be potentially translated into targeted cellular and tissue-specific clinical applications designed to achieve maximal therapeutic efficacy with minimal side effects. Since it is an established fact that there has been little success story on the impact of drug administration on targeted tumors in the human body because several approaches in the immediate past have failed to yield needed results. Therefore, the application of nanotechnology can be tie-breaker to revolutionize health care sector especially in the areas of disease diagnosis, bio-compatible materials and drug delivery systems.

METHODOLOGY

Primary data were collected from medical doctors and pharmacists across the teaching hospitals and federal medical centers in Nigeria via google map app in a 5-linkert model utilized to evaluate the awareness of medical practitioners on the application of nanotechnology to improve treatment of malignant illnesses. The Cronbach Alpha formula was used to evaluate internal consistency of collated data collected. From the index of association, $\alpha \geq 0.82$ was considered good and the percentage of respondents that strongly agrees on the application of nanotechnology in medical practice in the country was very low at 111 out of 126 with 88% response with a value of Cronbach alpha recorded at 0.82 indicating that the questions were internally consistent. Therefore, over 80% of the medical practitioners supported the drive to increase awareness on the application of nanotechnology to medical practice in the country.

From survey below, the awareness and application of Nanotechnology on medical science across the Nigeria is low (> 35%) and that medical doctors needs to know more about nanotechnology concepts and its application in medical practice in the country.

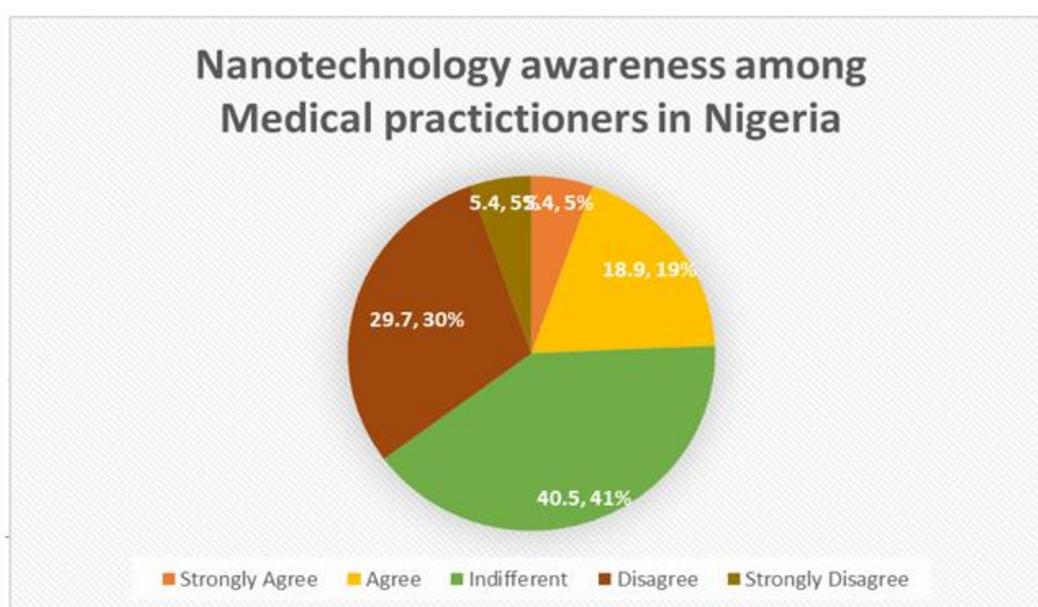


Fig 1- Field survey among medical practitioners in Nigeria

FINDINGS

Nanotechnology is the science of materials at molecular level that involves manipulation of particles smaller than 100 nanometers (1 nanometer is 1 billionth meter) and the technology involves developing materials or devices within size invisible to human eye and often many hundred times thinner than the width of human hair. It is a proven fact that the physical and chemical properties of materials are radically different when reduced to the nanoscale because they have different strengths, conductivity and reactivity, and this could be exploited by engineers to revolutionize medicine in Nigeria such as deploying nanotechnology concept to deliver drugs to specific areas of the body with greater precision, and the drugs can be formulated so that the active ingredient better permeates cell membrane, reducing the required dose.

The high mortality rate of cancer in Nigeria calls for a drastic measure to be taken to curb the disease that has proven to be a death sentence thereby improving health and wellbeing of Nigerians. Studies have shown that 90% of drugs administered to cancer patients end up not reach the tumor and as such becomes insufficient to attack the and defeat the malignant tumors. The drugs targeted at the tumors does not reach because 90% of them are destroyed by immune cells in the liver or washed off in the kidneys, thereby decreasing the actual dose that gets to the targeted cancer points.

EFFICACY OF CANCER TREATMENTS USING NANOTECHNOLOGY

In medicine cancer treatments currently is synonymous to sending out fire fighters to fight fire without fire trucks, emergency equipment. Cancer ailments is considered as a big fire and the firetrucks are the Nanoparticles (nanotechnology-an engineering concept), which is the vehicle that transport the cancer drugs to the site where the tumor is in the body without being washed away or destroyed by the kidney and the liver.

Today many have struggled and are still struggling with these malignant diseases like cancer for many years and medical communities have failed the masses. Every 5 seconds someone dies of cancer. Nigerian government have spent billions of naira on cancer research with limited progress, so a change is required in this direction because what we have been doing over the years is yielding little or no result at all.

What medical practitioners do is to send firefighters because cancer is like a big fire, and this fire fighters are the cancer drugs, they are sending them out without a fire truck, so without transportation, without ladders, and without emergency equipment. Over 99% of these firefighters never make it to scene of the fire, so over 99% of the cancer drugs never makes it to the tumor because they lack transportation and tools to take them to the location they are meant for. Cancer is all about the location, so we need a fire truck to get the fire fighters (cancer drugs) to the location of the fire (tumor). Nanoparticles are the fire trucks, cancer drugs can be loaded on nanoparticles, and nanoparticles can function as fire trucks and emergency equipment to bring the cancer drugs to the heart or location of the tumor.

There are many types of nanoparticles made up of various nanomaterials such as metal based nanoparticles or stack-based nanoparticles, but to illustrate what it means to be Nanosized, take a strand of your hair under the microscope it measures 40,000 Nano meters in diameter which is equivalent to 400 nanoparticles, if it is stacked on top of each other a thickness of a single hair strand which makes them heavy and cannot be easily washed away in the blood and as such can circulate until they reach the site of the tumor.

How does these nanoparticles manage to transport cancer drugs to the tumor? - they have an extensive toolbox, so cancer drugs without nanoparticles are quickly washed away from the body through the kidney because they are so small, it's like going through a sieve, and so they don't really have time to reach the tumor. That is we have the cancer drugs in the body and as they circulate because they are small having been sieved or washed in the kidney or destroyed in the liver, only little eventually make it to the tumor but if these cancer drugs are put into the body in the form of Nano particles they will not be washed out any longer by the body because they are too big, and as such the Nano particles carrying the cancer drugs can continue to circulate in the blood giving them more time to find tumor.

NANOTECHNOLOGY AS A TOOL OR VEHICLE FOR CANCER DRUGS

Nanoparticles utilized to synthesize or manufacture cancer drugs can serve to protect cancer drugs from being destroyed by the body, there are certain important and sensitive cancer drugs that gets easily degraded by enzymatic action in the body, except they are put inside Nano particles protection, they will be able to function. Another Nano particle tool is that it can extensions like fingers of human hands the grab the tumor, so that when

Nano particles are circulating, they grab the tumor buying the cancer drugs more time to engulf and attach on the tumor to do their job.

However, there is a major challenge to nanoparticles in the body is the liver because it destroys foreign objects, the immune present in the cells can eat up the nanoparticles. However, this challenge can be overcome by temporarily disarming the immune cells in the liver, and to do, utilization of other clinically approved medications in the body like malaria drugs was able to stop immune cells from internalizing the Nano particles in the liver, they block the nanoparticles from going to the liver and end up in the location of the tumor. Also, certain biological nanoparticles can also be used to fool the liver and will not be recognized by the liver and as such end up in the tumor.

CONCLUSION

The high mortality rate of cancer in Nigeria calls for a drastic measure to be taken to curb the disease that has proven to be a death sentence thereby improving health and wellbeing of Nigerians. Studies have shown that 90% of drugs administered to cancer patients end up not reach the tumor and as such becomes insufficient to attack and defeat the malignant tumors. The drugs targeted at the tumors does not reach because 90% of them are destroyed by immune cells in the liver or washed off in the kidneys, thereby decreasing the actual dose that gets to the targeted cancer points. Hence cancer drugs can be loaded on nanoparticles which serves as a vehicle to bring the cancer drugs to the heart or location of the tumor because they have an extensive toolbox, that will make cancer drugs not to be washed away through the kidney because they are so small thereby making the drugs not to reach the tumor or lesser dosage (quantity) of drugs to reach the targeted tumor, Also certain important and sensitive cancer drugs gets easily degraded by enzymatic action in the body, except they are put inside nano particles protection, they will be able to function

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