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AWARENESS ABOUT THE PHYSICS AND CHEMISTRY OF RADIATION ABSORPTION AMONG ALLIED HEALTH SCIENCE STUDENT

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Abstract

Introduction: The absorption of energy from radiation in biologic material may lead to excitation or to ionization. The raising of an electron in an atom or molecule to a higher energy level without actual ejection of the electron is called excitation. If the radiation has sufficient energy to eject one or more orbital electrons from the atom or molecule, the process is called ionization, and that radiation is said to be ionizing radiation. The important characteristic of ionizing radiation is the localized release of large amounts of energy. **Aim:** This survey was conducted for assessing the Awareness About The physics and chemistry of Radiation absorption among Allied Health Science Students. **Materials and Method:** A cross-section research was conducted with a self-administered questionnaire containing ten questions distributed amongst 100 Allied Health Science students. The questionnaire assessed Awareness The physics and chemistry of Radiation absorption among Allied Health Science Students. The responses were recorded and analysed. **Results:** 94.3% of the respondents were aware of Ionizing Radiation. 94.3% were aware of types of Radiation. 94.3% of the respondents were aware that Ionizing Radiation causes cancer. 74% of the respondents were aware of which of the given is Ionizing Radiation. 91% were aware that Ionizing radiation is used for Therapy and diagnosis. **Conclusion:** There is an adequate level of awareness amongst Allied Health Science students about The physics and chemistry of Radiation absorption among Allied Health Science Students. Enhanced awareness initiatives and educational programmes together with increased importance for curriculum improvements that further promote knowledge and awareness about the physics and chemistry of Radiation absorption among Allied Health Science Students should be initiated for further understanding and benefits.

Keywords: Radiation, Absorption of Energy, Chemistry of Radiation, Ionizing Radiation., Therapy.

INTRODUCTION

Radiobiology is the study of the action of ionizing radiations on living things. As such, it inevitably involves a certain amount of radiation physics. The purpose of this chapter is to present, in summary form and with a minimum of mathematics, a listing of the various types of ionizing radiations and a description of the physics and chemistry of the processes by which radiation is absorbed[1]. The absorption of energy from radiation in biologic material may lead to excitation or to ionization. The raising of an electron in an atom or molecule to a higher energy level without actual ejection of the electron is called excitation. If the radiation has sufficient energy to eject one or more

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orbital electrons from the atom or molecule, the process is called ionization, and that radiation is said to be ionizing radiation[2]. The important characteristic of ionizing radiation is the localized release of large amounts of energy.

Most experiments with biologic systems have involved x- or γ-rays, two forms of electromagnetic radiation. X- and γ-rays do not differ in nature or in properties; the designation of x- or γ-rays reflects the ways they are produced. X-rays are produced extranuclearly; γ-rays are produced intranuclearly[4]. In practical terms, this means that x-rays are produced in an electrical device that accelerates electrons to high energy and then stops them abruptly in a target usually made of tungsten or gold. Part of the kinetic energy (the energy of motion) of the electrons is converted to x-rays.

Energy in the form of heat or mechanical energy is absorbed uniformly and evenly, and much greater quantities of energy in these forms are required to produce damage in living things. The potency of x-rays, then, is a function not so much of the total energy absorbed as of the size of the individual energy packets[3]. In their biologic effects, electromagnetic radiations are usually considered ionizing if they have a photon energy in excess of 124 eV, which corresponds to a wavelength shorter than about 10-6 cm. The aim is to create awareness about the physics and chemistry of Radiation absorption among Allied Health Science Students.

MATERIALS AND METHOD :

This cross-sectional research was conducted with a self-administered questionnaire containing ten questions distributed amongst 100 Allied Health science students. The students were randomly selected across various disciplines of Allied health science. The study setting was designated in the university campus. The survey instrument was a questionnaire pretty tested and evaluated for validity and reliability concerns.

The questionnaire included ten questions eliciting the demographic data through open ended responses and multiple choice questions for the other responses. The study was approved by the institutional Ethical committee and informed consent was obtained from the participants. The questionnaire was posted in an online platform and the identity of the respondents were kept confidential. The questionnaire assessed the awareness about The physics and chemistry of Radiation absorption among Allied Health Science Students. The responses were recorded and analysed. There were no incomplete responses and no dropouts from the study. The final data obtained was organized, tabulated and subjected to statistical analysis. The salient questions in the study are :

1) Do you aware of ionising Radiation?
2) Do you know the type of radiation?
3) Ionising Radiation can cause cancer.
4) Which one of the following is ionization Radiation.
5) Ionising Radiation is used in both the diagnosis and Treatment.

RESULTS

94.3% of the respondents were aware of Ionizing Radiation (Figure 1). 94.3% were aware of types of Radiation(Figure 2). 94.3% of the respondents were aware that Ionizing Radiation causes cancer(Figure 3). 74% of the respondents were aware of which of the given is Ionizing Radiation(Figure 4). 91% were aware that Ionizing radiation is used for Therapy and diagnosis (Figure 5).

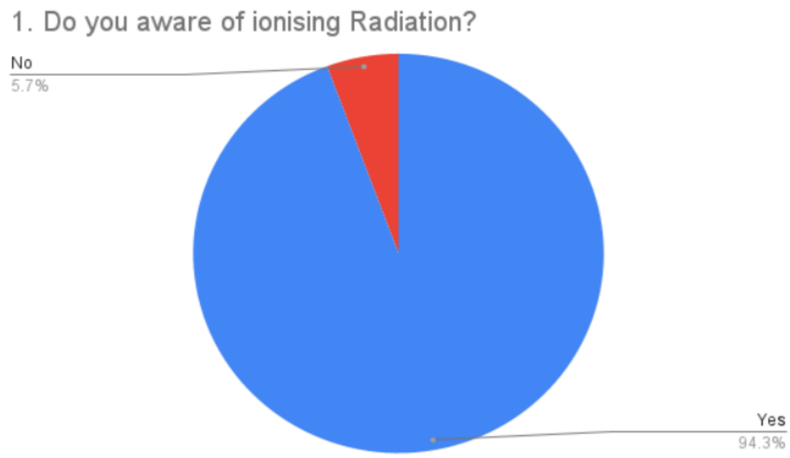

Figure 1: Awareness of Ionizing Radiation

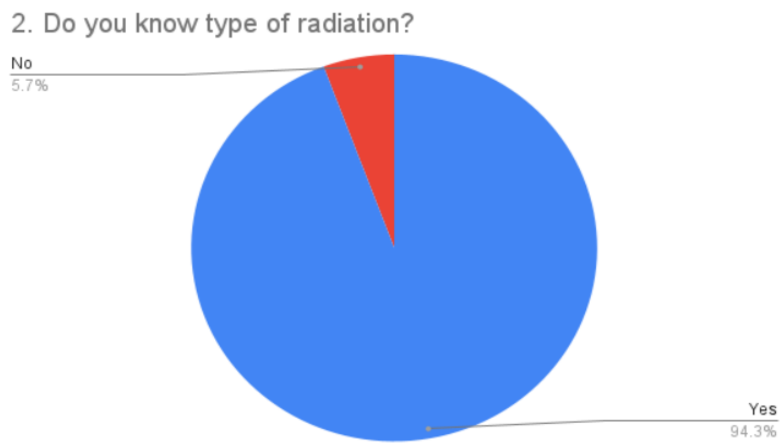

Figure 2: Awareness about types of Ionizing radiation

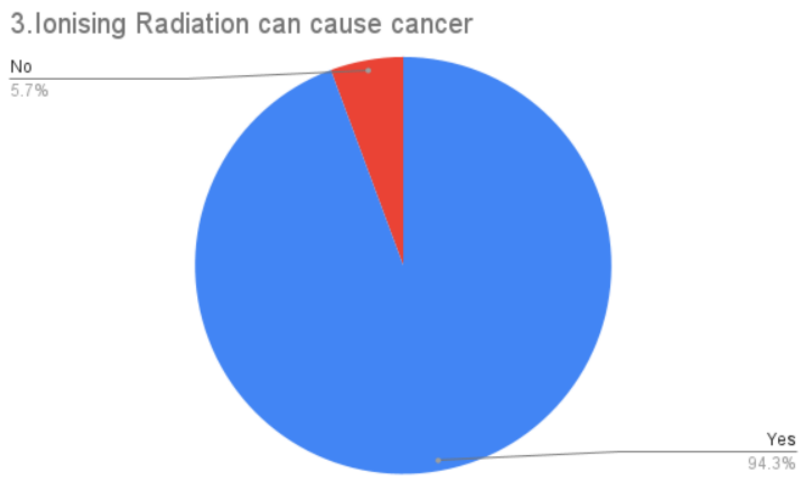

Figure 3: Awareness about Ionizing radiation and Cancer

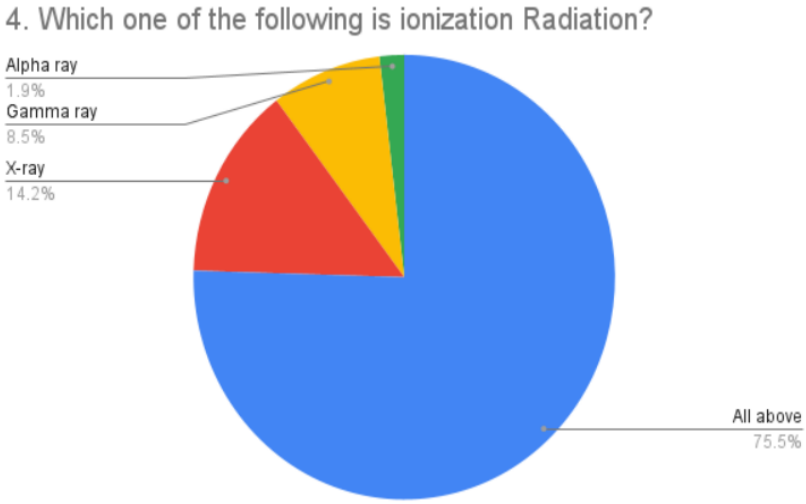

Figure 4 : Awareness about knowledge on Ionizing radiation

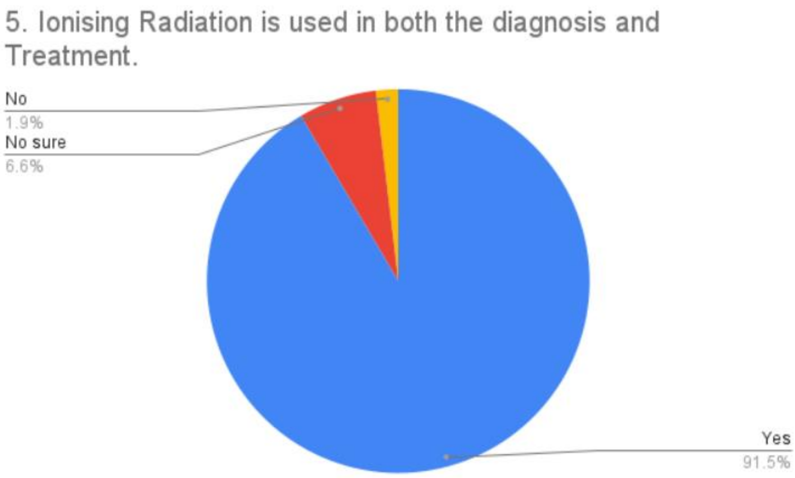

Figure 5: Awareness about application of Ionizing Radiation

DISCUSSION

When biological material is exposed to ionizing radiation, a chain of cellular events occurs as the ionizing particle passes through the biological material. A number of theories have been proposed to describe the interaction of radiation with biologically important molecules in cells and to explain the resulting damage to biological systems from those interactions. Many factors may modify the response of a living organism to a given dose of radiation[6]. Factors related to the exposure include the Dose Rate, the energy of the radiation, and the temporal pattern of the exposure (e.g., protracted or fractionated exposures). Biological considerations include factors such as species, age, sex, and the portion of the body exposed[7].

At acute doses up to 10 rad (100 mGy), single strand breaks in DNA may be produced. These single strand breaks may be repaired rapidly. With doses in the range of 0.5–5 Gy (50–500 rad), irreparable double-stranded DNA breaks are likely, resulting in cellular reproductive death after one or more divisions of the irradiated parent cell. At large doses of radiation, usually greater than 5 Gy (500 rad), direct cell death before division (interphase death) may occur from the direct interaction of free-radicals with essentially cellular macromolecules. Morphological changes at the cellular level, the severity of which are dose-dependent, may also be observed[9].

The sensitivity of various cell types varies. According to the Bergonie-Tribondeau law, the sensitivity of cell lines is directly proportional to their mitotic rate and inversely proportional to the degree of differentiation[8].

Cellular changes may result in cell death, which if extensive, may produce irreversible damage to an organ or tissue or may result in the death of the individual. If the cell recovers, altered metabolism and function may still occur, which may be repaired or may result in the manifestation of clinical symptoms. These changes may also be expressed at a later time as tumors, cellular mutations, or transformed tissue (scar tissue) which may result in abnormal tissue or compromised function[12].

In most organs and tissues the injury and the underlying mechanism for that injury are complex and may involve a combination of events. The extent and severity of this tissue injury are dependent upon the radiosensitivity of the various cell types in that organ system[11]. A rapid renewal system, such as the gastrointestinal mucosa; a slow renewal system, such as the pulmonary epithelium; and a non renewal system, such as neural or muscle tissue. In the rapid renewal system, organ injury results from the direct destruction of highly radiosensitive cells, such as the stem cells in the bone marrow. Injury may also result from constriction of the microcirculation and from edema and inflammation of the basement membrane, designated as the histohematic barrier (HHB), which may progress to fibrosis[13]. In slow renewal and nonrenewal systems, the radiation may have little effect on the parenchymal cells, but ultimate parenchymal atrophy and death over several months result from HHB fibrosis and occlusion of the microcirculation.

DNA is a major target molecule during exposure to ionizing radiation. Other macromolecules, such as lipids and proteins, are also at risk of damage when exposed to ionizing radiation. The genotoxicity of ionizing radiation is an area of intense study, as damage to the DNA is ultimately responsible for many of the adverse toxicological effects ascribed to ionizing radiation, including cancer. Damage to genetic material is basic to developmental or teratogenic effects, as well[14].

There is limited evidence of non-cancer human effects at low radiation doses. Non-cancer effects that have been reported are associated with the Japanese atomic bomb survivor population and include neurological and cardiovascular effects. Neurological effects were observed in fetuses exposed to prompt radiation during the detonations while they were in gestation weeks 8–15, less so for weeks 16–25, and were not observed for other developmental time frames. Cardiovascular effects have been reported for atomic bomb survivors following 60 years of follow-up[10].

CONCLUSION

There is an adequate level of awareness amongst Allied Health Science students about The physics and chemistry of Radiation absorption among Allied Health Science Students. Enhanced awareness initiatives and educational programmes together with increased importance for curriculum improvements that further promote knowledge and awareness about the physics and chemistry of Radiation absorption among Allied Health Science Students should be initiated for further understanding and benefits.

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