THE EFFECT OF RADIATION FROM DIFFERENT DEVICE ON THE GROWTH OF BACTERIA AND INVESTIGATE THE RADIATION AT ANTIBIOTIC RESISTANT LEVEL AND DETECT THE GROWTH RATE

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ABSTRACT

This study emphasis on the effect of radiation from different devices on the growth of bacteria and investigate the radiation at antibiotic resistant level and to detect the growth rate of bacteria before and after radiation. Two bacteria's are used this study staphylococcus and Klebsiella. To use this study, different devices such as mobile phone, microwave oven, 5Gmodem and UV rays. All these devices produce different frequency of radiation. To detects the radiation effect before and after. Radiation the resistant bacteria became sensitive after the different source of radiation. To detects the growth rate to use spectrophotometric method.

Spectrophotometer is used to calculate the growth Rate of given bacteria before and after radiation and the spectrophotometer works by passing a light beam through a sample to measure the light intensity of a sample. It has been well established that most bacteria influenced with different sources of radiation which affect the growth rate. The bacteria were initially screened to determine their normal growth rate and then given under radiation. In the initial screening without radiation, the bacteria exhibited their normal growth.

INTRODUCTION

A **microorganism** is an organism of microscopic size, which may exist in its single-celled form or as a cell. The possible existence of unseen microbial life was suspected from ancient times, such as in Jain scriptures from sixth century BC India. The scientific study of microorganisms began with their observation under the microscope in the 1670s by Anton van Leeuwenhoek.

Because microorganisms include most unicellular organisms from all three domains of life they can be extremely diverse. Two of the three domains, Archaea and Bacteria, only contain microorganisms. The third domain Eukaryota includes all multicellular organisms as well as many unicellular protists and protozoans that are microbes. Some protists are related to animals and some to green plants. There are also many multicellular organisms that are microscopic, namely micro-animals, some fungi, and some algae, but these are generally not considered microorganisms.

Microorganisms can have very different habitats, and live everywhere from the poles to the equator, deserts, geysers, rocks, and the deep sea. Some are adapted to extremes such as very hot or very cold conditions, others to high pressure, and a few, such as *Deinococcus radiodurans*, to high radiation environments. Microorganisms also make up the microbiota found in and on all multicellular organisms. There is evidence that 3.45-billion-year-old Australian rocks once contained microorganisms, the earliest direct evidence of life on Earth.

Microbes are important in human culture and health in many ways, serving to ferment foods and treat sewage, and to produce fuel, enzymes, and other bioactive compounds. Microbes are essential tools in biology as model organisms and have been put to use in biological warfare and bioterrorism. Microbes are a vital component of fertile

soil. In the body, Microorganisms make up the human microbiota, including the essential gut flora.
The pathogens responsible for many infectious diseases are microbes and, as such, are the target of measures. Bacteria are prokaryotic unicellular organisms. They have a relatively simple cell structure compared to eukaryotic cells. They also do not possess any membrane-bound organelles such as a nucleus. However, do they possess genetic material (DNA or RNA) in the intracellular space called the nucleoid?

Two species are taken in this experiment. The species of *Klebsiella* are all gram-negative and usually non- motile. They tend to be shorter and thicker when compared to others in the family Enterobacteriaceae. The cells are rods in shape and generally measures 0.3 to 1.5 µm wide by 0.5 to 5.0 µm long. They can be found singly, in pairs, in chains or linked end to end. *Klebsiella* can grow on ordinary lab medium and do not have special growth requirements, like the other members of Enterobacteriaceae. The species are aerobic but facultatively anaerobic. Their ideal growth temperature is 35° to 37 °C, while their ideal pH level is about 7.2.Staphylococcus is a genus of Gram-positive bacteria in the family Staphylococcaceae from the
order Bacillales. Under the microscope, they appear spherical (cocci), and form in grape-like
clusters. *Staphylococcus* species are facultative anaerobic organisms (capable of growth both aerobically and anaerobically).

Radiation is the emission or transmission of energy in the form of waves or particles through space or through a material medium. This includes: *Electromagnetic*, such as radio waves, microwaves, infrared, visible
light, ultraviolet, x-rays, and gamma radiation (γ).*Particle radiation*, such as alpha radiation (α), beta radiation (β), proton radiation and neutron radiation (particles of non-zero rest energy).*Acoustic radiation*, such
as ultrasound, sound, and seismic waves (dependent on a physical transmission medium).*Gravitational radiation*, that takes the form of gravitational waves, or ripples in the curvature of space-time.

Radiation is often categorized as either *ionizing* or *non-ionizing* depending on the energy of the radiated particles. Ionizing radiation carries more than 10 eV, which is enough to ionize atoms and molecules and break chemical bonds. This is an important distinction due to the large difference in harmfulness to living organisms. A common source of ionizing radiation is radioactive materials that emit α, β, or γ radiation, consisting of helium nuclei, electrons or positrons, and photons, respectively. Other sources include X-
rays from medical radiography examinations and muons, mesons, positrons, neutrons and other particles that constitute the secondary cosmic rays that are produced after primary cosmic rays interact with Earth's atmosphere.

Mutations are a heritable change in the base sequence of DNA. Such mutations can be neutral or beneficial to an organism, but most are actually harmful because the mutation will often result in the loss of an important cellular function. Mutagens can be in the form of a chemical (nicotine) or in the form of electromagnetic radiation. Again, there are two forms of electromagnetic radiation that are mutagenic; ionizing radiation and nonionizing radiation. Ionizing radiation (x-ray, gamma radiation) has the potential to remove electrons from molecules in a cell. These electrons called free radicals which damage most other molecules in a cell, such as DNA or RNA, by oxidizing them. Non-ionizing radiation (UV) causes the formation of pyrimidine dimers in the DNA molecule i.e., adjacent pyrimidine units are ionized forming highly reactive free radicals. These ionized pyrimidines interlink to form the dimers. The dimerization occurs by the formation of cyclobutane ring and this ring inhibits the replication process, thus hindering the normal functioning of the cell. Radiation destroys harmful microbes such as bacteria, yeast, molds, viruses and algae. So, radiation can be a way to control microorganisms or reduce their numbers.

There are about 4.7 billion mobile phone users in the world. This wide use of mobile technology has often raised the questions related to the health implications for humans. Electromagnetic waves in the range of 450- 2100 MHz resulting from mobile phones are altering many biological functions in the living Organisms. The incredible ability of antimicrobial resistance shown by microbe in last two decades especially by antibiotic superbug and mycobacterium tuberculosis (MTB) is turning to be a big hindrance in modern medicine, requiring alternative and overdose medications, which may be more expensive or highly toxic in nature. There are many studies in the literature about the effect of electromagnetic waves on living organisms. The rapid increase in the use of mobile phones in daily life and the decrease in age of using them have focused this interest on mobile phone and their effect on human health. In this study, possible mutating effects of radiation emitted by mobile phone have been investigated. Here the research was carried out to study the effect of mobile radiation on the antibiotic sensitivity against two bacteria namely Klebsiella and Staphylococcus.

Mobile phones and Wi-Fi radiofrequency radiation are among the main sources of the exposure of the general population to radiofrequency electromagnetic fields (RF-EMF). Previous studies have shown that exposure of microorganisms to RF-EMFs can be associated with a wide spectrum of changes ranged from the modified bacterial growth to the alterations of the pattern of antibiotic resistance. Our laboratory at the nonionizing department of the Ionizing and Non-ionizing Radiation Protection Research Center has performed experiments on the health effects of exposure to animal models and humans to different sources of electromagnetic fields such as cellular phones, mobile base stations, mobile phone jammers, laptop computers, radars, dentistry cavitrons, magnetic resonance imaging, and Helmholtz coils. On the other hand, we have previously studied different aspects of the challenging issue of the ionizing or nonionizing radiation-induced alterations in the susceptibility of microorganisms to antibiotics. In this study, we assessed if the exposure to 900 MHz GSM mobile phone radiation and 2.4 GHz radiofrequency radiation emitted from common Wi-Fi routers alters the susceptibility of microorganisms to different antibiotics.

The pure cultures of *Klebsiella* and Staphylococcus were exposed to RF-EMFs generated either by a GSM 900 MHz mobile phone simulator and a common 2.4 GHz WI-Fi router. It is also shown that exposure to RF-EMFs within a narrow level of irradiation (an exposure window) makes microorganisms resistant to antibiotics. This adaptive phenomenon and its potential threats to human health should be further investigated in future experiments. Altogether, the findings of this study showed that exposure to Wi-Fi and RF simulator radiation can significantly alter the inhibition zone diameters and growth rate for *Klebsiella* and *Staphylococcus.* These findings may have implications for the management of serious infectious diseases.

Microwaves are non-ionizing electromagnetic waves with frequencies between 0.3 and 300 GHz. Both humans and microorganisms living on the human body are exposed to significant doses of microwave radiation in everyday life. Microwaves produce significant effects on the growth of microbial cultures, which vary from the killing of microorganisms to enhancement of their growth. The nature and extent of the effect depend on the frequency of microwaves and the total energy absorbed by the microorganisms. Low energy, low frequency microwaves enhance the growth of microorganisms, whereas high energy, high frequency microwaves destroy the microorganisms.

Electromagnetic fields (EMF) have a major impact on biological systems (Panagopoulos et al., 2002, Balcavage et al., 1996, Grassi et al., 2004) including human health (Feychting and Ahlbom, 1993, Berg, 1999, Valberg et al., 1997). Recently, microorganisms are being exposed to radiofrequency and microwaves radiation signals from several sources (Balmori, 2016). Some studies were showed to confirm the effects of electromagnetic radiation (EMR) on functions of cell (Oncul et al. 2016). Studies on the effect of magnetic fields on prokaryotes have recently increased significantly, including studies on the effects of static magnetic fields, short frequency electromagnetic fields and pulsed electromagnetic fields. Fojt et al. (2004) for example, detected a decrease in colony forming units of *E. coli*, *S. aureus* and *L. adecarboxylata* at 50 Hz, 10 mT (particularly short frequency electromagnetic fields), while Strasak et al. (1998) reported that exposure of *E. coli* to extremely low frequency electromagnetic fields for 0–24 h for 0 – 24 h decreased the viability and growth rate of this bacterium when subjected to 50 Hz. Static magnetic fields have also been shown to inhibit bacterial growth (Chang et al., 2005, El-Sayed et al., 2006, Piatti et al., 2002, Zhang et al., 2003).

AIM AND OBJECTIVES

The present study aims of the study to investigate the effect of radiation from different devices on the growth of bacteria. The following are objectives of the present study.

- To determine the growth rate difference in radiation induced bacteria by experimental analysis of growth curve and generation time with its control.
- To detect the antibiotic susceptibility pattern of radiation induced bacteria towards common antibiotics with its control.

REVIEW OF LITERATURE

1. Ethne L. Nussbaum et al. (2002) reported Effects of 810 nm laser irradiation on in vitro growth of bacteria: Comparison of continuous wave and frequency modulated light. Low intensity laser therapy may modify growth of wound bacteria, which could affect wound healing. This study compares the effects on bacteria of 810 nm laser using various delivery modes (continuous wave or frequency modulated light at 26, 292, 1,000, or 3,800 Hz).

2. Ethne L Nussbaum et al. (2004) reported Effect of 630-, 660-, 810-, and 905-nm Laser Irradiation Delivering Radiant Exposure of 1-50 J/cm^2 on Three Species of Bacteria *in Vitro.*There were interactions between wavelength and species (p = 0.0001) and between wavelength and radiant exposure (p = 0.007) in the overall effects on bacterial growth; therefore, individual wavelengths were analyzed. Over all types of bacteria, there were overall growth effects using 810- and 630-nm lasers, with species differences at 630 nm. Effects occurred at low radiant exposures (1-20 J/cm^2). Overall effects were marginal using 660 nm and negative at 905 nm.
Inhibition of *P. aeruginosa* followed irradiation using 810 nm at 5 J/cm^2 (-23%; p = 0.02). Irradiation using 630 nm at 1 J/cm^2 inhibited *P. aeruginosa* and *E. coli* (-27%). Irradiation using 810 nm (0.015 W/cm^2) increased *E. coli*

growth, but with increased irradiance (0.03 W/cm^2) the growth was significant ($p = 0.04$), reaching 30% at 20 J/cm^2 ($p = 0.01$). *S. aureus* growth increased 27% following 905-nm irradiation at 50 J/cm^2. *Conclusion:* LILT applied to wounds, delivering commonly used wavelengths and radiant exposures in the range of 1-20 J/cm^2, could produce changes in bacterial growth of considerable importance for wound healing. A wavelength of 630 nm appeared to be most commonly associated with bacterial inhibition. The findings of this study might be useful as a basis for selecting LILT for infected wounds.

3.M. Fukuiet al. (2007) worked on Specific-wavelength visible light irradiation inhibits bacterial growth of *Porphyromonas gingivalis.The effects of laser irradiation on Porphyromonas gingivalis have been reported, but the results are still controversial regarding the efficiency because of the differences of the light sources and irradiation conditions. The aim of this study was to determine the wavelength and irradiation conditions under which the most effective inhibitory effect on P. gingivalis growth was seen without any photosensitizers.*

4. MaricelKeyser et al. (2008) reported Ultraviolet radiation as a non-thermal treatment for the inactivation of microorganisms in fruit juice. Fruit juices can be processed using ultraviolet (UV-C) light to reduce the number of microorganisms. The UV-C wavelength of 254 nm is used for the disinfection and has a germicidal effect against microorganisms. A novel turbulent flow system was used for the treatment of apple juice, guava-and- pineapple juice, mango nectar, strawberry nectar and two different orange and tropical juices. In comparison to heat pasteurization, juices treated with UV did not change taste and color profiles. Ultraviolet dosage levels ($J\ L^{-1}$) of 0, 230, 459, 689, 918, 1 148, 1 377, 1 607 and 2 066 were applied to the different juice products in order to reduce the microbial load to acceptable levels. UV-C radiation was successfully applied to reduce the microbial load in the different single strength fruit juices and nectars but optimization is essential for each juice treated. This novel UV technology could be an alternative technology, instead of thermal treatment or application of antimicrobial compounds.

5. Toshi Mishra et al. (2013) workedon Effect of Low Power Microwave Radiation on Microorganisms and other Life Forms. Microwaves are a part of electromagnetic spectrum with multiple applications. Thermal effects resulting from high-power microwave radiation are well established, but considerable controversy surrounds the possible microwave specific a thermal effect. Reports suggesting its presence or absence keep accumulating in literature. Exact mechanism through which low-power microwave radiation exerts its effect on different life forms including microorganisms yet remains to be elucidated. For these effective experimental strategies needs to be devised, where thermal and a thermal effect can be studied separately. Identifying suitable biological model(s) for such studies is also required. This review focuses on the effects of low-power mi- crowave radiation on different life forms, particularly microorganisms. Effects of low-power microwave on growth and enzyme activity of microbes are described. Factors affecting the interaction of microwaves with living systems, such as microwave power, frequency, exposure duration, continuous vs. pulsed treatment, etc. has also been covered. The possibility of using mi-crowave for mutagenesis (strain improvement) has also been indicated.

6. Smj Mortazavi et al. (2013) reported Increased Radio resistance to Lethal Doses of Gamma Rays in Mice and Rats after Exposure to Microwave Radiation Emitted by a GSM Mobile Phone Simulator. The aim of this study was to investigate the effect of pre-irradiation with microwaves on the induction of radio adaptive response. In the 1(st) phase of the study, 110 male mice were divided into 8 groups. The animals in these groups were exposed/sham-exposed to microwave, low dose rate gamma or both for 5 days. On day six, the animals were exposed to a lethal dose (LD). In the 2 (nd) phases, 30 male rats were divided into 2 groups of 15 animals. The 1(st) group received microwave exposure. The 2(ND) group (controls) received the same LD but there was no treatment before the LD. On day 5, all animals were whole-body irradiated with the LD. Statistically significant differences between the survival rate of the mice only exposed to lethal dose of gamma radiation before irradiation with a lethal dose of gamma radiation with those of the animals pre-exposed to either microwave (p=0.02), low dose rate gamma (p=0.001) or both of these physical adapting doses (p=0.003) were observed. Likewise, a statistically significant difference between survival rates of the rats in control and test groups was observed. Altogether, these experiments showed that exposure to microwave radiation may induce a significant survival adaptive response.

7. Sabine Matallana-Surgetet al. (2013) reported Impact of Solar Radiation on Gene Expression in Bacteria. Microorganisms often regulate their gene expression at the level of transcription and/or translation in response to solar radiation. In this review, we present the use of both transcriptomics and proteomics to advance knowledge in the field of bacterial response to damaging radiation. Those studies pertain to diverse application areas such as fundamental microbiology, water treatment, microbial ecology and astrobiology. Even though it has been demonstrated that mRNA abundance is not always consistent with the protein regulation, we present here an exhaustive review on how bacteria regulate their gene expression at both transcription and translation levels to enable biomarkers identification and comparison of gene regulation from one bacterial species to another.

8.. Birol Otludil et al. (2014) revealed that The Effect of Microwave on the Cellular Differentiation Bacillus Subtilis YB 886 and REC Derivatives YB 886 A4.This study was carried out to investigate effects of microwave irradiation on cell differentiation and SOS repair system in Bacillus subtilis rec+ YB 886 and rec derivatives YB 886 rec A4. Amount of a specific protein that shynthesed during DNA damage by SOS repair system and binding to din C promoter region increased by microwave irradiation in rec+ bacteria. More increasing was determined in amount of the specific protein during Ultraviolet treatment. If amount of DNA, protein and RNA are taken into consideration, it has observed that amount of DNA decreased (P>0.05) but not statically significant, amount of protein decreased (p0.05) in amount of RNA may be due to structural deformation.

9. Saleh H. Salmen et al. (2017) reported Evaluation of effect of high frequency electromagnetic field on growth and antibiotic sensitivity of bacteria. This study was aimed to evaluate the impact of high frequency electromagnetic fields (HF-EMF at 900 and 1800 MHz) on DNA, growth rate and antibiotic susceptibility of S. *aureus*, *S. epidermidis*, and *P. aeruginosa*. In this study, bacteria were exposed to 900 and 1800 MHz for 2 h and then inoculated to new medium when their growth rate and antibiotic susceptibility were evaluated. Results for the study of bacterial DNA unsuccessful to appearance any difference exposed and non-exposed *S. aureus* and *S. epidermidis*. Exposure of *S. epidermidis* and *S. aureus* to electromagnetic fields mostly produced no statistically significant decrease in bacterial growth, except for *S. aureus* when exposure to 900 MHz at 12 h. Exposure of *P. aeruginosa* to electromagnetic fields at 900 MHz however, lead to a significant reduction in growth rate, while 1800 MHz had insignificant effect. With the exception of *S. aureus*, treated with amoxicillin (30 µg) and exposed to electromagnetic fields, radiation treatment had no significant effect on bacterial sensitivity to antibiotics.

10. *M.Taheri et al. (2017) reported* Evaluation of the Effect of Radiofrequency Radiation Emitted from Wi-Fi

Router and Mobile Phone Simulator on the Antibacterial Susceptibility of Pathogenic Bacteria Listeria monocytogenes and Escherichia coli. Mobile phones and Wi-Fi radiofrequency radiation are among the main sources of the exposure of the general population To radiofrequency electromagnetic fields (RF-EMF). Previous studies have shown that exposure of microorganisms to RF-EMFs can be associated with a wide spectrum of changes ranged from the modified bacterial growth to the alterations of the pattern of antibiotic resistance. Our laboratory at the nonionizing department of the Ionizing and Non-ionizing Radiation Protection Research Center has performed experiments on the health effects of exposure to animal models and humans to different sources of electromagnetic fields such as cellular phones, mobile base stations, mobile phone jammers, laptop computers, radars, dentistry cavitrons, magnetic resonance imaging, and Helmholtz coils. On the other hand, we have previously studied different aspects of the challenging issue of the ionizing or nonionizing radiation- induced alterations in the susceptibility of microorganisms to antibiotics. In this study, we assessed if the exposure to 900 MHz GSM mobile phone radiation and 2.4 GHz radiofrequency radiation emitted from common Wi-Fi routers alters the susceptibility of microorganisms to different antibiotics. The pure cultures
of *Listeria monocytogenes* and *Escherichia coli* were exposed to RF-EMFs generated either by a GSM 900 MHz mobile phone simulator and a common 2.4 GHz WI-Fi router. It is also shown that exposure to RF-EMFs within a narrow level of irradiation (an exposure window) makes microorganisms resistant to antibiotics. This adaptive phenomenon and its potential threats to human health should be further investigated in future experiments. Altogether, the findings of this study showed that exposure to Wi-Fi and RF simulator radiation can significantly alter the inhibition zone diameters and growth rate for *L monocytogenes* and *E coli*. These findings may have implications for the management of serious infectious diseases.

11. Giuliana Senatore et al. (2018) reported Effect of microgravity and space radiation on microbes.One of the new challenges facing humanity is to reach increasingly further distant space targets. It is therefore of upmost importance to understand the behavior of microorganisms that will unavoidably reach the space environment together with the human body and equipment. Indeed, microorganisms could activate their stress defense mechanisms, modifying properties related to human pathogenesis. The host–microbe interactions, in fact, could be substantially affected under spaceflight conditions and the study of microorganisms' growth and activity is necessary for predicting these behaviors and assessing precautionary measures during spaceflight. This review gives an overview of the effects of microgravity and space radiation on microorganisms both in real and simulated conditions.

12. Gabriele Beretta et al (2019) reported the effects of electric, magnetic and electromagnetic fields on microorganisms in the perspective of bioremediation. Some studies show how exposure to fields can enhance or reduce cell activity, with possible applicative consequences in the field of biotechnology, including biological techniques for depollution. In order to identify full-scale conditions that are suitable and potentially applicable for use in electromagnetic fields to stimulate and accelerate bioremediation processes, this paper offers an examination of the scientific literature that is available on the effects of fields on microorganisms, and a critical analysis of it. The biological effects at times contrast with each other.

13. Neha Bhardwaj et al. (2020) worked on A review on mobile phones as bacterial reservoirs in healthcare environments and potential device decontamination approaches. Mobile communication devices (MCDs), including cell phones and smart phones, have become an essential part of everyday life. Despite their frequent usage, most people, even healthcare personnel, often ignore the possibility that these devices might accumulate to carry a variety of microbial flora during and after the inspection of patients. The handling of MCDs with unwashed hands and/or they're seldom cleaning can aggravate potential health risks. Many of the harbored bacteria species can be harmful to immune-suppressed patients for whom the disinfection precautions should be taken more seriously. In this review, we discuss the significance of maintaining the cleanliness of mobile devices, especially in healthcare settings, to prevent the spread of nosocomial infections in patients.

Furthermore, we discuss strategies to address microbial contamination of MCDs to maintain good hand hygiene for the users of smart phones or other mobile communication devices. These techniques are capable of providing instant disinfection of the devices along with residual effects over prolonged periods.

14. Priyanka Shawet al. (2021) reported Evaluation of non-thermal effect of microwave radiation and its mode of action in bacterial cell inactivation. A growing body of literature has recognized the non-thermal effect of pulsed microwave radiation (PMR) on bacterial systems. However, its mode of action in deactivating bacteria has not yet been extensively investigated. Nevertheless, it is highly important to advance the applications of PMR from simple to complex biological systems. In this study, we first optimized the conditions of the PMR device and we assessed the results by simulations, using ANSYS HFSS (High Frequency Structure Simulator) and a 3D particle-in-cell code for the electron behavior, to provide a better overview of the bacterial cell exposure to microwave radiation. To determine the sensitivity of PMR, *Escherichia coli* and *Staphylococcus aureus* cultures were exposed to PMR (pulse duration: 60 ns, peak frequency: 3.5 GHz) with power density of 17 kW/cm^2 at the free space of sample position, which would induce electric field of 8.0 kV/cm inside the PBS solution of falcon tube in this experiment at 25 °C. At various discharges (D) of microwaves, the colony forming unit curves were analyzed. The highest ratios of viable count reductions were observed when the doses were increased from 20D to 80D, which resulted in an approximate 6 log reduction in *E. coli* and 4 log reductions in *S. aureus.* Moreover, scanning electron microscopy also revealed surface damage in both bacterial strains after PMR exposure. The bacterial inactivation was attributed to the deactivation of oxidation-regulating genes and DNA damage.

15. Jing Zhu et al. (2021) worked on Effect of Ionizing Radiation on the Bacterial and Fungal Endophytes of the Halophytic Plant *Kalidium schrenkianum.Endophytic bacteria and fungi colonize plants that grow in various types of terrestrial and aquatic ecosystems. Our study investigates the communities of endophytic bacteria and fungi of halophyte Kalidium schrenkianum growing in stressed habitats with ionizing radiation. The geochemical factors and radiation (at low, medium, high level and control) both affected the structure of endophytic communities. The bacterial class Actinobacteria and the fungal class Dothideomycetes predominated the endophytic communities of K. schrenkianum. Aerial tissues of K. schrenkianum had higher fungal diversity, while roots had higher bacterial diversity. Radiation had no significant effect on the abundance of bacterial classes. Soil pH, total nitrogen, and organic matter showed significant effects on the diversity of root endophytes. Radiation affected bacterial and fungal community structure in roots but not in aerial tissues, and had a strong effect on fungal co-occurrence networks. Overall, the genetic diversity of both endophytic bacteria and fungi was higher in radioactive environments, however negative correlations were found between endophytic bacteria and fungi in the plant. The genetic diversity of both endophytic bacteria and fungi was higher in radioactive environments. Our findings suggest that radiation affects root endophytes, and that the endophytes associated with aerial tissues and roots of K. schrenkianum follow different mechanisms for community assembly and different paradigms in stress response.*

MATERIALS AND METHODS

BACTERIAL CULTURE:

The bacterial culture of Staphylococcus and Klebsiella was collected from polyclinic laboratory Thrissur. The strain of bacteria was maintained on nutrient slant and streak plating on nutrient agar.

BACTERIAL INOCULATION

The two bacterial cultures were inoculated into 5ml peptone water on test tube. Total 72 test tubes are taken to inoculate these two bacterial strains. After that the tubes are covered with Clingfilm.

ANTIBIOTIC SENSITIVITY TEST

Muller-Hinton Agar was used to investigate before and after effect of radiation from different device on the growth of microorganism at antibiotic sensitivity level. Penicillin, Ampicillin, Tetracycline and Chlorampenicol are antibiotics used for this experiment. Disc potency of these antibiotics are 10µg,10 µg,30µg ,30 µg.

Antimicrobial agent	Disc potency	Resistant (≤)	Intermediate	Sensitive (≥)
Tetracycline	30 µg	14	15-18	19
Chlorampenicol	30 µg	12	13-17	18
Ampicillin	10 µg	13	14-16	18
Penicillin G	10 µg	28	-	29

DEVICES USED

Four Devices are used this experiment, the devices are Microwave Oven, Mobile phone, WIFI modem, UV Radiation.

MICROWAVE OVEN: Microwave ovens heat food using microwaves, a form of electromagnetic radiation similar to radio waves. The Wavelength of microwave oven radiation is 2450MHz and range of wavelength 300GHz-2450MHz.Emit the radiation to organism inoculated peptone water at regular time interval 15, 30, 45, and60 minutes.

MOBILE PHONE: The antennas contained in mobile phones, including smart phones, emit radiofrequency radiation such as radio waves and microwaves. Two different mobile brands are used for emitting the radiation, the wavelength of mobile phones is Samsung 1800-1900MHz, and vivo 1800-2600MHz and also emit the radiation to organism at regular time interval 15, 30,45, and 60minutes.

5G MODEM: 5G modem is the latest network of wireless technology. It is used to transmit data between appliances, like mobile phones and Bluetooth devices.5G modem by producing a type of energy called electromagnetic radiation. It uses higher frequencies than previous wireless networks, Making it faster and more efficient. The wavelength of 5g modem is 3.5GHz-300GHz.Emit the radiation at regular time interval 15, 30, 45, and 60minutes.

UV: Ultraviolet (UV) radiation is a form of non-ionizing radiation that is emitted by the sun and artificial sources, such as tanning beds. The wavelength of UV radiation is 800THz up to 30 PHz. Emit the radiation at regular interval 15, 30, 45 and 60minutes.

SPECTROPHOTOMETRIC METHOD

Spectrophotometer is used to calculate the growth Rate of given bacteria before and after radiation and the spectrophotometer works by passing a light beam through a sample to measure the light intensity of a sample. When fresh liquid medium is inoculated with a given number of bacteria and incubated for sufficient period of time, it gives a characteristic growth pattern of bacteria. If the bacterial Population is measured periodically and log of number of viable bacteria is plotted in a graph against time, it gives a characteristic growth rate.

PROCEDURE OF BACTERIAL GROWTH RATE DETECTION: Using sterile loop, streak a loopful of bacterial culture onto the nutrient agar plate. Incubate at 37°C for 18-24 hours. Pick up a single colony of each strain from the agar plate and inoculate it into a test tube containing 5ml of autoclaved peptone water and emit the radiation in these test tubes. Incubate the test tube overnight at 37°C.FirstTake OD at zero hour. After incubate the flask at 37°C.Aliquot 3 ml of the culture suspension at an interval of every 30 minutes and take the optical density (OD) at a wavelength of 600 nm using spectrophotometer, till the reading becomes static. At the end of experiment, plot a graph of time in minutes on X axis versus optical density at 600nm on Y axis to obtain a growth rate of bacteria.

RESULT AND DISCUSSION

Radiation has some effect on the growth microorganism's .To given the antibiotic sensitivity test result before and after radiation.

ANTIBIOTIC SENSITIVITY RESULT BEFORE RADIATION RESULT

STAPHYLOCOCCUS SPECIES AND KLEBSIELLA SPECIES

Table 1

Sl no	Species name	Antibiotic name	Disc potency	Diameter of zone(mm)	Result
1	Staphylococcus species	Tetracycline Chlorampenicol Penicillin G Ampicillin	30 µg 30 µg 10 µg 10 µg	30mm No zone No zone No zone	Sensitive - - -
2	Klebsiella species	Tetracycline Chlorampenicol Penicillin G Ampicillin	30 µg 30 µg 10 µg 10 µg	15mm 20mm No zone No zone	Intermediate Sensitive - -

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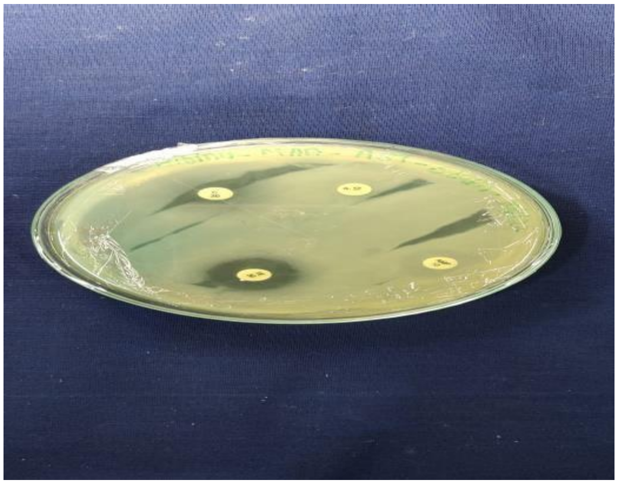
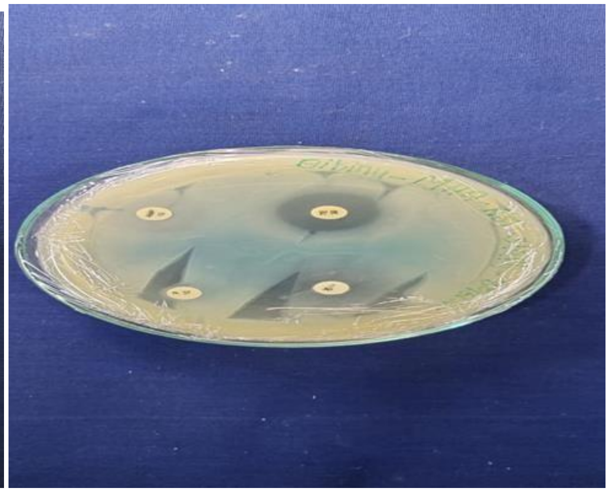



The result of antibiotic sensitivity study of staphylococcus bacteria against Tetracycline.

Table 2:1

Mobile phone radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate	
15min	30 µg	27mm	Sensitive	
30min	30 µg	25mm	Sensitive	
45min	30 µg	21mm	Sensitive	
60min	30 µg	26mm	Sensitive	

Table 2:2

Microwave oven radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	30 µg	26mm	Sensitive
30min	30 µg	25mm	Sensitive

45min	30 µg	25mm	Sensitive
60min	30 µg	26mm	Sensitive

Table 2:3

5G modem radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	30 µg	27mm	Sensitive
30min	30 µg	26mm	Sensitive
45min	30 µg	25mm	Sensitive
60min	30 µg	26mm	Sensitive

Table2:4

UV radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	30 µg	29mm	Sensitive
30min	30 µg	27mm	Sensitive
45min	30 µg	17mm	Intermediate
60min	30 µg	26mm	Sensitive

Before radiation staphylococcus form zone in tetracycline, it is also sensitive to tetracycline. The diameter of zone is 30mm. But after radiation from mobile phone, microwave oven, 5Gmodem and UV, Zone is formed in tetracycline but the zone diameter is less than 30mm. Especially in UV radiation (45min) to seen, the zone sensitive changes to intermediate.

The result of antibiotic sensitivity study of staphylococcus bacteria against Chlorampenicol.

Table3:1

Mobile phone radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	30 µg	26mm	Sensitive
30min	30 µg	25mm	Sensitive
45min	30 µg	26mm	Sensitive
60min	30 µg	22mm	Sensitive

Table3:2

Microwave oven radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	30 µg	25mm	Sensitive
30min	30 µg	25mm	Sensitive
45min	30 µg	24mm	Sensitive
60min	30 µg	22mm	Sensitive

Table3:3

5G modem radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	30 µg	28mm	Sensitive
30min	30 µg	25mm	Sensitive
45min	30 µg	24mm	Sensitive
60min	30 µg	25mm	Sensitive

Table3:4

UV radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	30 µg	29mm	Sensitive
30min	30 µg	25mm	Sensitive
45min	30 µg	28mm	Sensitive
60min	30 µg	27mm	Sensitive

The best changes occur at this stage because before radiation staphylococcus dose not form the zone in Chlorampenicol so it is resistant. But after radiation from mobile phone, microwave oven, 5G modem and UV, it is forms zone in Chlorampenicol And the ranges of the zone is above 18mm and it also sensitive to Chlorampenicol.

The result of antibiotic sensitivity study of staphylococcus bacteria against Penicillin. **Table4:1**

Mobile phone radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	10 µg	13mm	Resistant
30min	10 µg	12mm	Resistant
45min	10 µg	9mm	Resistant
60min	10 µg	12mm	Resistant

Table4:2

Microwave oven radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	10 µg	11mm	Resistant
30min	10 µg	12mm	Resistant
45min	10 µg	13mm	Resistant

60min	10 µg	12mm	Resistant

Table4:3

5G modem radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	10 µg	13mm	Resistant
30min	10 µg	11mm	Resistant
45min	10 µg	13mm	Resistant
60min	10 µg	10mm	Resistant

Table4:4

UV radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	10 µg	19mm	Resistant
30min	10 µg	13mm	Resistant
45min	10 µg	12mm	Resistant
60min	10 µg	10mm	Resistant

Before radiation, staphylococcus does not formed zone in a penicillin so it is resistant to penicillin but after radiation it is formed zone in penicillin but it is also resistant due to penicillin is sensitive at the range above 29mm but after radiation it form zone below 28mm.

The result of antibiotic sensitivity study of staphylococcus bacteria against Ampicillin.

Table5:1

Mobile phone radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	10 µg	9mm	Resistant
30min	10 µg	8mm	Resistant

45min	10 µg	5mm	Resistant
60min	10 µg	10mm	Resistant

Table5:2

Microwave oven radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	10 µg	10mm	Resistant
30min	10 µg	10mm	Resistant
45min	10 µg	9mm	Resistant
60min	10 µg	10mm	Resistant

Table5.3

5G modem radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	10 µg	12mm	Resistant
30min	10 µg	11mm	Resistant
45min	10 µg	10mm	Resistant
60min	10 µg	9mm	Resistant

Table 5.4

UV radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	10 µg	15mm	Intermediate
30min	10 µg	10mm	Resistant

45min	10 µg	6mm	Resistant
60min	10 µg	2mm	Resistant

Before radiation, staphylococcus does not formed zone in a Ampicillin so it is resistant to Ampicillin but after radiation it is formed zone in Ampicillin but it is also resistant due to penicillin is sensitive at the range above 18mm but after radiation it form zone below 13mm and Especially in UV radiation (15min) to seen, the zone resistant changes to intermediate.

The result of antibiotic sensitivity study of Klebsiella bacteria against Tetracycline.

Table 6.1

Mobile phone radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	30 µg	20mm	Sensitive
30min	30 µg	19mm	Sensitive
45min	30 µg	13mm	Resistant
60min	30 µg	20mm	Sensitive

Before radiation Klebsiella form intermediate zone at the diameter 15mm and after radiation from mobile phone to seen difference, in the time interval 15, 30,60mins Klebsiella is sensitive to tetracycline it forms above 19mm zone and 45 min Klebsiella resist the tetracycline it becomes 14mm diameter zone. This result is proves that mobile phone radiation is affected the growth of Klebsiella.

Table 6.2

Microwave oven radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	30 µg	10mm	Resistant
30min	30 µg	19mm	Sensitive
45min	30 µg	35mm	Sensitive
60min	30 µg	24mm	Sensitive

Before radiation Klebsiella form intermediate zone at the diameter 15mm and after radiation from microwave oven to seen difference, in the time interval 30, 45,60mins Klebsiella is sensitive to tetracycline it forms above 19mm zone and 15 min Klebsiella resist the tetracycline it becomes 14mm diameter zone. This result is proves that microwave oven radiation is affected the growth of Klebsiella.

Table 6.3

5G modem radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	30 µg	No zone	Resistant
30min	30 µg	28mm	Sensitive
45min	30 µg	37mm	Sensitive
60min	30 µg	No zone	Resistant

Before radiation Klebsiella form intermediate zone at the diameter 15mm and after radiation from 5G modem to seen difference, in the time interval 30, 45 mins Klebsiella is sensitive to tetracycline it forms above 19mm zone and 15, 60mins Klebsiella resist the tetracycline it does not form the zone. This result is proves that 5G modem radiation is affected the growth of Klebsiella.

Table 6.4

UV radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	30 µg	5mm	Resistant
30min	30 µg	10mm	Resistant
45min	30 µg	10mm	Resistant
60min	30 µg	25mm	Sensitive

After UV radiation Klebsiella resist tetracycline at 15, 30 and 45mint time interval it means that UV radiation sometimes not affect the growth of Klebsiella. Increase the time of radiation Klebsiella become sensitive to tetracycline.

The result of antibiotic sensitivity study of Klebsiella bacteria against Chlorampenicol.

Table 7.1

Mobile phone radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	30 µg	13mm	Intermediate
30min	30 µg	30mm	Sensitive
45min	30 µg	15mm	Intermediate
60min	30 µg	20mm	Sensitive

Before radiation Klebsiella sensitive to Chlorampenicol and after radiation at 15 and 45 mins to show intermediate zone and 30 and 60 mins Klebsiella sensitive to Chlorampenicol.

Table 7.2

Microwave oven radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	30 µg	30mm	Sensitive
30min	30 µg	30mm	Sensitive
45min	30 µg	25mm	Sensitive
60min	30 µg	30mm	Sensitive

Table 7.3

5G modem radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	30 µg	19mm	Sensitive
30min	30 µg	30mm	Sensitive
45min	30 µg	40mm	Sensitive
60min	30 µg	20mm	Sensitive

Before and after radiation from microwave oven and 5G modem Klebsiella sensitive to the Chlorampenicol and it form zone above 18mm.

Table 7.4

UV radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	30 µg	No zone	Resistant
30min	30 µg	14mm	Intermediate
45min	30 µg	10mm	Resistant
60min	30 µg	30mm	Sensitive

After radiation from UV Klebsiella shows resistant, intermediate and sensitive zone. It halftly affect the growth of Klebsiella.

The result of antibiotic sensitivity study of Klebsiella bacteria against Penicillin.

Table 8.1

Mobile phone radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	10 µg	5mm	Resistant
30min	10 µg	No zone	Resistant
45min	10 µg	No zone	Resistant
60min	10 µg	12mm	Resistant

Table 8.2

Microwave oven radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	10 µg	No zone	Resistant
30min	10 µg	No zone	Resistant
45min	10 µg	20mm	Resistant
60min	10 µg	20mm	Resistant

Table 8.3

5G modem radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	10 µg	No zone	Resistant
30min	10 µg	14mm	Resistant
45min	10 µg	15mm	Resistant
60min	10 µg	5mm	Resistant

Table 8.4

UV radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	10 µg	10mm	Resistant
30min	10 µg	15mm	Resistant
45min	10 µg	10mm	Resistant
60min	10 µg	10mm	Resistant

Before radiation, Klebsiella does not formed zone in a penicillin so it is resistant to penicillin but after radiation it is formed zone in penicillin but it is also resistant due to penicillin is sensitive at the range above 29mm but after radiation it form zone below 28mm and some is does not form zone after radiation .

The result of antibiotic sensitivity study of Klebsiella bacteria against Ampicillin.

Table 9.1

Mobile phone radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	10 µg	No zone	Resistant
30min	10 µg	No zone	Resistant
45min	10 µg	No zone	Resistant
60min	10 µg	12mm	Resistant

Table 9.2

Microwave oven radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	10 µg	No zone	Resistant
30min	10 µg	No zone	Resistant
45min	10 µg	No zone	Resistant
60min	10 µg	No zone	Resistant

Table 9.3

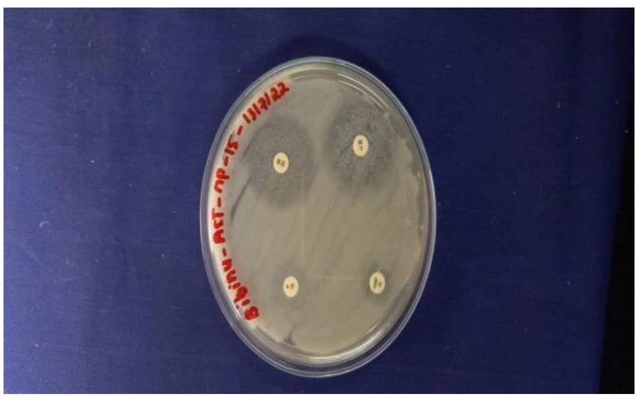
5G modem radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	10 µg	No zone	Resistant
30min	10 µg	20mm	Sensitive
45min	10 µg	18mm	Sensitive
60min	10 µg	No zone	Resistant

Table 9.4

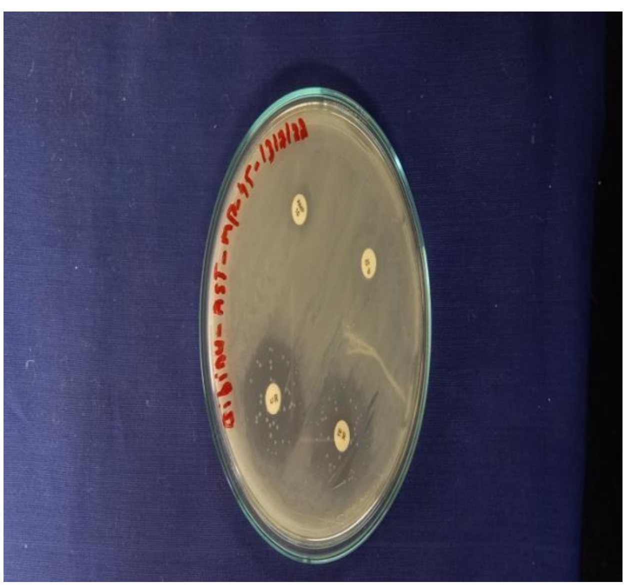
UV radiation At interval of 15min	Disc potency	Zone Diameter	Resistant or Sensitive or Intermediate
15min	10 µg	No zone	Resistant
30min	10 µg	10mm	Resistant
45min	10 µg	No zone	Resistant
60min	10 µg	15mm	Intermediate

After radiation Klebsiella only form zone at particular time period. Almost time period from different devices it does not form the zone so it is resistant to Ampicillin.

<u>STAPHYLOCOCCUS ANTIBIOTIC SENSITIVITY TEST</u>



AST **FIG 1:1** MOBILE PHONE RADIATION (15MIN) **FIG 1:2** MOBILE PHONE RADIATION (30MIN)



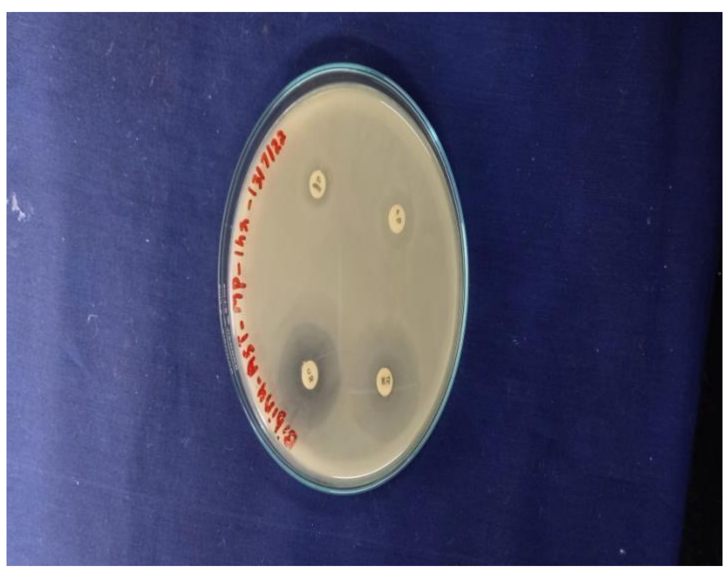


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FIG 1:3 MOBILE PHONE RADIATION (45MIN)

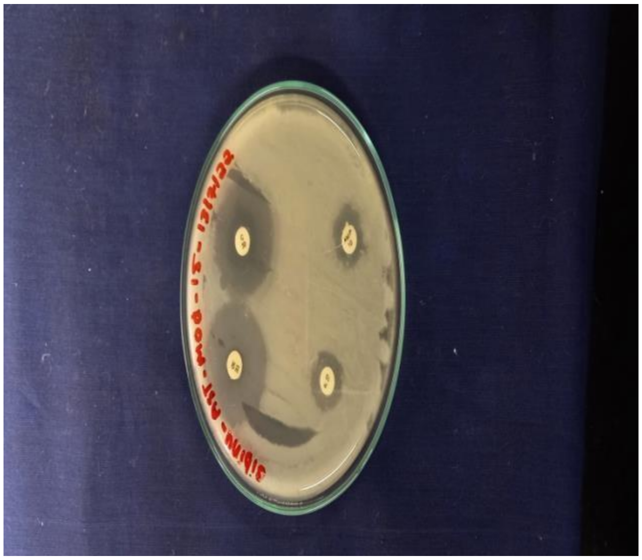


FIG 1:4 MOBILE PHONE RADIATION (60MIN)

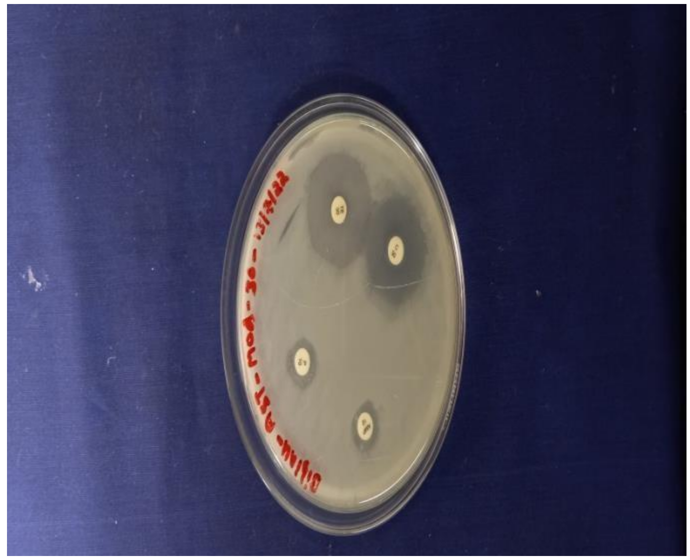


FIG 2:1 MODEM RADIATION (15MIN)

FIG 2:2 MODEM RADIATION (30MIN)

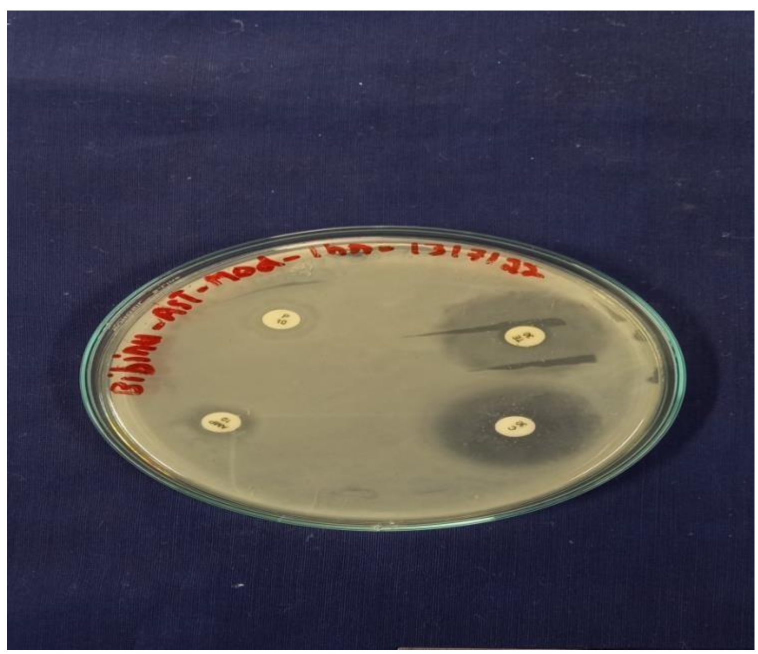
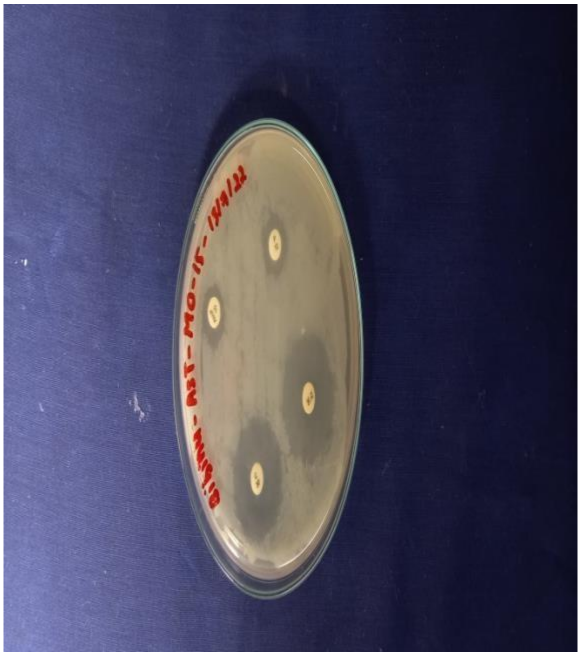


FIG 2:3 MODEM RADIATION (45MIN) **FIG 2:4**MODEM RADIATION (60MIN)



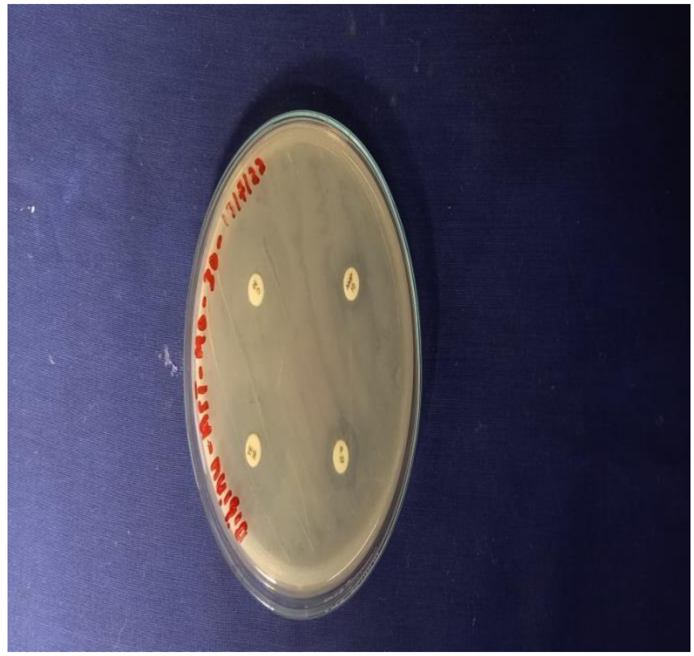


FIG 3:1 MICROWAVE OVEN RADIATION (15MIN) **FIG 3:2** MICROWAVE OVEN RADIATION (30MIN)

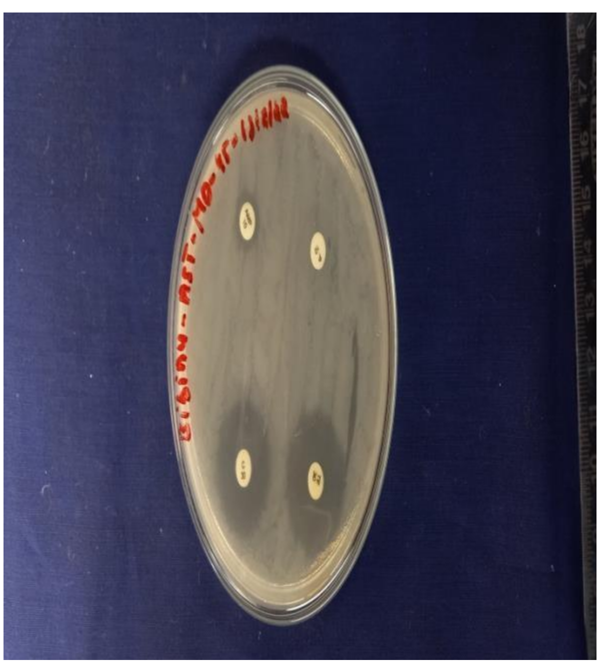
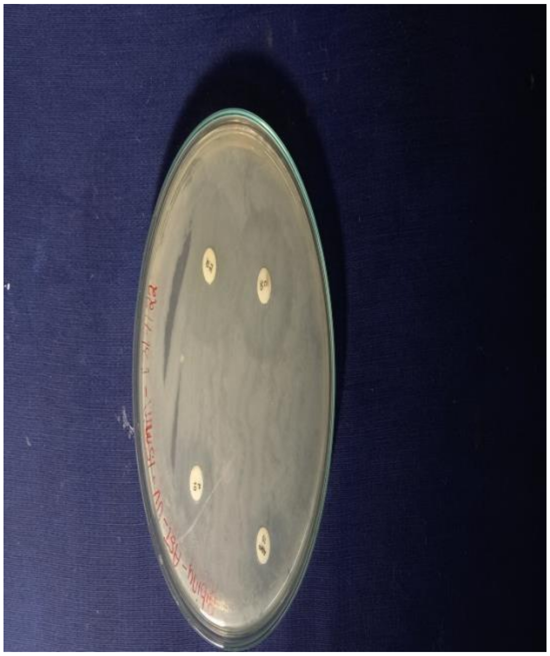


FIG 3:3 MICROWAVE OVEN RADIATION (45MIN) **FIG 3:4** MICROWAVE OVEN RADIATION (60MIN)



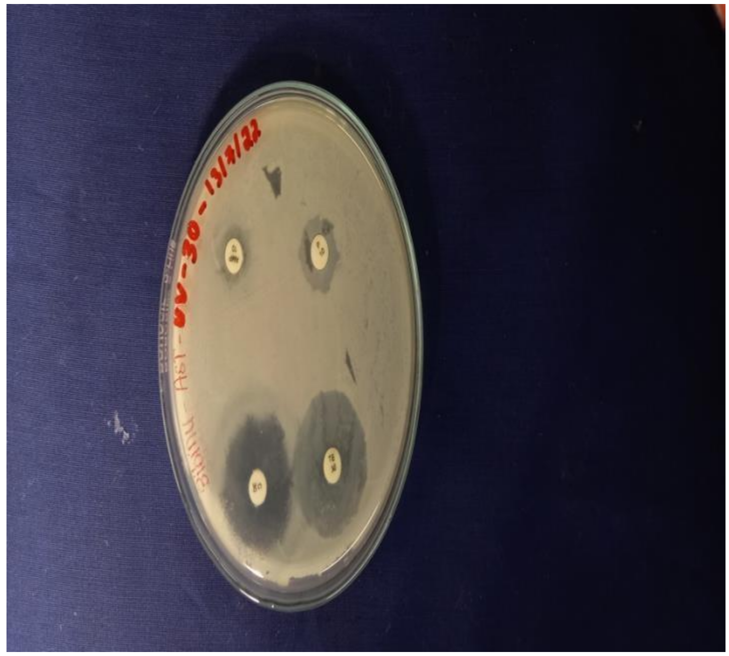


FIG 4:1 UV RADIATION (15MIN) **FIG 4:2** UV RADIATION (30MIN)

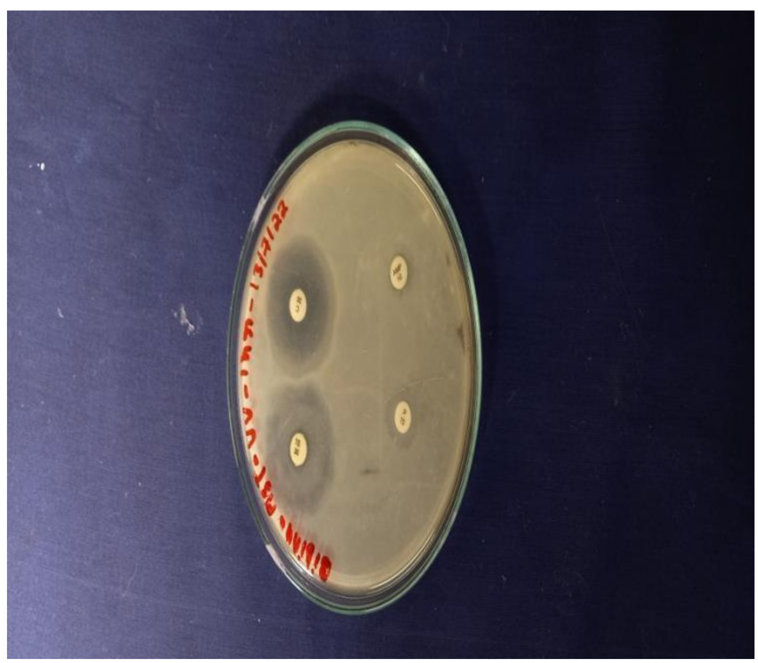


FIG4:3 UV RADIATION (45MIN) **FIG 4:4** UV RADIATIONS (60MIN)

KLEBSIELLA ANTIBIOTIC SENSITIVITY TEST

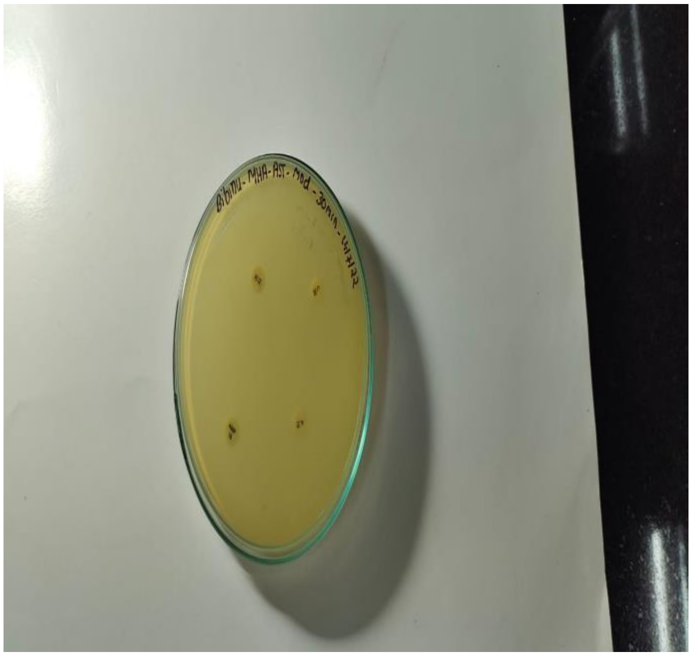


FIG A1:1 MODEM RADIATION (15MIN)

FIG A1:2 MODEM RADIATION (30MIN)

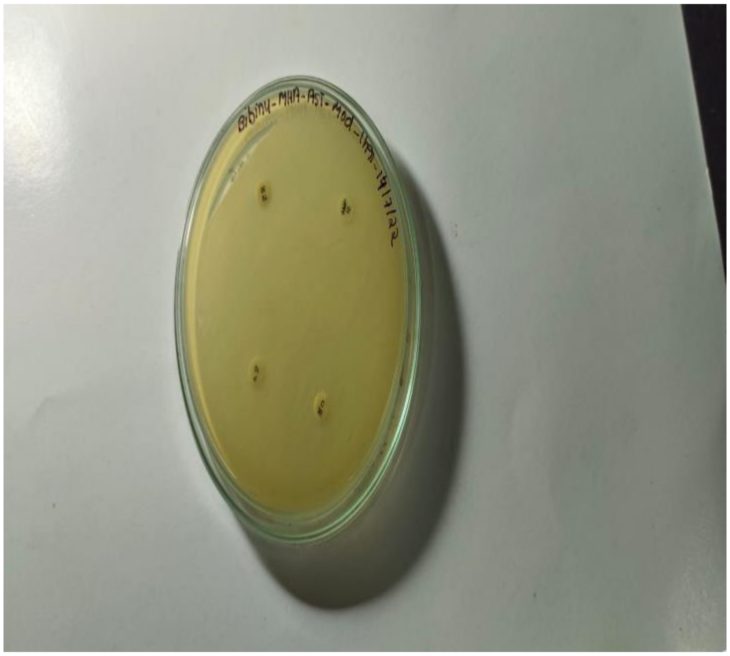
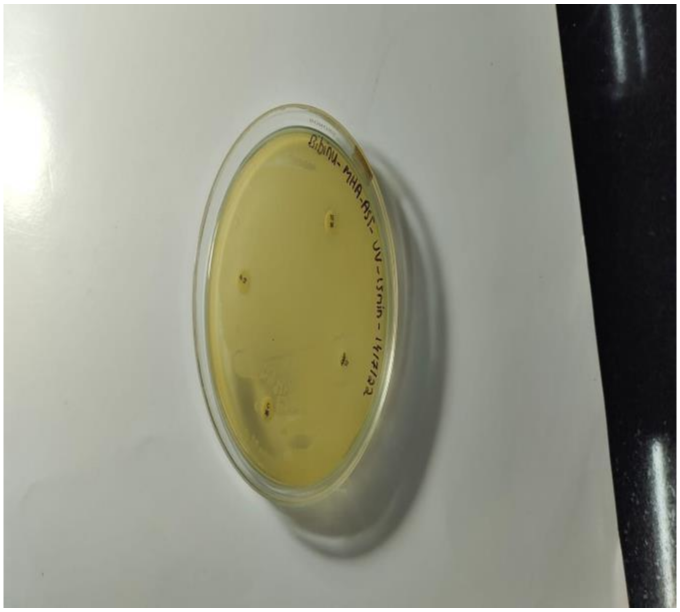


FIG A1:3 MODEM RADIATION (45MIN)

FIG A1:4 MODEM RADIATION (60MIN)



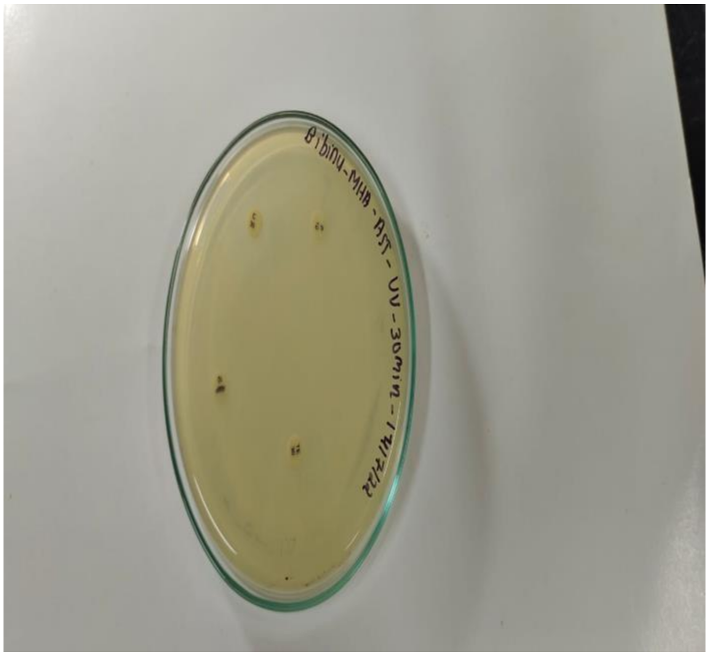
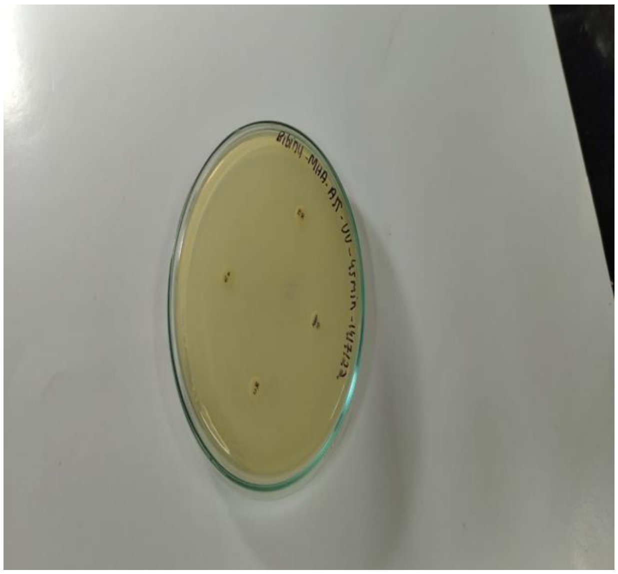


FIG B1:1 UV RADIATION (15MIN)

FIG B1:2 UV RADIATIONS (30MIN)



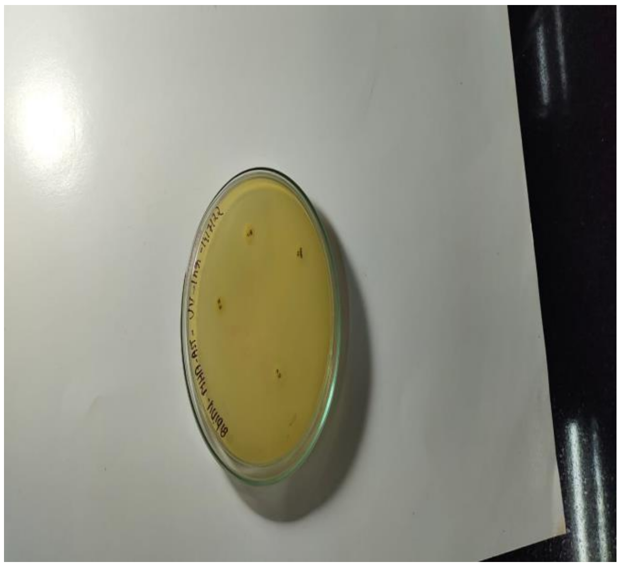
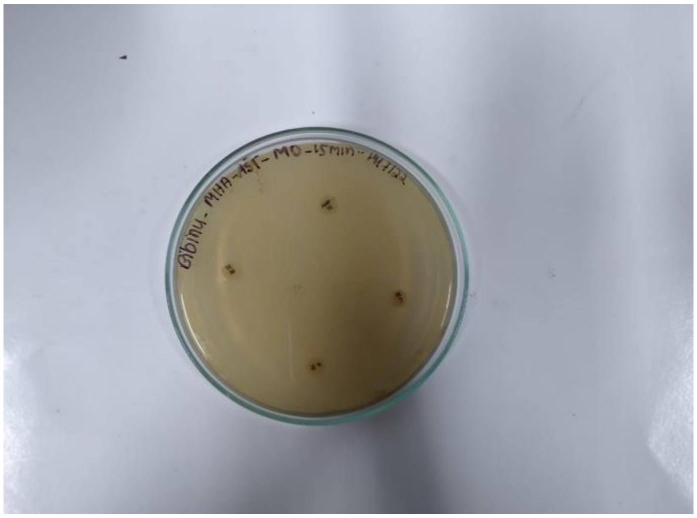


FIG B1:3 UV RADIATION (45MIN)

FIG B1:4 UV RADIATIONS (60MIN)



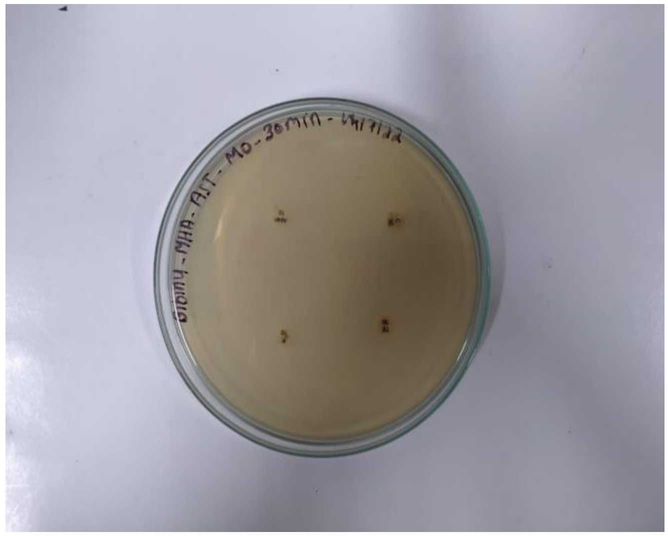
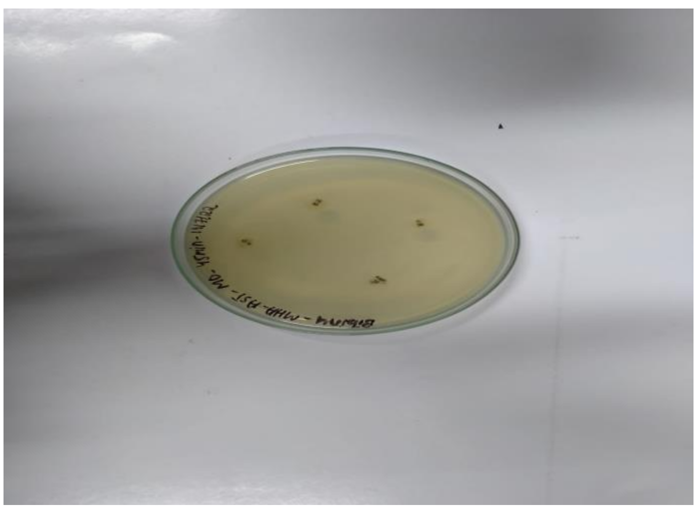


FIG C1:1 MICROWAVE OVEN RADIATION (15MIN) **FIG C 1:2** MICROWAVE OVEN RADIATION (30MIN)



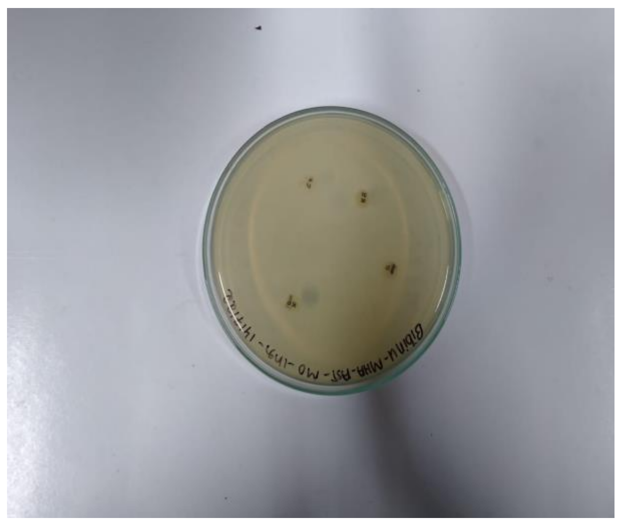


FIG C1:3 MICROWAVE OVEN RADIATIONS (45MIN) **FIG C1:4** MICROWAVE OVEN RADIATION MIN)

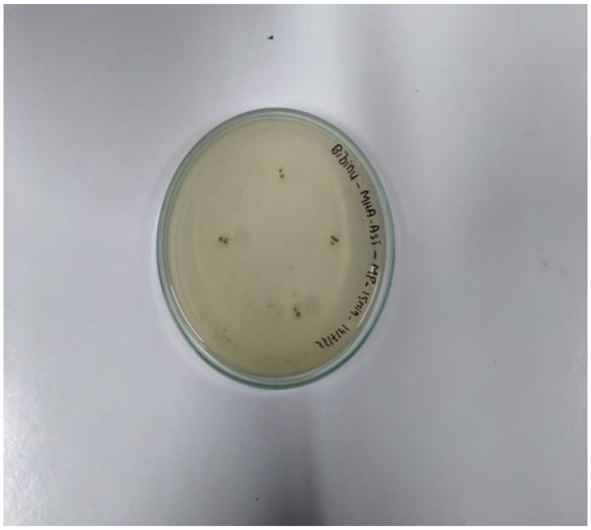


FIG D1:1 MOBILE PHONE RADIATION (15MIN)

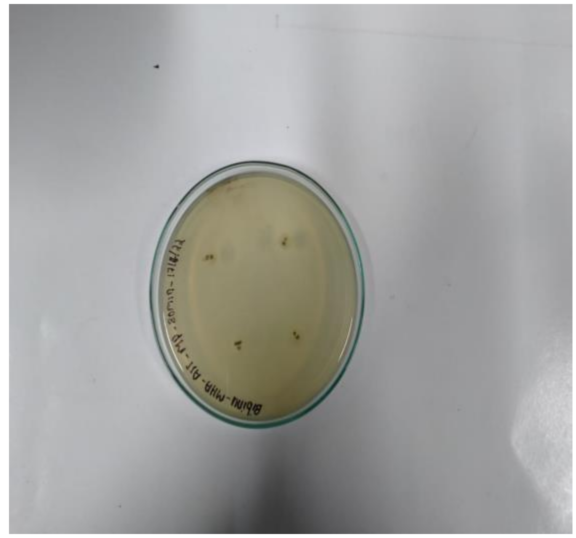


FIG D1:2 MOBILE PHONE RADIATION (30MIN)

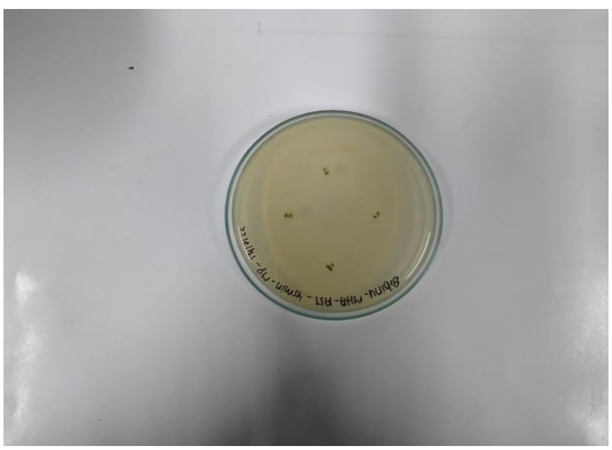


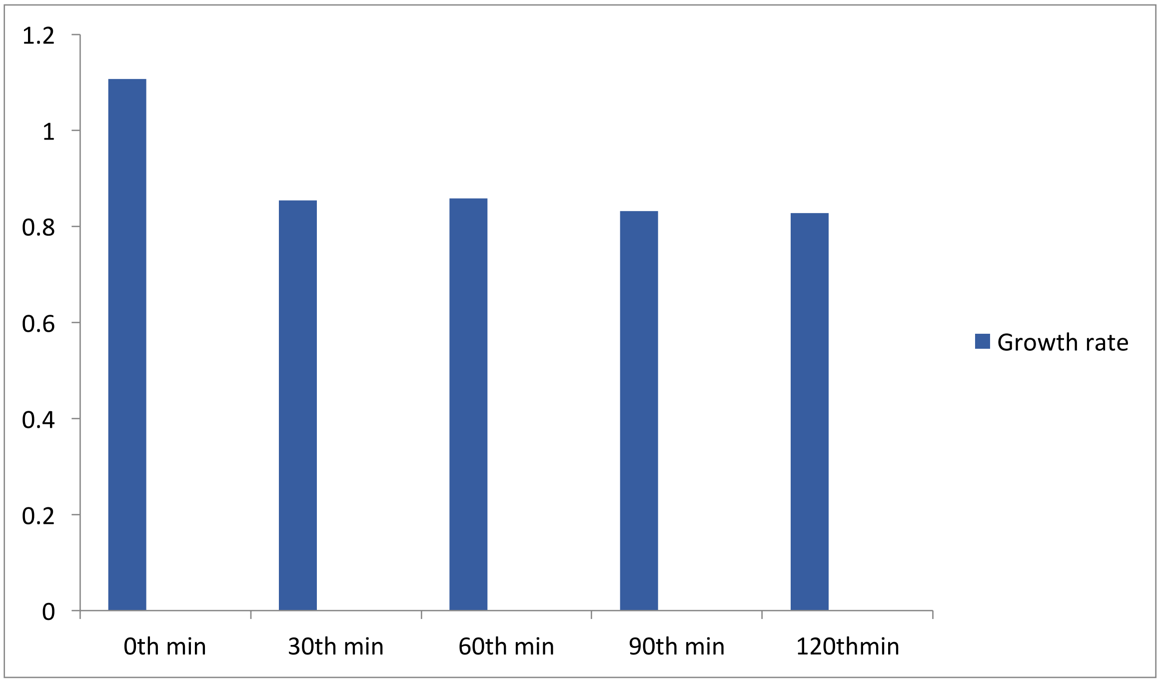
FIG D1:3 MOBILE PHONE RADIATION (45MIN)

FIG D1:4 MOBILE PHONE RADIATIONS (60MIN)

GROWTH RATE RESULT BEFORE AND AFTER RADIATION

BEFORE RADIATION-STAPHYALOCOCCUS

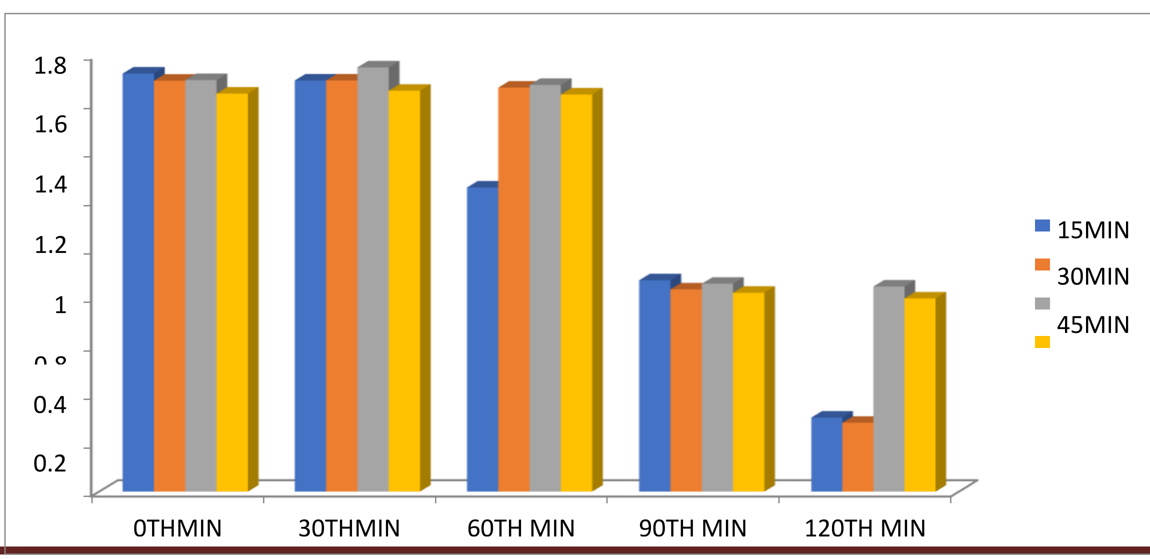
TIME INTERVAL	GROWTH RATE
0TH Min	1.1074
30th min	0.8543
60th min	0.8585
90th min	0.8325
120th min	0.8282



AFTER RADIATION STAPHYLOCOCCUS GROWTH RATE

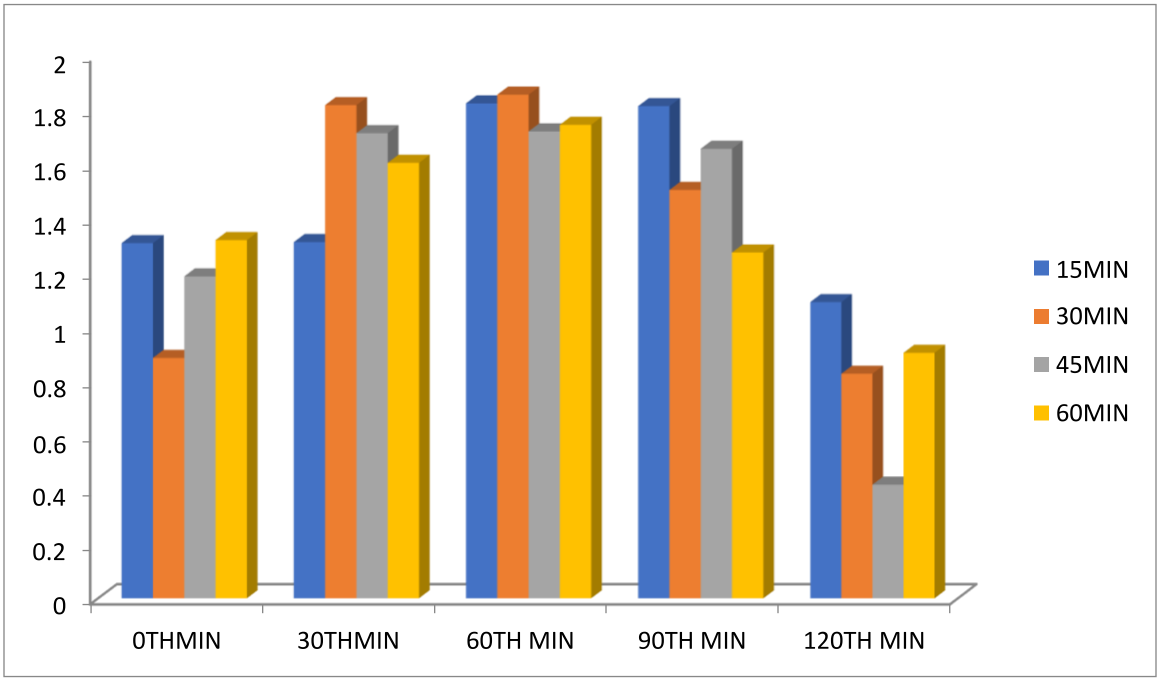
MICROWAVE OVEN

TIME INTERVAL	15MIN	30MIN	45MIN	60MIN
0THMIN	1.7235	1.6939	1.6966	1.6407
30THMIN	1.6948	1.6948	1.7488	1.6527
60TH MIN	1.2534	1.6653	1.6766	1.6371
90TH MIN	0.8712	0.8336	0.8568	0.8198
120TH MIN	0.3051	0.2836	0.8454	0.7962



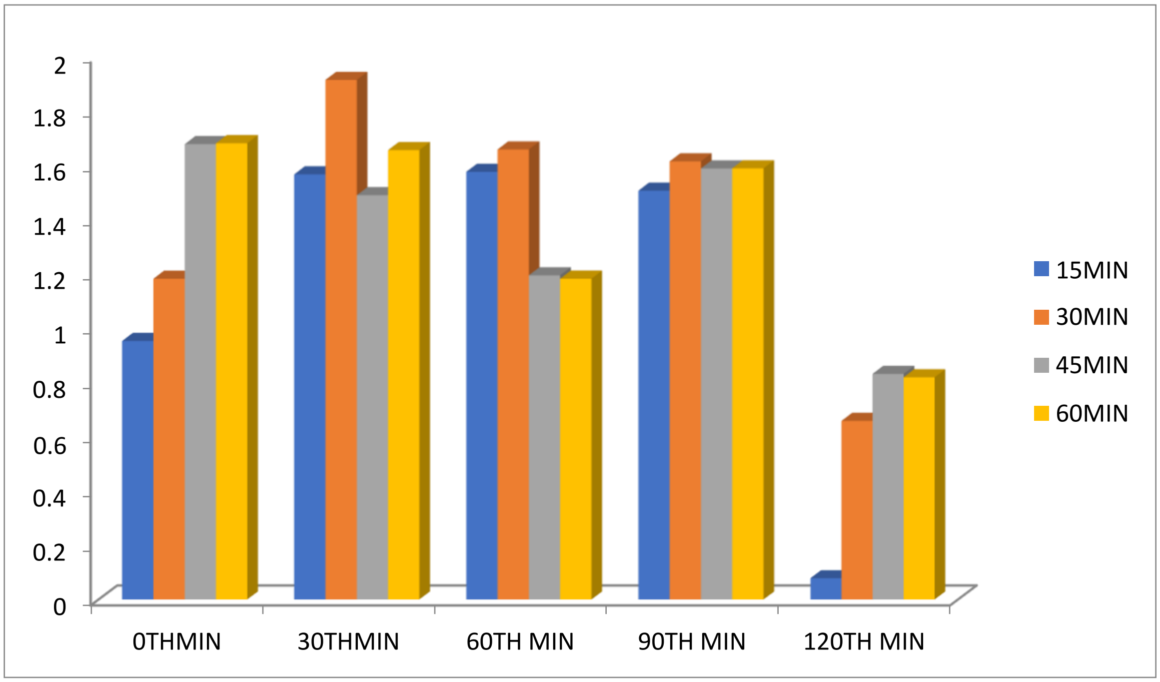
MOBILE PHONE

TIME INTERVAL	15MIN	30MIN	45MIN	60MIN
0THMIN	1.3091	0.8860	1.1863	1.3203
30THMIN	1.3129	1.8179	1.7145	1.6052
60^{TH} MIN	1.8240	1.8564	1.7207	1.7453
90^{TH} MIN	1.8141	1.5053	1.6569	1.2745
120^{TH} MIN	1.0916	0.8276	0.4185	0.9047



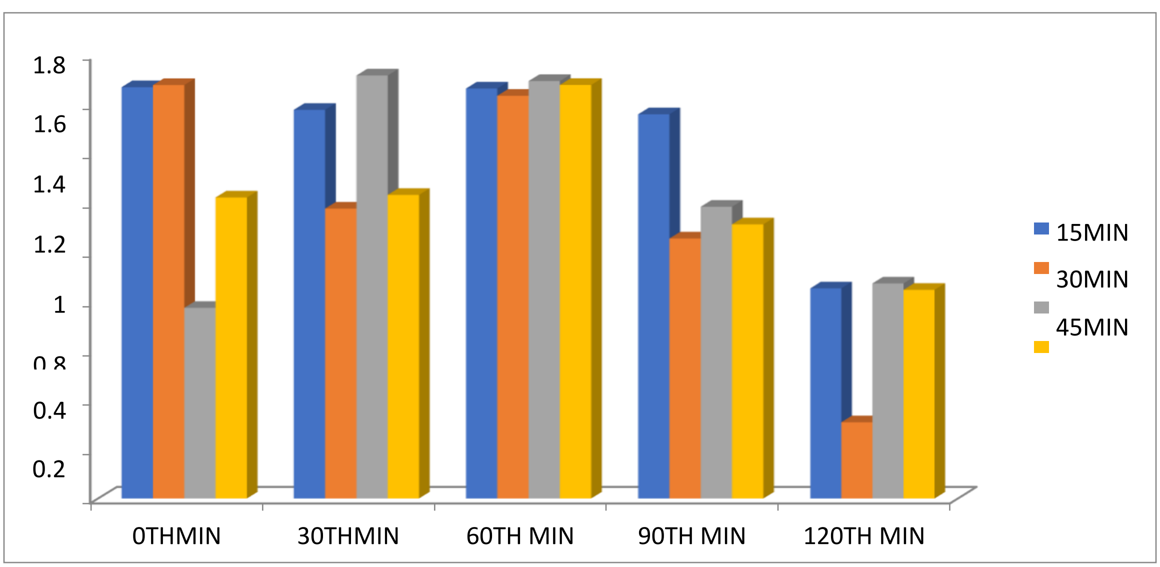
5G MODEM

TIME INTERVAL	15MIN	30MIN	45MIN	60MIN
0THMIN	0.9571	1.1850	1.6782	1.6818
30THMIN	1.5675	1.9138	1.4911	1.6563
60^{TH} MIN	1.5769	1.6588	1.1976	1.1853
90^{TH} MIN	1.5076	1.6153	1.5892	1.5898
120^{TH} MIN	0.0794	0.6642	0.8365	0.8241



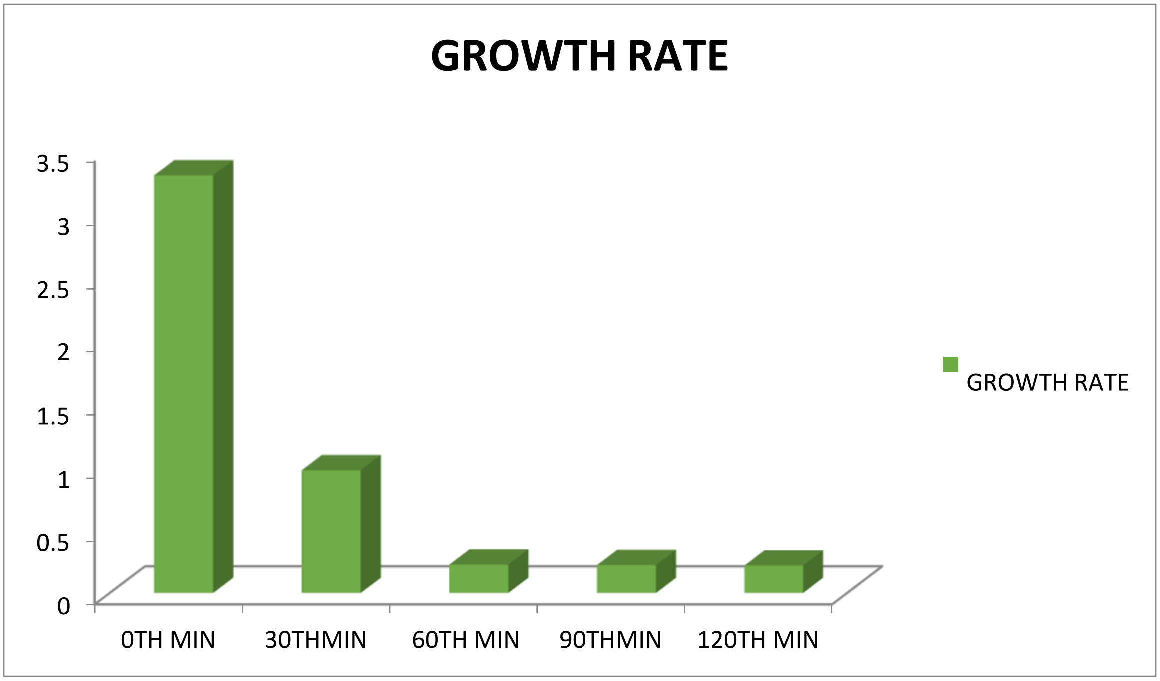
UV

TIME INTERVAL	15MIN	30MIN	45MIN	60MIN
0THMIN	1.6691	1.6778	0.7734	1.2214
30THMIN	1.5771	1.1764	1.7167	1.2319
60^{TH} MIN	1.6636	1.6341	1.6939	1.6783
90^{TH} MIN	1.5590	1.0551	1.1839	1.1125
120^{TH} MIN	0.8527	0.3092	0.8725	0.8467



BEFORE RADIATION-KLEBSIELLA

TIME INTERVAL	GROWTH RATE
0TH MIN	3.3000
30THMIN	0.9709
60TH MIN	0.2241
90THMIN	0.2206
120TH MIN	0.2169



AFTER RADIATION KLEBSIELLA GROWTH RATE

MICROWAVE OVEN

TIME INTERVAL	15MIN	30MIN	45MIN	60MIN
0TH MIN	0.3803	0.5481	0.4470	0.5551
30THMIN	0.3720	0.5859	0.4839	0.6008
60TH MIN	1.2701	1.4551	1.3965	0.9765
90THMIN	0.6118	1.4945	0.8381	0.9861
120TH MIN	0.5801	0.9865	0.5461	0.7685

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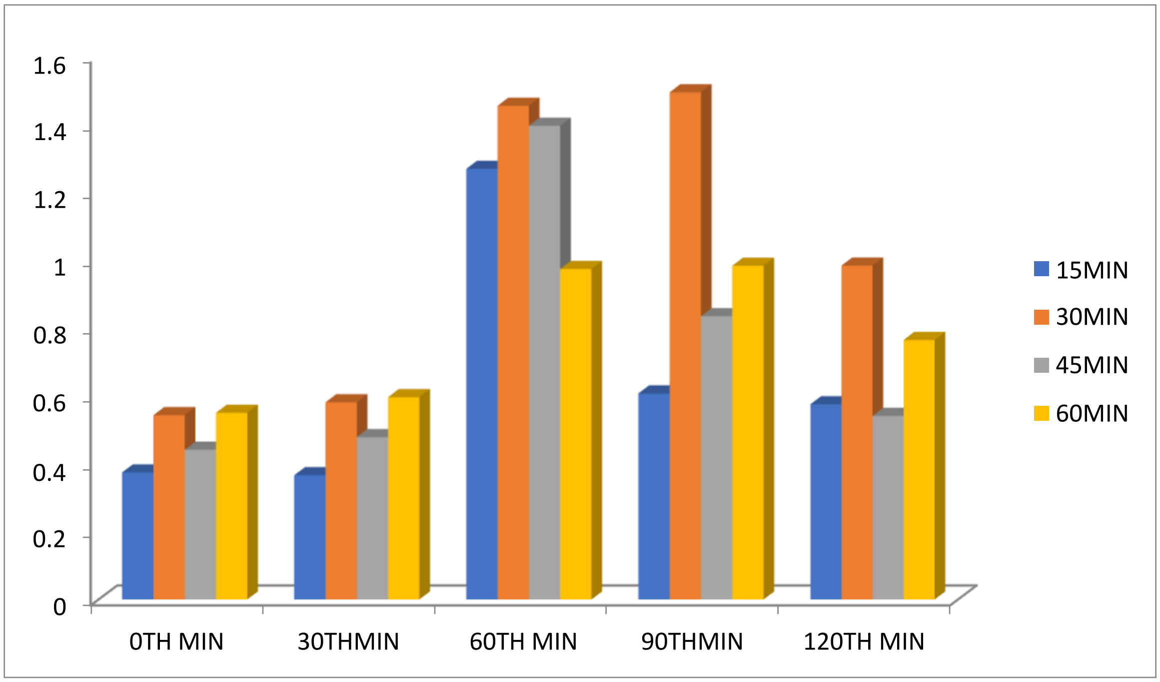
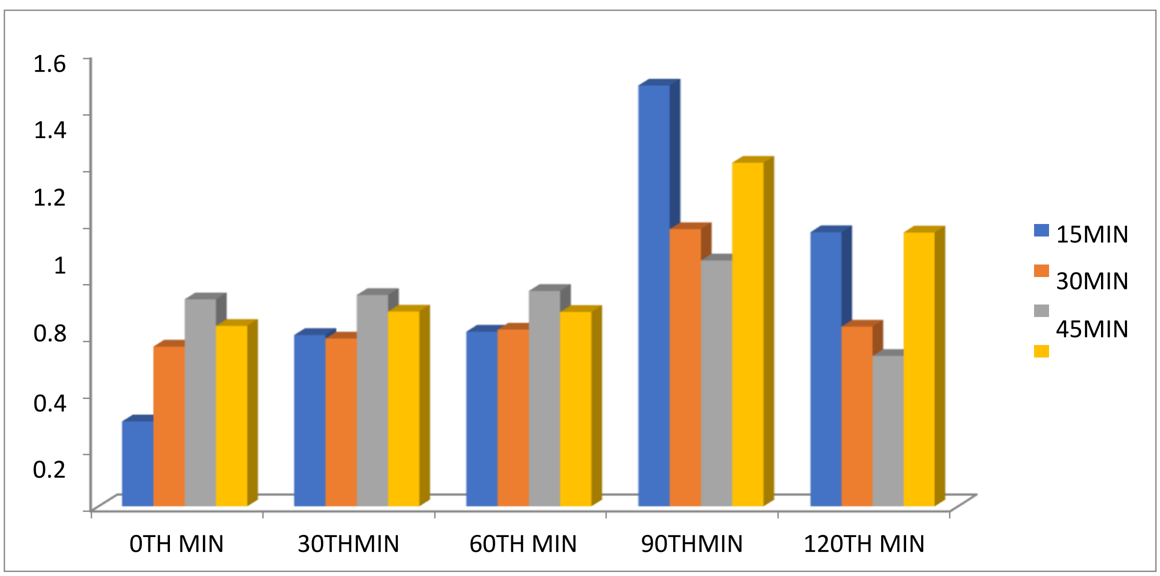


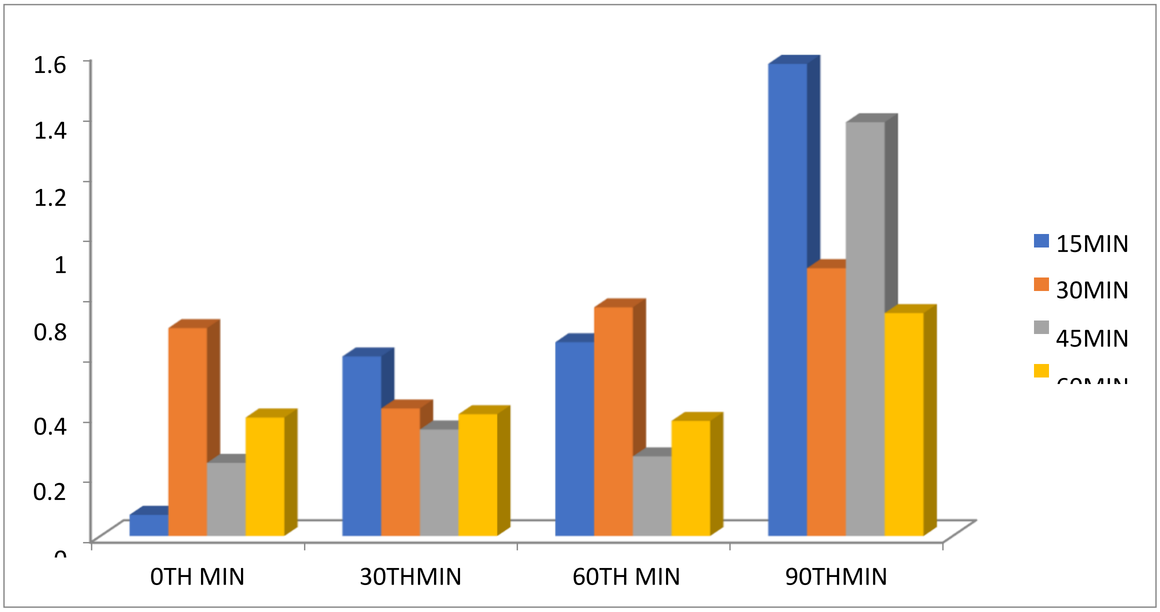
MOBILE PHONE

TIME INTERVAL	15MIN	30MIN	45MIN	60MIN
0TH MIN	0.3000	0.5641	0.7310	0.6372
30THMIN	0.6050	0.5926	0.7463	0.6879
60TH MIN	0.6168	0.6241	0.7606	0.6866
90THMIN	1.4863	0.9791	0.8684	1.2135
120TH MIN	0.9682	0.6345	0.5312	0.9672



5G MODEM

TIME INTERVAL	15MIN	30MIN	45MIN	60MIN
0TH MIN	0.0701	0.6893	0.2425	0.3929
30THMIN	0.5953	0.4227	0.3532	0.4038
60TH MIN	0.6426	0.7582	0.2639	0.3814
90THMIN	1.5658	0.8882	1.3721	0.7392
120TH MIN	0.9683	0.6232	0.9262	0.5231



UV

TIME INTERVAL	15MIN	30MIN	45MIN	60MIN
0TH MIN	0.5236	0.5234	0.5128	0.4319
30THMIN	0.5535	0.5085	0.5297	0.0159
60TH MIN	0.5662	0.5401	0.5197	0.5263
90THMIN	1.5017	0.9119	1.4373	1.4757
120TH MIN	0.5932	0.8625	0.9654	0.9675

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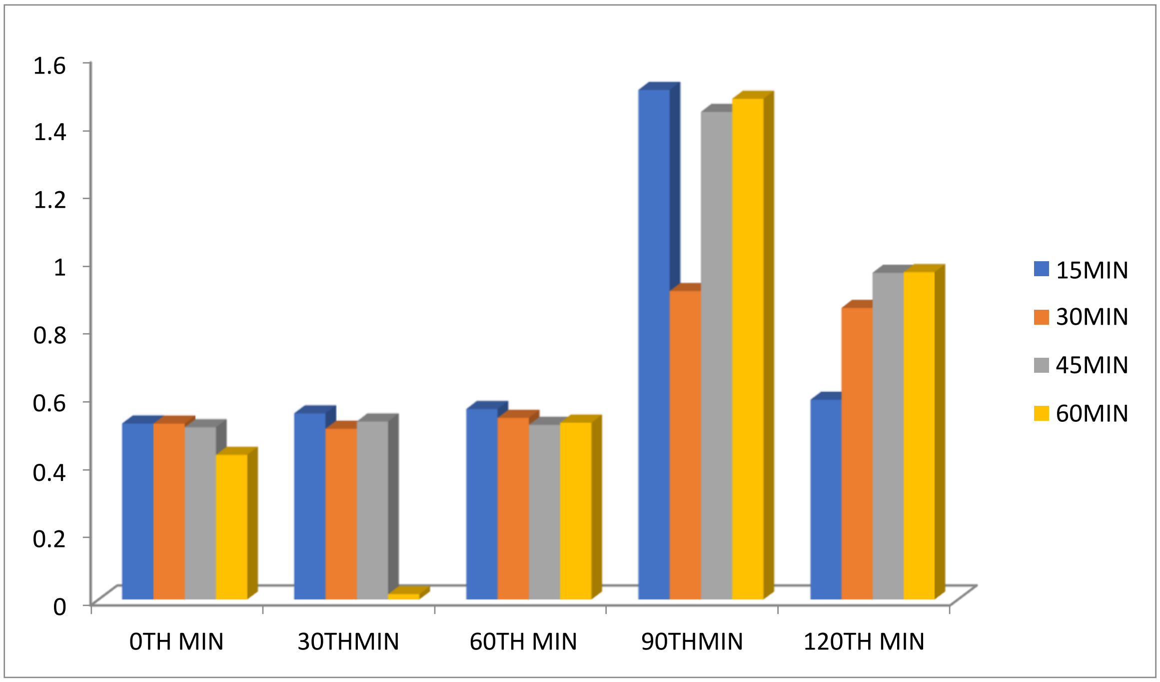

Before radiation comparing to after radiation of both bacteria's (staphylococcus and Klebsiella).slight variation is seen in these two bacterial growth rates. Radiation from four devices affected the bacterial growth rate.

CONCLUSION

In this study, bacteria both staphylococcus and Klebsiella were exposed to different source of radiation (range at 1800MHz to 800THz)and the effect on growth rate, and antibiotic sensitivity of bacteria was determined. The used devices are mobile phone, microwave oven, 5G modem, and UV radiation. In this study to detect these devices producing radiation is mainly affect the growth of bacteria.

Firstly, it has been well established that most bacteria influenced with different sources of radiation which affect the growth rate. The bacteria were initially screened to determine their normal growth rate and then given under radiation. In the initial screening without radiation, the bacteria exhibited their normal growth. When they are given by the radiation such as Mobile phone, microwave oven, 5G modem, and UV rays, they showed resistance after radiations .in some aspects; the resistant bacteria became sensitive after the different source of radiation. The radiation from all these devices inhibits the growth of microorganisms comparing to normal growth. In Klebsiella species, after radition from 5G modem to affect the growth rate of bacteria comparing to normal growth rate.

Secondly, the radiation from all devices affects the bacteria it is determined by antibiotic sensitivity level. Main change occur these stage such as before radiation staphylococcus does not form zone to Chlorampenicol so it is resistant but after radiation from these all devices staphylococcus form zone in Chlorampenicol. The resistant bacteria became sensitive after the different source of radiation.

These studies help in the future because the devices used in this study, we also use in our daily life, since the radiation from these used devices affect small oranisams, this radiation also affected the human body and causes cancer.

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