The Correlation between Radiation in Indian Rice and Cholesterol Levels of Diabetic Mellitus Type II

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ABSTRACT

In this research, specific activity of uranium-238 (^{238}U), thourium-232 (^{232}Th), and potsium-40 (^{40}K) in ten samples of rice that importuned from India in Iraqi markets. Specific activity was measured using NaI(Tl) detector. Also, internal hazard index (H_{in}) in all samples was calculated. The results of specific activity in the samples of the present study were ranged from 8.47 to 18.09 for ^{238}U, from 3.65 to 19.72 for ^{232}Th, and from 152.44 to 548.19 for ^{40}K. It was found that all values of ^{238}U and ^{232}Th were below the global limit by UNSCEAR 2008, while the values of only some samples of ^{40}K were higher than of global limit by UNSCEAR 2008. The results have been shown no significant and no correlation ($P>0.05$) between H_{in} and cholesterol as well as HDL, and LDL in patients (males and females). But, according to H_{in} due to natural radioactivity in all Indian rice samples in Iraqi markets is safe.

Keyword: Radionuclide, gamma ray, NaI(Tl), rice, Cholesterol, Diabetic Mellitus Type II

INTRODUCTION

There are two basic groups which it is natural radioactivity depending on their origin's Terrestrial radionuclides, such as ^{238}U and ^{232}Th, have a natural chain and are non-sequenced, unlike ^{40}K, and human-made elements such as ^{137}Cs, are the two sources of radioactive elements found in soil. Natural radioactivity has a half-life of more than a hundred million years [1]. The presence of (NORM) in the environment is known to cause human exposure to high amounts of radiation. Many different types of nuclear radiation are released during various radiation processes, each with its own characteristics such as mass, charge, and capacity to permeate media and materials. The types of nuclear radiation are alpha, beta, and gamma. Gamma rays are also a type of electromagnetic wave. The wavelength of gamma radiation is short, with corresponding energy ranging from 0.1 to 10 MeV [2]. The energy changes associated with the re-arrangement of the particles in the nucleus after the discharge of an alpha or beta particle produce gamma radiation. After this emission, the nucleus generated can be in a high-energy or excited state and release this excess energy before returning to the ground state; it emitted this energy as a gamma photon. Gamma rays are thus a type of nuclear spectrum, linked to the degree of nuclear energy without any change in the nucleus atomic number's mass [3]. Photoelectric

phenomena, Compton scattering, and Pair creation are the three basic processes by which gamma rays interact with matter. The radionuclides were found in the water and food, as well as the earth's crust, such as rocks, mineral ores, and soil [1]. Due to the action of fertilizers on soil, the activity concentration of naturally radioactive elements (radionuclides) in soil and plants is higher in agricultural areas than in uncultivated areas [4]. Radiation effects, on the other hand, can reach soil and water via plants. As a result, tainted plants are devoured by cattle and cows, who are then consumed by humans via the food chain [5]. Food consumption is the primary source of radioactive element exposure in humans, resulting in internal radiation doses [6]. External and internal radiation exposure in humans is mostly caused by naturally occurring radioisotopes [7]. Radiation hazard from natural radioactivity concentration of different samples of Indian rice that a viables in Iraqi markets. Rice was assessed effect of the cholesterol on the patient of Diabetic Mellitus Type II. Indian rice was chosen because it is commonly found in Iraqi markets as well as commonly used Iraqi Kitchens, and it may contain natural radiation form soil, water, air, and chemical fertilizers. Therefore, the aim of this work is to evaluate specific activity levels of ^{238}U, ^{232}Th, and ^{40}K in different samples of Indian rice in Iraqi Markets using NaI (Tl) detector. Also, internal hazard index due to gamma emitters in all samples on the present study are being calculated. As well as, study the relation between specific activity levels of ^{238}U, ^{232}Th, and ^{40}K with cholesterol level in diabetic mellitus type II patients.

1. MATERIAL AND METHOD

1.1.Collection and Preparation of the Samples

This study includes Eight samples Indian rice which it was collected from Iraqi markets from 1/10/2022 to 1/11/2022. The company name of Indian rice samples in the present study were Gold, Basmati, Abu Araba, Royal, Afah, Mahmoud, Alsaqer, and Mino Gold. Rice samples were put in a plastic bag that collected from locally markets and then labeled with their names. Next, samples were preparate to measure natural radioactivity by several step [5-8] such as, cleaned, dried, crushed, sieved, weighted, put in the marinelli beakers, and stored at least for1 month to examine secular equilibrium between ^{226}Ra and ^{222}Rn. The study was conducted on randomly selected 40 type 2 diabetic patients (males and females) at age about 50 years. Diabetes Mellitus was diagnosed by consultant doctors.

1.2. Test Technical

The scintillation detector NaI(Tl) of (3"×3") crystal dimension was used in this study. Spectrum data were found by NaI(Tl) system and analyzed by Maestro-32 software that instantly transferred to the laboratory's PC. Energy of calibration and efficiency for NaI(Tl) detector were done using stander of gamma ray standard source (Model RSS–8). The standard sources are ^{137}Cs, ^{60}Co, and ^{152}Eu. Specific activity at gamma ray emery for ^{238}U, ^{232}Th, and ^{40}K were determined according to secular equilibrium for ^{214}Bi (1765 keV), ^{208}Ti (2614 keV), and ^{40}Ar (1460 keV), respectively [9,10]. Lipid profile tests such as Total Cholesterol, HDL, and LDL for blood samples were CBC technical in Al-Sadr Teaching Hospital (Najaf)

2.3. Theoretical Equitation

The specific activity (A) and Internal hazard index (H_{in}) that depended on many parameters such as neat of area under peak (N), weight of sample (m), efficiency of NaI(Tl) detector (ε), gamma emotion probability (I_γ), and time count (t) were estimated using to the equation [11-13]:

$$A\left(\frac{Bq}{kg}\right) = \frac{N}{t \times \varepsilon \times I_\gamma \times m} \qquad (1)$$

$$H_{in} = \frac{A_U}{185} + \frac{A_{Th}}{259} + \frac{A_K}{4810} \qquad (2)$$

2. RESULT AND DISCUSSION

Table (1) shows the results of specific activities for natural radionuclides (^{238}U, ^{232}Th and ^{40}K) and internal hazard index in Indian samples of rice in Iraqi markets. From Table (1), the specific activity ^{238}U were ranged from 8.47 Bq/kg in Abu Araba samples to 18.09 Bq/kg in Alsaqer samples, with an average value of 13.72±1.19 Bq/kg. While from Table (1), the specific activity ^{232}Th were ranged from 3.65 Bq/kg in Abu Araba samples to 19.72Bq/kg in Mino Gold samples, with an average value of 9.87±1.72 Bq/kg. From Table (1), the specific activity ^{40}K were ranged from 152.44 Bq/kg in gold samples to 548.19 Bq/kg in Mahmoud samples, with an average value of 375.11±58.62 Bq/kg. From Table (1), it is found the values of H_{in} was ranged from low value 0.099 in Abu Araba sample to high value 0.260 in Alsaqer sample, with an average value of 0.190±0.023. The compaction of the average values of specific activity between ^{238}U, ^{232}Th, and ^{40}K in the samples of the present study were shown in Table (1). It is noted that, the potassium-40 is larger than the quantity of uranium-238, thorium-232. Those of nature original primarily due to the extensive use of fertilizers is survey shown that the application of agricultural.

Table (1): Results of natural radionuclide in rice samples in present study

Sample name	Specific activity (Bq/kg)			H_{in}
	Uranium-238	Thourium-232	Potsium-40	
Gold	9.51	5.49	152.44	0.104
Basmati	13.58	10.26	417.19	0.200
Abu Araba	8.47	3.65	186.49	0.099
Royal	11.76	4.98	162.51	0.117
Afah	17.47	10.61	515.54	0.243
Mahmoud	16.72	11.44	548.19	0.249
Alsaqer	18.09	12.78	542.09	0.260
Mino Gold	14.17	19.72	476.42	0.252
Average±S.E	13.72±1.19	9.87±1.72	375.11±58.62	0.190±0.023

UNSCEAR (2008) recommended standard indicate that the world's average (global limit) specific activity of ^{238}U, ^{232}Th, and ^{40}K are 33 Bq/kg, 45 Bq/kg, and 420 Bq/kg, respectively [14]. From the results in Table (1) and Figure 1, it was found that all values of ^{238}U and ^{232}Th the specific activities were less than the worlds average activity that recommended by UNSCEAR 2008 that the specific activities. While, the specific activities of ^{40}K in four samples such as Afah, Mahmoud, Alsaqer, and Mino Gold were higher than the worldwide average (420 Bq/kg). These because increasing used chemical fertilizers by peasants. Moreover, the data values of H_{in} in all of Indian samples were less than 1 [15].

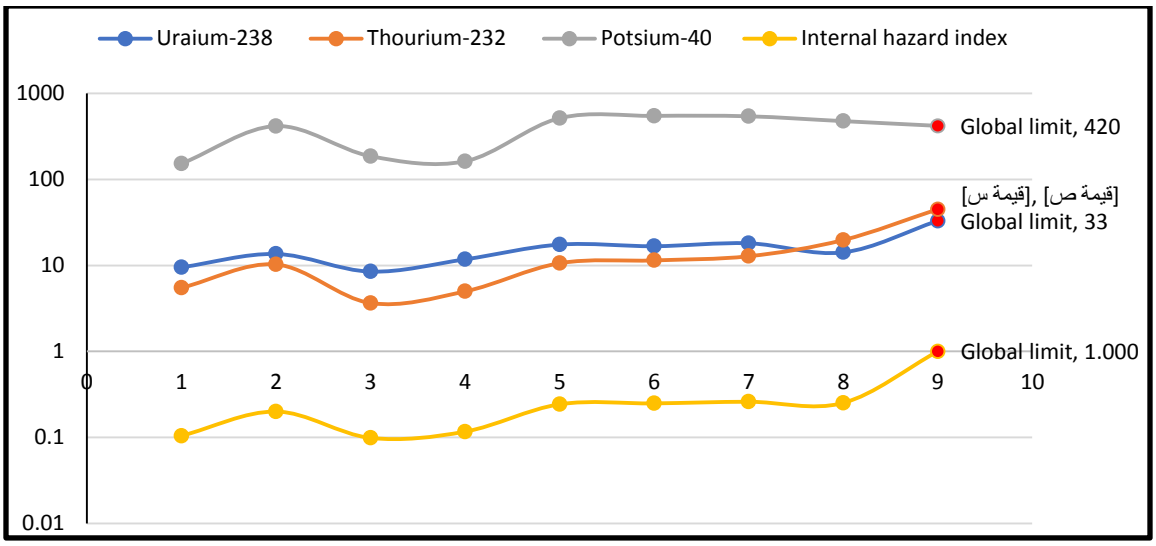

Figure (1): Comparing the results of ^{238}U, ^{232}Th, and ^{40}K as well as H_{in} in Indian of rice samples with global limit.

Table (2) shows the results of Lipid profile (Total Cholesterol, HDL, and LDL) for blood samples of male and female that eat of Indian rice samples in Iraqi markets. From Table (2), the average values of Total Cholesterol, HDL, and LDL in male samples were 175.12±10.78 mg/dl, 49.5±3.93 mg/dl, and 104.25±6.37 mg/dl, respectively. While, the average values of Total Cholesterol, HDL, and LDL in female samples were 141.37±13.71 mg/dl, 41.87 ±4.72 mg/dl, and 98.25±6.67 mg/dl, respectively. Figure (2) shows the compared of the results of Lipid profile (Total Cholesterol, HDL, and LDL) for blood samples of between male and female which it is shown all results of the Lipid profile for male are higher than the Lipid profile for female.

Table (2) Results of Lipid profile for human samples in the present study.

Sample code	Male			Female		
	Total Cholesterol(mg/dl)	HDL (mg/dl)	LDL (mg/dl)	Total Cholesterol(mg/dl)	HDL (mg/dl)	LDL (mg/dl)
1	189	40	111	102	34	88
2	201	56	85	190	42	115
3	177	33	98	205	55	93
4	180	58	122	156	38	77
5	98	44	124	83	62	129
6	172	39	78	122	40	75
7	188	61	89	133	15	119
8	196	65	127	140	49	90
Average±S.E	175.12±10.78	49.5±3.93	104.25±6.37	141.37±13.71	41.87 ±4.72	98.25±6.67

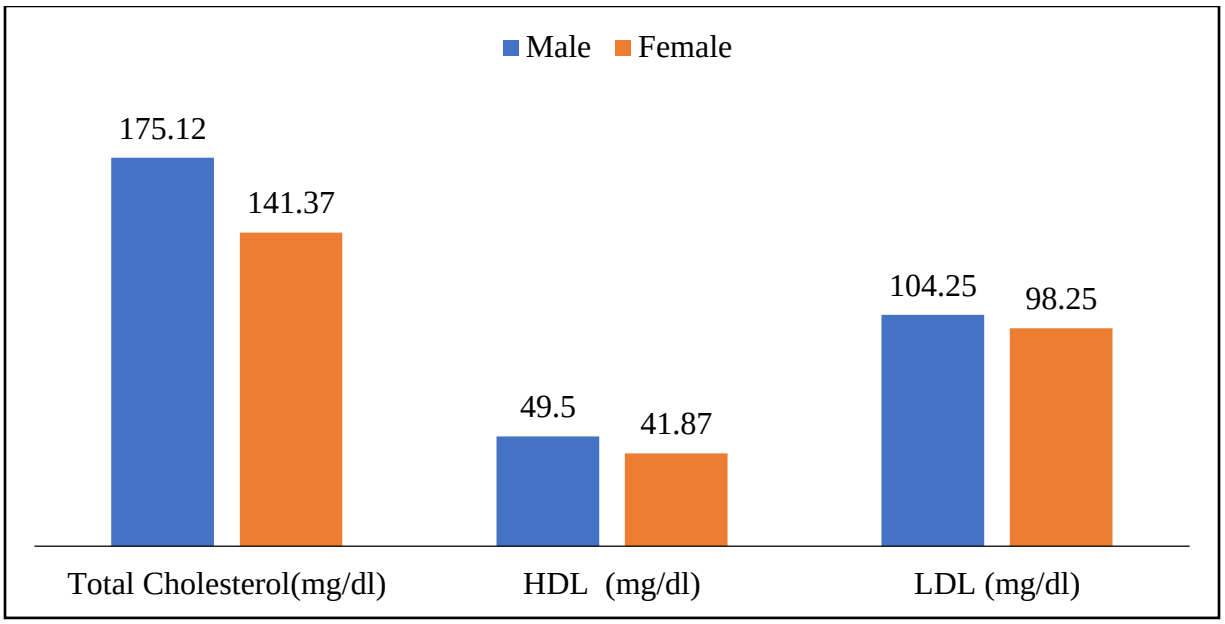

Figure (2): Comparing the results of Lipid profile between male and female in the present study.

Statistically using T-test, the correlation value as well as p-value between Internal hazard index (H_{in}) and the lipid profile (Total Cholesterol, HDL, and LDL) are obtained in Figures (3), (4), and (5), respectively. From Figure (3), it is found a weak correlation and no significant ($p > 0.05$) values between Hin and Total Cholesterol for male and female. Also, from Figures (4) and (5) it is found a weak correlation and no significant ($p > 0.05$) values between Hin with HDL, and LDL for male and female, respectively. Therefore, the results of internal hazard index due to radiation for gamma emitters such as uranium-238, thourium-232, and potasium-40 have been shown no significant and no correlation ($P>0.05$) with Lipid profile (Total Cholesterol, HDL, and LDL) for male and female that used Indian rice as food. Moreover, the data values of H_{in} in all of Indian samples were safe.

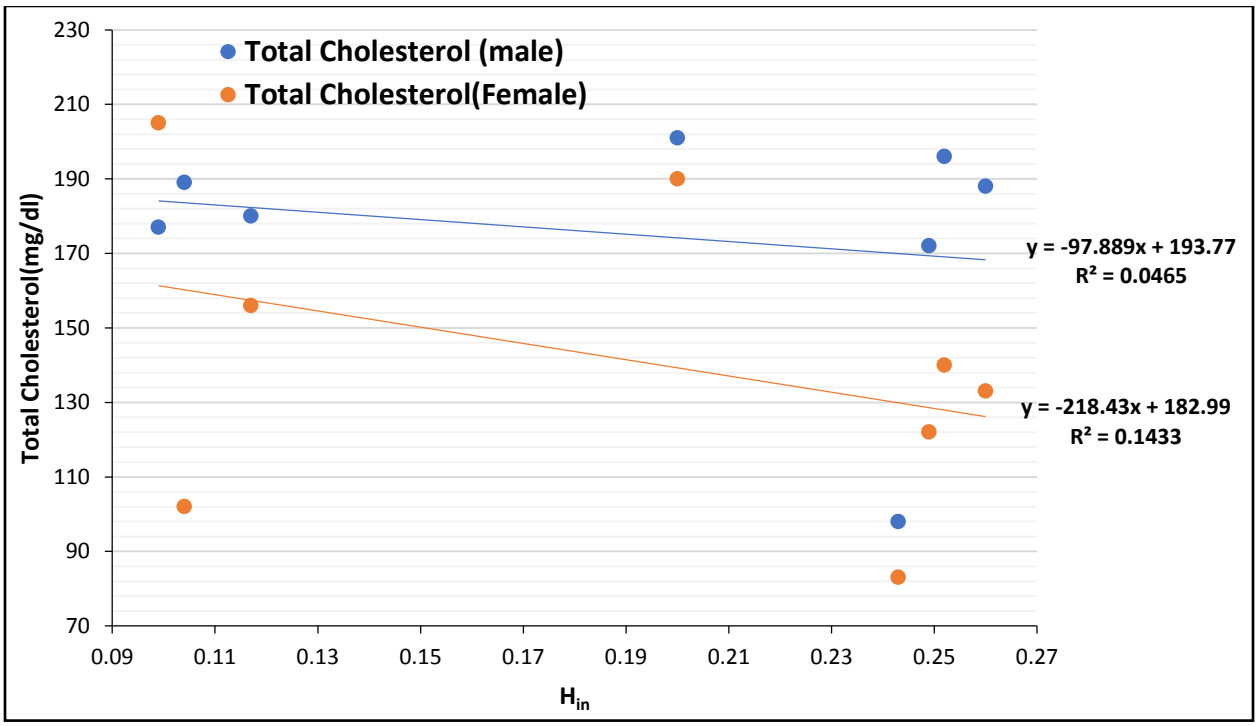

Figure (3): Correlation between H_{in} and Total Cholesterol.

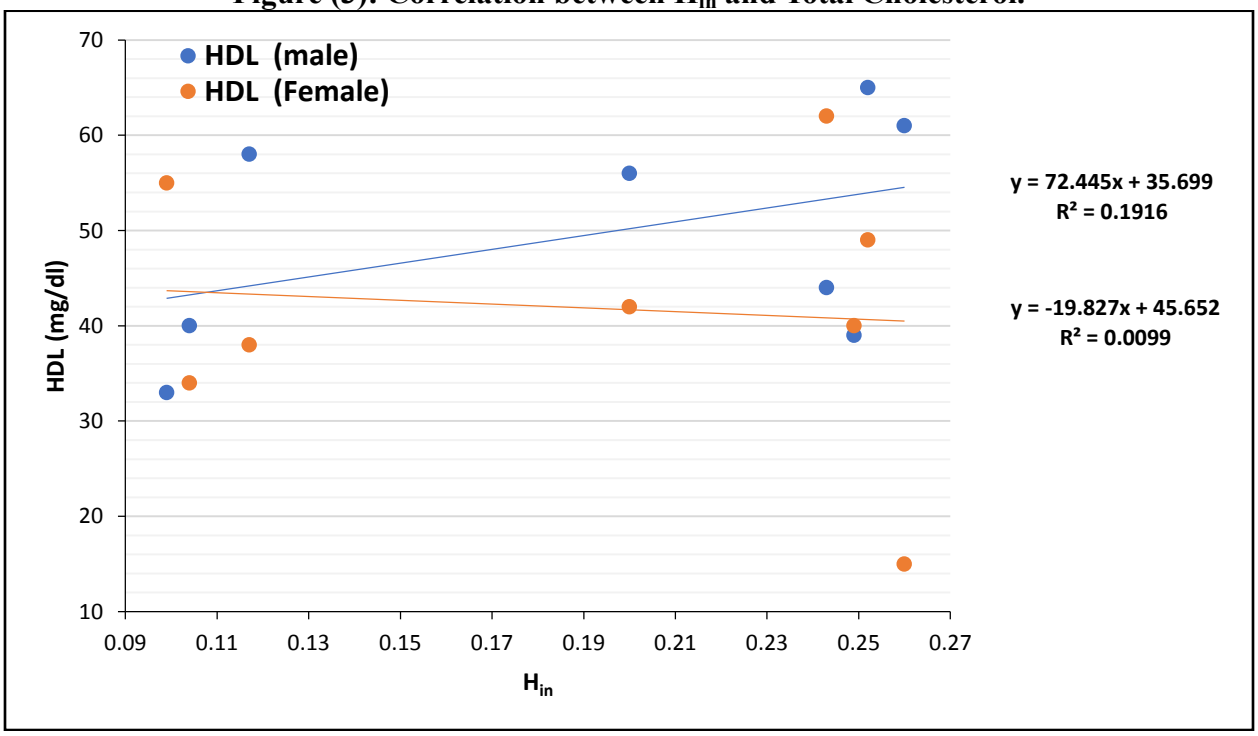

Figure (4): Correlation between H_{in} and HDL.

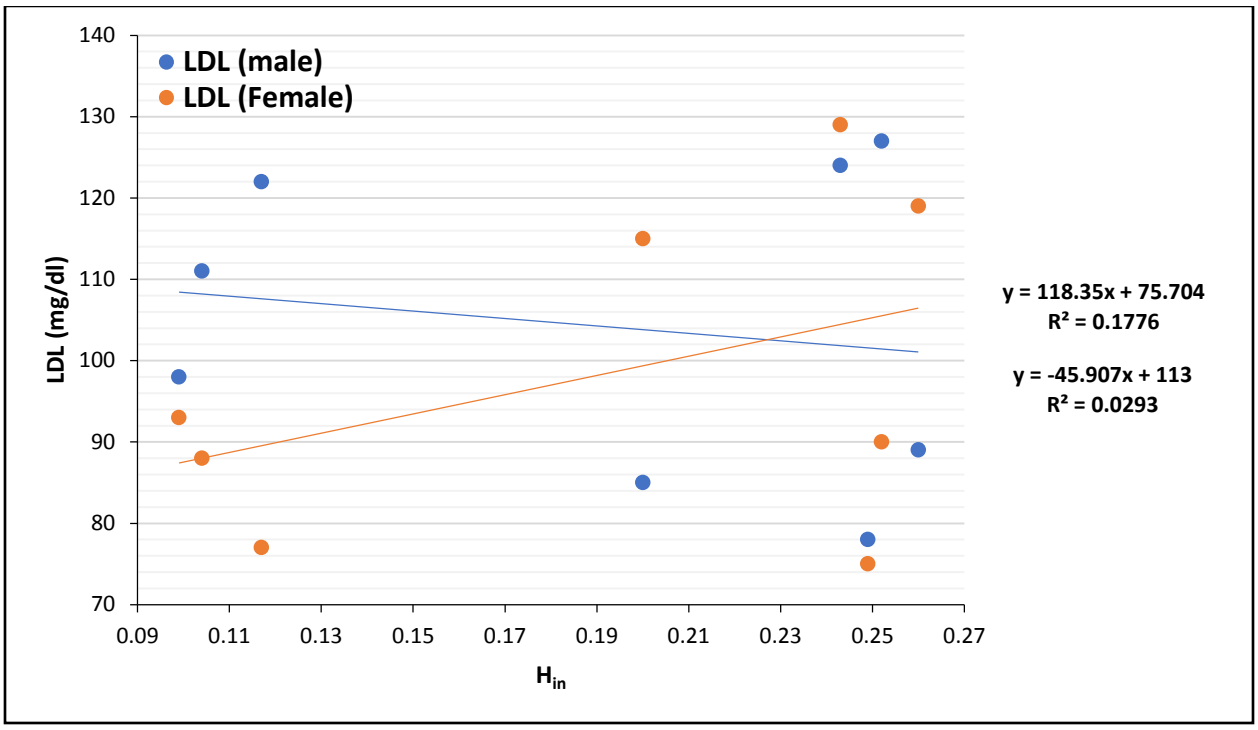

Figure (5): Correlation between H_{in} and LDL.

3. CONCLUSIONS

The results of the specific activity of ^{238}U and ^{232}Th in all samples of Indian of rice for studied were found within worldwide according to UNSEAR 2008, while some samples were the values of the specific activity of ^{40}K larger than worldwide according to UNSEAR 2008. The results of internal hazard index due to ^{238}U, ^{232}Th, and ^{40}K were within the acceptance of the permissible limit according to UNSEAR 2008. Also, it is concluded that there is no significant and no correlation (P>0.05) between Hin and Lipid profile (Total Cholesterol, HDL, and LDL) for male and female that used Indian rice as food. Therefore, as a result, it the internal hazard index in the all Indian of rice samples do not result in medical changes in the internal radiation dose and safe.

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