Nuclear Science
2021; 6(2): 8-11
http://www.sciencepublishinggroup.com/j/ns
doi: 10.11648/j.ns.20210602.11
ISSN: 2640-4338 (Print); ISSN: 2640-4346 (Online)

Review Article

Radiation Dose Level and Biological Effect Toward Human Being

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To cite this article:
Baye Zinabe Kebede. Radiation Dose Level and Biological Effect Toward Human Being. *Nuclear Science*. Vol. 6, No. 2, 2021, pp. 8-11. doi: 10.11648/j.ns.20210602.11

Received: March 24, 2021; **Accepted**: April 27, 2021; **Published**: May 21, 2021

Abstract: Ionizing radiation is emitted from the result of radioactive materials. The scientific regular measure of dose was quantified according to the exposure of radiation to ward human being. The aim of the study was assessing the amount of dose level and its consequence that effect toward human being. The importance of this work was judged based on how much was questioned and the path ahead for people to defend themselves from radiation exposure. The present work was conducted by using gamma spectroscopy to determine the radiation dose level of ionizing radiation. It was checked of quantification dose which incorporates the total amount of ionizing radiation that is associated with damage the tissue. It was determined that absorbed and Annual equivalent dose of natural occurrence of radioactive material. All human being are exposed to ionizing radiation with natural cosmic rays coming from outer space and image therapy within in hospital. When it seen that the exposures were varied as of people immunity. The sources of radiation exposures to the human were estimated based on the dose which affects the organ. Radiation exposed was leads serious gene and cancer disease. Generally, in this survey we assessed that particularly ionizing radiation caused damaged short and long term effect.

Keywords: *Ionizing radiation*, Dose, Radiation, Exposure and Radionuclides

1. Introduction

Ionizing radiation occurs at the highest frequencies. The process of transforming a neutral atom or molecule into an electrically charged component is known as ionization. Ions are either positively charged or negatively charged, depending upon the number of protons and electrons present in the atom [1]. The natural sources of ionizing gamma radiation in the environment can be classified into terrestrial and Cosmo genic radiation sources. Terrestrial radioactivity comes from the ground and Cosmo genic radioactivity comes from the interaction of atmospheric gases with cosmic rays. Among these natural ionizing radiation sources, cosmic radiation contributes only to the external exposure of humans, whereas cosmic radiation induced radionuclides (for example ^{14}C) and terrestrial radionuclide's contributed to both external and internal exposures [2]. External exposure is mostly due to emitted-rays, and internal exposure is due to deposition in the human body and emitted-, and also-and-radiation. Terrestrial radionuclides are most often determined by geographical and geological conditions. The level of radioactivity varies depending on the composition of rocks. Radioactive materials are produced in volcanic rocks like granite and pumice. Radioactivity, absorbed dose, exposure and dose equivalent too are measured in different units. The units for quantifying radioactivity are Curie (Ci) and Becquerel (Bq), which refer to the concentration of particles emitted by a sample [3]. The dose equivalent is the same as the absorbed dose for beta and gamma radiation but larger than the absorbed dose for the more hazardous alpha and neutron radiation [4].

2. Literature Review

2.1. Sources of Radiation Exposure

Radiation sources can be grouped into two main categories namely: natural sources and man- made sources [5]. Cosmic rays, terrestrial, internal, and radon are most popular natural sources (about 82 percent). Man-made sources are produced artificially. The majority of people are exposed to naturally occurring radioactive material (NORM) and artificial radioisotopes in our environment through air, food, soil, and water. Monitoring radioactive materials is of primary importance for human and environmental protection. The radiation from radionuclides can cause damage to living tissues only when the energy is absorbed in the tissues and one of the major pathways over which it passes to people is food [6]. The main contributions of this study are to provide an overview of ionizing radiation characterization and to determine the amount of dose effect. Ionizing radiation can be highly harmful to humans, and care should be taken to reduce the risks. The overall purpose of radiation protection and safety is to provide appropriate levels of protection and safety for people from not unduly limiting the benefits of practice that generates exposure [7].

2.2. Biological Effect of Radiation

Biological effects Ionizing radiation, by definition, interacts only with atoms in a mechanism known as ionization, which indeed has a detrimental effect on living cells [8]. As a side effect, all biological damage effects begin as a consequence of radiation interactions with atoms of cells. Despite the fact that all subsequent biological effects can be traced back to radiation's interaction with atoms, radiation affects cells by two mechanisms. These two mechanisms are known as direct and indirect effects [9]. Radiation has a direct effect when it interacts with the atoms of the DNA molecule or with a cellular factor that is essential to the life of the cell. Such interaction affects the cell's ability to reproduce or survive. When one cell is exposed to radiation, the probability of the radiation interacting with the DNA molecule is very low since these essential components occupy such a small portion of the cell [10].

As radiation interacts with water, it may break the bonds that hold the water molecule together, due to the presence of fragments such as hydrogen (H) and hydroxyl (OH). These fragments can recombine or interact with other fragments or ions to form compounds that aren't harmful to the cell, such as water. They can, however, combine to form pollutants such hydrogen peroxide (H2O2), in which they can co-exist [11].

There was no precise unit of radiation dose that was suitable for either radiation protection or radiation therapy in the early days of radiological experience. Furthermore, since the fraction of energy absorbed by the body in a radiation field is energy dependent, it is necessary to distinguish between radiation exposure and radiation absorbed dose [12]. The SI unit of radioactivity is the Becquerel (Bq), where 1Bq=1disintegration per second [13]. There was no precise unit of radiation dose that was suitable for either radiation protection or radiation therapy in the early days of radiological experience. Furthermore, since the fraction of energy absorbed by the body in a radiation field is energy dependent, it is necessary to distinguish between radiation exposure and radiation absorbed dose [14].

2.3. Radiation Dosimeter

2.3.1. Absorbed Dose

As radiation reacts with matter, light is absorbed from the radiation to the matter. The energy emitted to tissue or a radiation shield is ultimately dissipated as heat. The radiation dose is estimated by the radiation's intensity and energy, the exposure time, the area exposed, and the depth of energy deposition [15]. The Absorbed Dose is given by:

$$D=\frac{E}{M} \tag{1}$$

J/kg or Gray (Gy), formally rad, is the unit. 1 Gy equals 100 rad. If the exposure is known, the absorbed dose in a material is determined. Radiation absorbed dose has been found to be correlated with biomedical effects at the tissue, organ, and organism levels, ideal for radiation safety measurements and medical diagnostic and therapeutic uses of radiation [16]. The conversion factors used to compute the absorbed gamma dose rate (DR) in air per unit specific activity in Bq kg−1 (dry weight) corresponds to 0.462 nGy h-1 for 238U, 0.604 nGyh-1 for232Th and 0.0417 nG/h for 40K [17].

2.3.2. Equivalent Dose

The equivalent dose of the absorbed dose and a factor related to the type of radiation (depending on the ionizing capacity and density). The absorbed dose has not had an accurate reflection of the damage that radiation can do [18]. A 0.1Gy dose of alpha radiation, for example, is more harmful than a 0.1Gy dose of beta or gamma radiation. The equivalent dose is used to reflect the damage done to biological systems from different types of radiation.

$$H_T=D_R.w_R \tag{2}$$

Where H_T (mSv) is equivalent Dose, D_R (nGy) Absorbed dose rate and W_R radiation weight factor. The unit is sievert (Sv) formally rem. 1Sv=100rem [20].

2.3.3. Effective Dose

A dose coefficient could be used to estimate the effective dose due to ingestion of a radioisotope in that certain chemical form. The effective dose, E, is the sum of the weighted equivalent doses in all of the body's tissues and organs. It is calculated using the following expression, where wT is the tissue weighting factor [19].

$$E=H_T*D_R \tag{3}$$

Where E is effective dose, H_T (mSv) is equivalent dose and W_T is weighting factor for tissue. Absorbed dose rate in 1meter above the ground surface does not directly provide radiological hazard risk to which an individual is exposed. Absorbed dose can be express in terms of annual effective dose equivalent. Annual estimated average effective dose equivalent received by member is calculate using factor of 0.7 SvGy-1, which was used to convert the absorbed dose rate to human effective dose equivalent with an outdoor of 20% and 80% for indoor by considering that the people on the average spent-20% their time in outdoor [20].

2.3.4. Tissue Threshold Dose

A threshold dose is the maximum dose at which a tissue-specific reaction does not occur. This dose is difficult to determine. The 'threshold dose' is defined here as the estimated dose required to cause a specific, observable effect in 1% of the others exposed [21]. The equivalent dose is a single unit that accounts for the degree of harm caused by different types of radiation on the same tissue. A radiation weighting factor was used to equate the biological impact of various types of radiation [22]. LET (linear energy transmission) radiations that produce dense ionization tracks cause more biologic damage per unit dose than low LET radiations and have higher radiation weighting factors [23]. The equivalent dose is the product of the absorbed dose (D) and the radiation weighing factor. The International Commission on Radiological Protection is assigned tissue weighing factors which change the effective dose as the tissue type changes [24]. Since there is some risk of cancer even with no occupational exposure, the risk does not start at null. The slope of the line practically means that a person which receives 5 rems per year faces 10 times the risk of a person who is receiving 0.5 rems per year. Radiation exposure does not in itself result in harm. However, because of the liner, no threshold model, more exposure means more risk, and no radiation dose is so small that it will not have some effects [25]. The LNT hypothesis emphasizes the stochastic nature of ionizing radioactive material DNA damage. However, it should be found that low radiation often activates the body's defense and adaptive reactions when high dose radiation is near it. Among these reactions are antioxidants, DNA repair, apoptosis of damaged cells, adaptive response in mutagenesis, and immune surveillance [26].

3. Methodology

The present work was conducted by using gamma spectroscopy to determine the radiation dose level of ionizing radiation. It done by taking the sample which source natural radioactive materials with compared radiation the amount of dose data recorded by gamma spectroscopy was an instrument preferable to detect the amount of dose in ionizing radiation. The data could analysis through quantitative vs. Qualitative analysis using high pure germanium device determined radiation dose level.

4. Result and Discussion

Absorbed dose and Annual effective equivalent dose of natural occurrence of radioactive material of the sample. The calculated value and average of gamma absorbed dose rate in air outdoors and annual effective dose at ^{238}U, ^{232}Th and ^{40}K compared with the permissible limit value, suggested by [17].

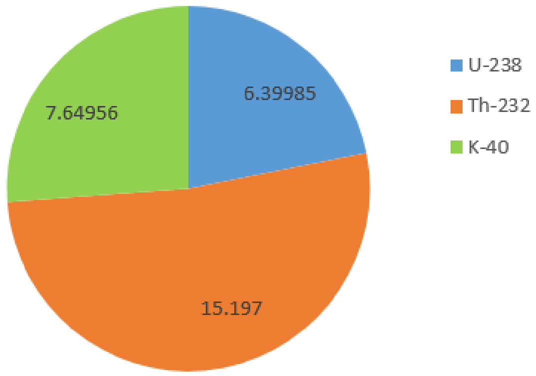

Figure 1. *The amount of γ dose within natural occurrence of radioactive materials.*

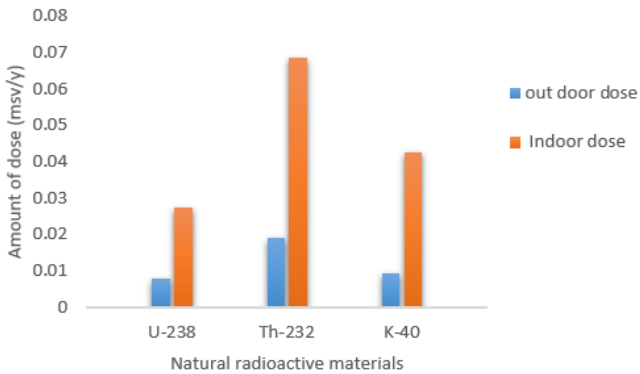

Figure 2. *The amount of dose in and out door vs. natural radioactive materials.*

When compared dose of the world average with the present dose rate in outdoor from ^{238}U, ^{232}Th and ^{40}K were varied. While it assessed the world average dose were larger radiation dose amount with that of the individual country perspective. It can be seen from figure 1 that the natural occurrence of radioactive materials ^{232}Th was the high γ dose of which cause the serious damage the radiation exposure. The same manner when being was compared out and indoor dose of nuclide. The natural radionuclide of 232Th also were largest amount of dose it tested in analysis of the data. This shows that most of people exposed in ionizing radiation in generals. The effect of radiation was depending on the energy of radiation, type of radioactive materials and the distance when being exposed to ionizing radiation. If the radiation dose was high amount then, it could serious consequence which damaged the whole body of the organ.

5. Conclusion

In this paper, we discussed the effect of radiation dose on the natural occurrence of radioactive materials. We calculated the indoor and outdoor radiation doses for a natural radionuclide. It saw that the gamma radiation dose of ^{238}U, ^{232}Th, ^{40}K was checked. We discovered that the radiation dose was proportional to the projectile particle of energy. It is possible that the amount of radiation dose sample determined using a gamma spectroscopy instrument was fit to analysis of the gathered data. The natural radionuclide of ^{232}Th also the largest amount of dose it tested in analysis of the data. In both cases, the smallest dose effect occurred with the radionuclide ^{238}U. It should also be noted that the basic principle of limiting radiation exposure may be to put it as low as practically possible, and can be achieved in general by using optimal techniques, equipment, and procedures best practices. The nature of the rays, the body part exposed to radiation, and the dose received all contribute to determining the hard risk posed by ionizing radiation to cells. The effect of ionizing radiation was studied. More study is needed to raise issues about radiation levels while people are in the area of a hospital or a personal computer. A major concern was the extrapolation of biological effects observed at high doses and high dose rates to low doses and low dose rates of ionizing radiation typical of radiological protection settings. The dose level of radioactive materials varied from nuclide to nuclide. We suggested that radiation exposure affected people unless they protected them from various sources emitted radioactive materials.

Conflicts of Interest

The author declared no conflict interest by the other researchers.

Acknowledgements

I would like to express my deepest gratitude to my physics department staff's to support constrictive idea an encouragement to successfully throughout my work.

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