CORRELATION OF ACTIVITY CONCENTRATION OF NATURALLY OCCURRING RADIONUCLIDES IN SOME ENVIRONMENTAL MATRICES WITH PREVALENCE OF CANCER IN SOUTHWESTERN NIGERIA

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Abstract

The study obtained the distribution of cancer prevalence in some part of Southwestern Nigeria, determined the activity concentration and radiological parameters of naturally occurring gamma emitters in some environmental matrices from the selected area in the region, established an association between cancer prevalence and radiological parameters and correlated the reported cancer prevalence with other variables such as occupation and age of patients. This was with a view to correlating cancer prevalence with the geographical distribution of patients'.

The available data of cancer prevalence between 2010 - 2014 was obtained from the Ife-Ijesha Cancer Registry. Geo - spatial technique was employed to identify geographical areas with varying registry reported prevalence of cancer in South West Nigeria. Five Local Government areas (Ondo West, Ondo East, Idanre, Akure South, and Ifedore) with different cancer prevalence were selected. Five soil and water samples were collected from each of the selected Local Government and taken to the laboratory for evaluation of gamma radioactivity using a CsI detector. Furthermore, a survey meter was used at each sample collection point to determine *in situ* gamma dose rate in air.

The results showed that the entire five class- intervals with varying prevalence of cancer were represented in Ondo State. The activity concentration of ^{40}K ranged from 86.68 ± 2.89 to 561.92 ± 18.56 Bq/Kg, ^{238}U were 20.26 ± 2.09 to 344.34 ± 35.44 Bq/Kg and ^{232}Th ranged from 3.29 ± 0.56 to 83.4 ± 14.21 Bq/Kg in soil. The activity concentration of ^{40}K ranged from 6.62 ± 1.93 to 58.98 ± 5.76 Bq/L with a mean of 28.53 ± 3.65 Bq/L, ^{238}U were 9.66 ± 2.33 to 19.40 ± 3.30 Bq/L and ^{232}Th were 0.36 ± 0.13 to 0.59 ± 0.16 Bq/L in water. There was a positive linear correlation value between K-40 in soil and water and cancer prevalence. Also, positive linear

correlation was recorded between U-283 in water and cancer prevalence. Others radionuclides show a negative correlation with cancer prevalence. The result showed that all radiological parameters in water except for the external hazard index showed a strong positive correlation (value) with cancer prevalence. Furthermore, noting that two LGAs with wide disparity in cancer prevalence (Ondo West n = 53 and Ondo East, n = 4). The activity concentrations of all three families of radioactivity were found to be higher in Ondo West which has the higher cancer prevalence. The p-levels of the differences were respectively for K-40 (p = 0.025), U-238 (p = 0.066), and Th-232 (p = 0.081) in soil; and K-40 (p = 0.30), U-238 (p = 0.23), and Th-232 (p = 0.17) in water. Nature of cancer was correlated with other variables as occupation and age of registry reported patients; their p-values were 0.5123 and 0.3592 respectively. This result shows a negative and weak relationship between ages, occupation of cancer patients and reported cancer incidences.

The study concluded that there was a significant association between radioactivity in water and cancer prevalence in Southwestern Nigeria.

Keywords: Radioactivity / Radionuclides / Environmental Matrices / Cancer

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CHAPTER ONE

GENERAL INTRODUCTION

1.1 Background to the study

Our world is radioactive and has been since it was created. Over 60 radionuclides (radioactive elements) can be found in nature, and they can be primordial (formed before the creation of the Earth), cosmogenic (formed as a result of cosmic ray interactions) or anthropogenic (enhanced or formed due to human actions). Radionuclides are found naturally in air, water, soil and in human being. Every day, we ingest and inhale radionuclides from air, food, soil and water. Natural radioactivity is common in the rocks and soil that makes up our planet, in water and oceans, and in our building materials and homes (Merril *et al*., 1997). There is nowhere on earth that is free from natural radioactivity, but its occurrences and concentrations varies depending primarily on geological and geographical conditions of an area (UNSCEAR, 2000).

There is a great interest in the study of natural radioactivity in environmental matrices because of its effects on man. It has been noted that radiation emitted due to the decay of these radionuclides constitutes a source of health hazard and it is capable of causing various types of diseases, especially cancer, ranging from mild effects to chronic effects (Avwiri, 2005; Clomo *et al*., 1994 and Horton, 1984). Background radiation levels are from a combination of terrestrial (from the ^{40}K, ^{232}Th, ^{226}Ra, etc.) and cosmic radiation (photons, muons, etc.). The level is fairly constant over the world and areas with high background radiation had been reported to have high cancer prevalence especially when it is high compare to the threshold limit (Hendry *et al*., 2009).

1.2 History of Cancer in Nigeria

Cancer involves a pathological breakdown in the processes which control cell proliferation, differentiation and death of particular cells. Cancer is a major disease burden worldwide but there are marked geographical difference in prevalence overall. From the world cancer report edited by Bernard *et al*., (2003) approximately 10 million people are diagnosed with cancer annually and more than 6 million die of the disease every year; currently over 22 million people in the world are cancer patients. In Nigeria it has assumed prominence as a major cause of mortality in the last few decades (Farai *et al*., 2006). Cancer is a reportable disease in every country in the world. Having data to help us understand the burden is the first important step for effective cancer control planning.

In Nigeria is required that every reported case of cancer or other malignant diseases be processed and reported to the cancer registry. Cancer Registry data are used for public health planning and assessment as well as for research. The Cancer Registry plays an important role in research to identify the causes of cancer. Researchers often use Registry data to determine whether groups of people with particular exposures, such as those who work in a particular occupation or those who live in a particular area, are more likely to develop cancer than people who do not have these exposures. Cancer registration schemes are central to research into the nature and causation of cancer, to the planning of health service resources and cancer control programmes, and to the assessment of their effectiveness. Cancer registration is thus a part of the modern health information system (Jensen *et al*., 1991). There are two major types of cancer registries; Hospital-based registries and Population-based registries. In regions where population based cancer registries are not in existence, Hospital Based Cancer Registry is useful for research. Compilation of cancer rate in the hospital- based Cancer Registries allows the