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ASSESSMENT THE NORMS FOR AGRICULTURAL SOILS IN GHAMMAS TOWN, IRAQ

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Abstract

The study of radioactive nuclei concentrations in agricultural soils is a very important topic due to the contribution of fertilizers in increasing these concentrations. Where the nucleus transition to food and then the human and endanger his life. In this study, 24 samples of agricultural soils were taken from the Ghammas region, and a gamma-ray spectrometer system connected with the NaI detector was used to measure the specific activity of the ^{226}Ra, ^{232}Th and ^{40}K nuclei, the specific activity values were varied from (5.87-26.16) Bq/kg with mean (15.780 Bq/kg) for ^{226}Ra, (3.21-13.12) Bq/kg with average (8.596 Bq/kg) for ^{232}Th and (253.6-532.6) Bq/kg with mean (393.012 Bq/kg) for ^{40}K, respectively. Specific activity values showed that there was only a significant increase in ^{40}K concentrations in the Ghammas region, other than uranium and thorium concentrations. External and internal hazard indices, outdoor and indoor absorbed doses and Radium equivalent activity are also calculated, and Their values were less than the permissible limits except for one of the values of the indoor absorbed dose was higher than the permissible limit. Potash fertilizers used in agricultural activities played an important role in increasing indoor absorbed dose values.

Key words : NORMs, agricultural soil, Gamma spectroscopy, Ghammas, Iraq.

Introduction

U-238, Th-232 and K-40 are three long-lived natural radionuclides present in the earth's crust. In general, there are two sources of environmental, natural radionuclides (mainly from the ^{238}U series, ^{232}Th) and artificial sources (^{137}Cs). These radionuclides can be released into the environment as a result of human activities, including energy production and military operations such as nuclear weapons testing or nuclear accidents (Chernobyl disaster in 1986 and Fukushima earthquake in 2011) (Tawalbeh *et al.*, 2013).

It is important to study the distribution, properties of radionuclides and their effect on the environment. Uranium, thorium, and decay products are radionuclides that pose a potential risk to human health due to the emission of ionizing radiation (Hamidalddin, 2014). It is very important to measure natural radioactivity in rocks and soil to determine and control the amount of natural background activity change with time to protect the environment (Najam *et al.*, 2011).

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The level of radiation is not the same in different parts of the world and depends on the concentration of radionuclides in the earth's crust. Natural concentrations of radionuclides in the soil are usually associated with the radionuclide concentration in the substratum. The concentrations of radionuclides (ultra microelement) in plants are linearly linked to the concentration of radionuclides in soil (Efremova and Izosimova, 2012).

Natural background levels of the agro-ecosystem can be increased if phosphoric fertilizers are applied. The concentrations of Naturally Occurring Radioactive Materials (NORMs) in phosphorus fertilizers can be similar to the mean concentrations in soil or ten times higher. The production, transport, storage and use of these fertilizers cause an additional dose of exposure to humans. It is, therefore, necessary to limit values (NORMs) concentrations in fertilizers (Jibiri *et al.*, 2007).

Terrestrial isotopes, thorium, uranium, and potassium enter the human body through the food chain, mostly by eating (Jibiri *et al.*, 2007). Plants absorb these radionuclides through their roots and accumulate in eaten parts of plants. When these plants are processed and consumed, the accumulating radionuclides produce an internal radiation dose for humans (Jibiri and Ajao, 2005).

There is a plentiful study on the effect of radionuclides in soil under laboratory conditions (Garg *et al.*, 1996; Hussain and Alzhraa, 2017; Kalra *et al.*, 1997; Mishra and Shukla, 1986; Sikka and Kansal, 1994; Sinha and Gupta, 2005). Since the soil is contaminated with radionuclides and heavy metals, there is a proclivity for crops to absorb the toxic material and ultimately transport them to the human body. In addition, the low quality and productivity of crops caused by contaminated foods, grains and vegetables will ultimately affect human health (Zainal *et al.*, 2016).

The aim of this study is to measure thenatural radioactivity contents, radium equivalent activity, external and internal radiation hazard indices in the surface agricultural soils of Ghammas town. In this town, themanufacturer fertilizers (Potassium, compound, and ammonium nitrate Fertilizer) contain phosphates were used to cultivate and increase the fertility of the soil. The data provided in this study will be baseline data for natural radioactivity in soil and may be useful for studies in this field.

Analytical technique

Study area

The study area is located in the southeastern part of the city of Diwaniyah between longitudes $44^{o}32^{1}$ - $44^{o}42^{1}$ east and between the latitude $31^{o}35^{1}$ -$31^{o}48^{1}$ North, which bounded by the district of Shamia from its northern edges while the province of Najaf is in the west. And the district of Al-Hamzah from the eastern and southern sides of the administrative borders of Shinafiyah. It has a population of about 140,000. The Ghammas region is part of the Sedimentary Plain, a flat land that inclines slowly from the south-east to the north-west. Its southern sections are 20 m above sea level and 17 m in its northern sections, while the rise in its central sections is 17-18 m above sea level. This area is famous for agriculture, especially Rice and Date crops.

Rice is cultivated in the Ghammas area in the summer season and the best date is from mid-May to the end of June, depending on the type of rice and climatic conditions prevailing. Urea fertilizer is used in the study area of 70 kg/dunam. Compound fertilizer is used by 56 kg/dunam. In addition to the use of potash fertilizer at the rate of 24 kg/dunam, knowing that when adding chemical fertilizers should be mixed with soil and at a depth of 10 cm to increase its effectiveness and reduce the loss during the washing and evaporation, but after farming consider the need to maintain two layers of water not less than 7 cm. Avoid field drainage for fear of loss of fertilizers. Organic fertilizer is also used in the study area (1 dunam=2500 m^2) (Razak and Muheisen, 2016).

Sample Collection and Measuring Methods

Agricultural soil samples were collected from twenty-four different sites and randomly from various agricultural lands located within the administrative boundaries of Ghammas. These samples cover an area of approximately 35.72 square kilometers as shown in fig. 1.

The Global Positioning System (GPS) was used to locate the sampling points as shown in Table1, which shows the locations of samples coordinate for latitude and longitude,

In addition, the collection of samples was carried out in (May 2017) and prior to the planting date, to ensure that the fertilizer used was dissolved in the soil by irrigation and watering.

1 kg of soil samples were taken by manually using a small shovel from 5-10 cm depth and kept in plastic bags

Fig. 1: A map showing the locations of sampling for Ghammas town.

Table 1: Samples coordinate for latitude and longitude.

No.	Sample cod	Geographical Coordinates	
		Latitude	Longitude
1	S1	N 31° 45' 03.452"	E 44° 33' 47.147"
2	S2	N 31° 44' 06.588"	E 44° 33' 36.790"
3	S3	N 31° 43' 21.279"	E 44° 33' 39.311"
4	S4	N 31° 43' 08.032"	E 44° 34' 19.529"
5	S5	N 31° 43' 38.520"	E 44° 34' 51.716"
6	S6	N 31° 43' 04.300"	E 44° 35' 41.488"
7	S7	N 31° 43' 04.721"	E 44° 36' 30.358"
8	S8	N 31° 43' 05.719"	E 44° 37' 16.113"
9	S9	N 31° 43' 32.108"	E 44° 36' 25.698"
10	S10	N 31° 44' 04.696"	E 44° 37' 14.024"
11	S11	N 31° 44' 45.374"	E 44° 37' 24.246"
12	S12	N 31° 45' 11.229"	E 44° 36' 34.943"
13	S13	N 31° 45' 49.377"	E 44° 37' 19.289"
14	S14	N 31° 45' 58.939"	E 44° 36' 33.509"
15	S15	N 31° 45' 44.858"	E 44° 35' 36.925"
16	S16	N 31° 45' 50.743"	E 44° 34' 44.347"
17	S17	N 31° 45' 51.899"	E 44° 33' 42.500"
18	S18	N 31° 45' 15.748"	E 44° 34' 30.210"
19	S19	N 31° 44' 55.148"	E 44° 35' 28.967"
20	S20	N 31° 44' 48.001"	E 44° 36' 09.655"
21	S21	N 31° 44' 39.803"	E 44° 34' 27.219"
22	S22	N 31° 44' 20.778"	E 44° 35' 08.055"
23	S23	N 31° 44' 03.855"	E 44° 35' 35.296"
24	S24	N 31° 43' 47.982"	E 44° 34' 18.715"

and transferred to the laboratory of the physics department of the Faculty of Science, University of Kufa.

The samples were prepared for measurement after removal of impurities such as rocks, roots of plants and leaves, and then dried with air and using the oven at 80° C until the moisture was completely removed and fixed weight.

Dried samples were grinding and passed through a 250 mesh sieve. Then, the samples were packed into (1-liter) polyethylene Marinelli beaker and sealed tightly. In order to reach the state of the secular equilibrium between the radium (^{226}Ra and ^{228}Ra) nuclei and their daughters, the samples were stored for two months. Agriculture soil samples were analyzed to measure the radioactivity of natural radioactive nucleiby using aþ Ortec-digi BASE gamma-ray spectrometer based on the 3" × "3 NaI detector with 6.8% energy resolution at 662 keV for ^{137}Cs. The Scinti Vision^{TM}-32 software was installed in the computer for data analysis, and the energy and efficiency of the system were calibrated. The measurement time was (28,800 second). An empty Marinelli was used in the same time period above to measure the average background radiation. The values of energies 1460 keV for ^{40}K, 1764 keV for ^{214}Bi and 2614 keV for ^{208}Tl were adopted to measure the radioactivity for the ^{40}K, ^{226}Ra and ^{232}Th nuclei respectively.

Calculations

For each individual isotope, the specific activity in Bq/kg units was calculated by using the equation (1) (Hussain and Hussain, 2011).

$$A_n = \frac{(C_n - C_b)}{t\varepsilon_\gamma l_\gamma m_s} \quad (1)$$

where A_n is the specific activity of each radionuclide in Bq/kg, C_n the count rate in cps for a sample, C_b the count rate in cps for background, ε_γ and l_γ are detection efficiency and emission probability of γ-ray, t is the counting time and m_s is the mass of the sample in kg.

The distribution of ^{40}K, ^{226}Ra and ^{232}Th nuclei in rocks and soil are not uniform, so a common factor was used to compare its combined radiological effects. This factor is called the Radium equivalent activity (Ra_{eq}). As proposed by the Organization of Economic Cooperation and Development (Ahmad *et al.*, 2015; OECD, 1979), the permissible Radium equivalent activity values for safe use should be less than 370 Bq/kg. Equation (2) was used to calculate the radium equivalent activity () (Beretka and Matthew, 1985).

$$Ra_{eq} = A_{Ra} + 1.43\ A_{Th} + 0.077A_k \quad (2)$$

Where, A_{Ra} and are the specific activity of ^{226}Ra, ^{232}Th and ^{40}K respectively.

The external (H_{ex}) and A_{Th} internal (H_{in}) hazard indices were calculated using Equations (3) and (4)(Beretka and Matthew, 1985).

$$H_{ex} = \frac{A_{Ra}}{370} + \frac{A_{Th}}{259} + \frac{A_K}{4818} \quad (3)$$

$$H_{in} = \frac{A_{Ra}}{185} + \frac{A_{Th}}{259} + \frac{A_K}{4818} \quad (4)$$

If the calculated values of indices are greater than unity, Radioactivity may cause harm to the population.

Equation (5) was used to calculate the outdoor dose (D_{out}) (UNSCEAR, 2000), and the average value is 51 nGy/h as recommended by the UNSCEAR (2000) report.

$$D_{out} = 0.462A_{Ra} + 0.64A_{Th} + 0.0417A_K \quad (5)$$

While the indoor absorbed dose rate for agricultural soil samples was calculated by using equation (6) (Beretka and Matthew, 1985).

$$D_{in} = 0.92A_{Ra} + 1.1A_{Th} + A_K \quad (6)$$

Table 2: The specific activity of ^{226}Ra, ^{232}Th,and ^{40}K and their ratios in agricultural soil samples collected from Ghammas.

Sample code	Specific Activity (Bq/kg)			Ratios		
	^{226}Ra	^{232}Th	^{40}K	Ra/K	Th/K	Th/Ra
S1	22.12±0.92	06.41±0.29	405.9±4.13	0.054	0.016	0.290
S2	12.93±0.61	06.45±0.29	397.2±4.09	0.033	0.016	0.499
S3	24.01±0.95	03.85±0.28	381.1±3.75	0.063	0.010	0.160
S4	11.01±0.55	03.21±0.20	380.3±3.72	0.029	0.008	0.292
S5	14.25±0.68	03.79±0.22	402.4±4.12	0.035	0.009	0.266
S6	15.43±0.71	09.81±0.35	395.5±4.08	0.039	0.025	0.636
S7	25.03±0.98	09.85±0.35	375.4±3.69	0.067	0.026	0.394
S8	21.02±0.88	08.25±0.32	370.8±3.67	0.057	0.022	0.392
S9	13.45±0.62	10.25±0.36	521.6±4.81	0.026	0.020	0.762
S10	15.24±0.70	13.12±0.41	423.0±4.19	0.036	0.031	0.861
S11	16.89±0.79	08.76±0.33	490.8±4.55	0.034	0.018	0.519
S12	26.16±1.01	11.98±0.39	430.3±4.21	0.061	0.028	0.458
S13	14.09±0.66	11.03±0.37	442.2±4.42	0.032	0.025	0.783
S14	19.56±0.86	11.56±0.38	352.0±3.56	0.056	0.033	0.591
S15	17.63±0.81	09.35±0.34	532.6±4.99	0.033	0.018	0.530
S16	05.87±0.48	10.46±0.36	468.5±4.51	0.013	0.022	1.782
S17	11.72±0.58	11.07±0.37	477.8±4.53	0.025	0.023	0.945
S18	07.98±0.49	09.63±0.34	416.9±4.15	0.019	0.023	1.207
S19	10.03±0.51	07.59±0.31	318.1±3.36	0.032	0.024	0.757
S20	15.26±0.71	03.48±0.21	345.9±3.43	0.044	0.010	0.228
S21	11.16±0.56	07.06±0.30	295.7±3.32	0.038	0.024	0.633
S22	18.06±0.85	07.89±0.31	293.4±3.31	0.062	0.027	0.437
S23	14.79±0.69	12.28±0.40	253.6±2.95	0.058	0.048	0.830
S24	15.05±0.70	09.18±0.33	261.3±3.01	0.058	0.035	0.610
Max	26.16	13.12	532.6	0.067	0.048	1.782
Min	5.87	3.21	253.6	0.013	0.008	0.160
Mean	15.780	8.596	393.012	0.042	0.023	0.619
Median	15.145	9.265	396.35	0.036	0.023	0.561
Standard deviation	5.109	2.826	73.830	0.015	0.009	0.346

The recommended value of indoor absorbed dose rate is 70 nGy/h (UNSCEAR, 1988).

Results and Discussion

The specific activity values calculated for the 24 agricultural soil samples were listed in Table 2 in addition to their ratios.

From Table 2 we can see that the values of ^{226}Ra specific activity for the agricultural soil samples in this study ranged between the maximum and minimum values. The maximum value of a specific uranium activity was recorded in sample S12, which was (26.16 Bq/kg). The lowest value was recorded in sample S16, which was (5.87 Bq/kg). It should be noted that sample S16 is located in a region very close to a sub-river, which is constantly exposed to soil washing and discharging processes which lead to the escape of radionuclides with discharge water, which may explain the low activity value of this site.

As for the specific activity of ^{232}Th, the highest value was (13.12 Bq/kg) recorded in sample S10, while the lowest value was (3.21 Bq/kg) and recorded in sample S4. The mean, median and standard deviation values for the specific activity of ^{226}Ra are (15.780, 15.145 and 5.109) Bq/kg, while for ^{232} Thare (8.596, 9.265 and 2.826) Bq/kg, respectively. In this study, all specific activity values of agricultural soil samples measured for uranium and thorium nuclei were significantly lower than the worldwide average (33 Bq/kg for ^{226}Ra and 45 B/q for ^{232}Th) recommended by UNSCAER (UNSCEAR, 2000).

In general, the specific activity values of ^{226}Ra nucleus were greater than the specific activity values of ^{the} ^{232}Th nucleus, and this may be due to the fact that clay minerals have the ability to adsorb uranium rather than thorium (Syed, 1999).

The measurements of the specific activity of the ^{40}K nucleus varied between a maximum value of (532.6 Bq/kg) in sample S15 and a minimum value of (253.6 Bq/kg) in sample S23 with an average value of (393.012 Bq/kg), The median value and the standard deviation were (396.35 Bq/kg) and (73.830), respectively. Only eight samples out of twenty-four samples have specific activity values of ^{40}K higher than the worldwide average value (420 Bq/kg) recommended by the UNSCAER, other values, although below the worldwide average, are close to the worldwide average. The observed increase in the values of the specific activity of potassium in many agricultural soil samples is due to the periodic use of potash fertilizers in this region, especially that this region is famous for the cultivation of rice, wheat and barley constantly.

Figure 2 and 3 shows that the specific activity resulting from the decay of the uranium chain (^{226}Ra) is higher than the specific activity of the thorium chain

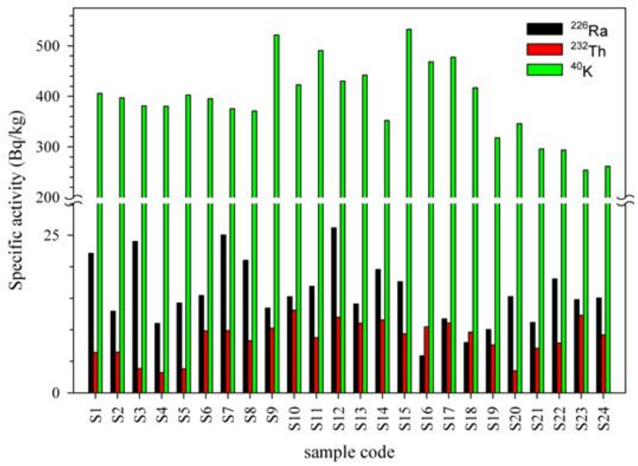

Fig. 2: The specific activity of natural radionuclides in Ghammas agricultural soils.

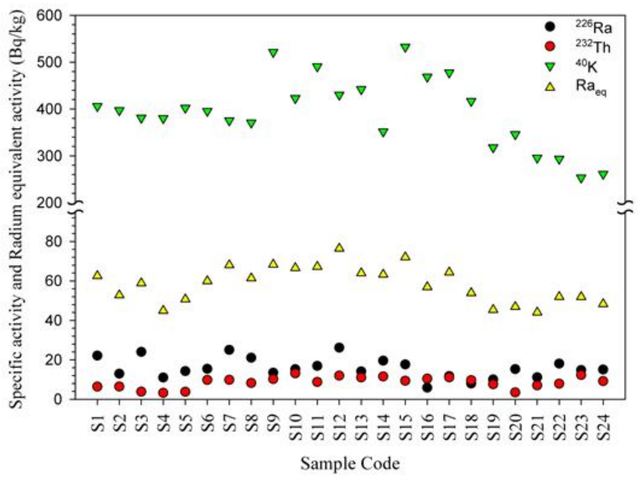

Fig. 3: Distribution of specific activity and radium equivalent activity in Ghammas agricultural soils.

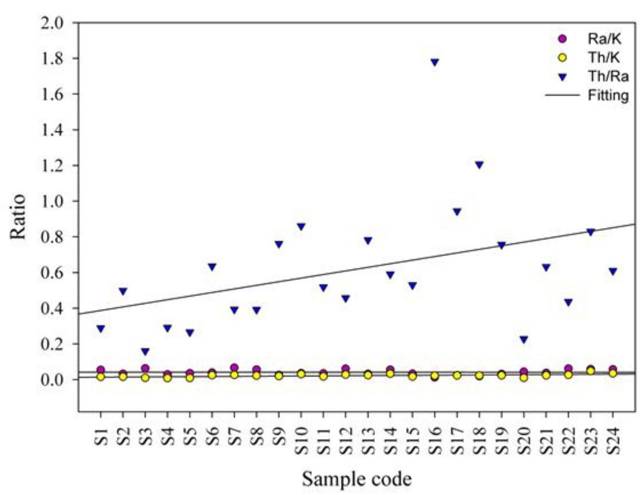

Fig. 4: Ratios of specific activities between radionuclide in Ghammas agricultural soils.

(^{232}Th), in general. We can also observe that the specific activity of potassium much higher than the specific activity values of ^{226}Ra and ^{232}Th. For the purpose of comparing

Table 3: Calculated values of hazard indices for agricultural soil samples collected from Ghammas.

Sample code	Ra_{eq} (Bq/kg)	H_{ex}	D_{out} (nGy/h)	H_{in}	D_{in} (nGy/h)
S1	62.5406	0.16892	31.01711	0.228703	59.8734
S2	52.7379	0.142427	26.4327	0.177373	50.7666
S3	58.8602	0.158988	29.30989	0.223879	56.8122
S4	44.8834	0.121215	22.88397	0.150972	44.0842
S5	50.6545	0.136806	25.65274	0.175319	49.471
S6	59.9118	0.161804	29.54625	0.203506	56.6266
S7	68.0213	0.183725	33.16744	0.251374	63.8946
S8	61.3691	0.165753	30.1566	0.222564	58.0774
S9	68.2707	0.184367	34.15562	0.220719	65.377
S10	66.5726	0.179787	32.60446	0.220977	62.2928
S11	67.2084	0.181508	33.56058	0.227157	64.4388
S12	76.4245	0.206417	37.26535	0.27712	71.6692
S13	63.9123	0.172601	31.61144	0.210683	60.4718
S14	63.1948	0.170679	30.69736	0.223544	58.8712
S15	72.0107	0.194477	36.00188	0.242125	69.1126
S16	56.9023	0.153652	28.56623	0.169517	54.3864
S17	64.3407	0.173752	32.02518	0.205427	61.1834
S18	53.8522	0.145423	26.88801	0.16699	51.2866
S19	45.3774	0.122546	22.48299	0.149654	43.0246
S20	46.8707	0.126592	23.57607	0.167835	45.5392
S21	44.0247	0.118897	21.75085	0.149059	41.6892
S22	51.9345	0.140272	25.34406	0.189083	48.7662
S23	51.8776	0.14011	24.82522	0.180083	47.4028
S24	48.2975	0.130444	23.39403	0.17112	44.848
Max	76.425	0.206	37.265	0.277	71.669
Min	44.025	0.119	21.751	0.149	41.689
Mean	58.335	0.158	28.872	0.200	55.415
Median	59.386	0.160	29.428	0.204	56.719
Standard deviation	9.025	0.024	4.406	0.0339	8.455

radionuclide concentrations in agricultural soils, the ratios were used to provide a clear idea of the relationship between these concentrations. The values of the ratios in Table 2 show that the concentrations of thorium are lower than the concentrations of uranium at a mean of (0.619), but, both less than the concentrations of potassium (0.023 and 0.042), respectively. Because of the significant increase in potassium concentrations, the ratio between concentrations of Th/K and Ra/K is almost equal in agricultural soils (as shown in Fig. 4).

Radium equivalent activity was also calculated for agricultural soil samples where the maximum and minimum values were (76.425 Bq/kg and 44.025 Bq/kg), respectively, with an average value of (58.335 Bq/kg) as shown in Table 3. All calculated values were less than

Table 4: Comparison of specific activity in agricultural soils samples measured in other countries of the world.

Country	Activity concentration Bq/kg			Reference
	^{226}Ra	^{232}Th	^{40}K	
Algeria	53.2	50.03	311	(Boukhenfouf and Boucenna, 2011)
Bangladesh, Manikganj	26	40	404	(Gaffar *et al.*, 2014)
Bangladesh, Savar	24	41	408	
Egypt	43	54	183	(Issa, 2013)
Egypt (S.V.U.)	11	15	582	(Nagwa, 2010)
Egypt (Q.G.)	15	22	705	
Greece	27	36	496	(Psichoudaki and Papaefthymiou, 2008)
India	57	87	143	(Singh *et al.*, 2005)
India	39	49	348	(Pulhani *et al.*, 2005)
India, Amritsar	54.45	78.31	301.80	(Mehra and Singh, 2011)
India, Bathinda	55.67	92.75	377.04	
Jordan	84	82	560	(Al-Jundi *et al.*, 2003)
Jordan, Northern	42.50	26.70	291.10	(Al-Hamarneh and Awadallah, 2009)
Malaysia	138.20	175.40	681.90	(Musa *et al.*, 2011)
Malaysia	80.63	116.87	200.66	(Ahmad *et al.*, 2015)
Nigeria, Kogi state	41.27	18.9	508.8	(Okeme *et al.*, 2016)
	9.81	11.95	633.5	
Pakistan	28	51	589	(Akhtar *et al.*, 2005b)
Pakistan	......	50.6-64	560.2-635.6	(Akhtar *et al.*, 2005a)
Pakistan	30	56	602	(Tufail *et al.*, 2006)
Saudi Arabia	75	23	2818	(Khater and Al-Sewaidan, 2008)
Saudi Arabia, Jeddah	44.87	54.59	2752.89	(Hamidalddin, 2014)
Saudi Arabia, Riyadh	14.50	11.20	225	(Alaamer, 2008)
South Yemen, Aden	48.01	58.11	624.27	(Harb *et al.*, 2015)
South Yemen, Aden	70.78	84.75	771.53	
Vietnam	42.77	59.84	411.93	(Huy *et al.*, 2012)
Vojvodina	39.04	53	554	(Bikit *et al.*, 2005)
Worldwide	33	45	420	(UNSCEAR, 2000)
Iraq, Ghammas	15.780	8.596	393.012	Present work

the permissible limit (370 Bq/kg) (UNSCEAR, 2000).

Table 3 shows the calculated values of external hazard index, outdoor absorbed dose, internal hazard index and indoor absorbed dose. The maximum values of these factors were (0.206), (37.265 nGy/h), (0.227) and (71.669 nGy/h) respectively. While the minimum values were (0.119), (21.751 nGy/h), (0.149) and (41.689 nGy/h) respectively. The calculated mean values were (0.158), (28.872 nGy/h), (0.200) and (55.415 nGy/h) respectively. Although there is a significant increase in the concentration of potassium in agricultural soils, the calculated values of internal and external hazard indices and their mean values were less than unity, similarly in mean and values of outdoor absorbed does where all values were below the permissible limit (51 nGy/h) (UNSCEAR, 2000).

As for the indoor absorbed dose, this relative increase in potassium concentration in agricultural soils contributed significantly to the increase in calculated indoor absorbed dose values. Which has resulted in exceeding one of the values of the permissible limit and the convergence of other values of it significantly.

The specific activity values calculated in this study for agricultural soil samples were compared with those measured in other countries (Table 4).

The specific activity values of ^{226}Ra and ^{232}Th which calculated in this study were very close to those measured in Egypt (S.V.U.), Egypt (Q.G.), Saudi Arabia, Riyadh and Nigeria, Kogi state, and less than the values measured in the other countries listed in Table 4.

The convergence in the specific activity values of ^{226}Ra and ^{232}Th between the current study and the three countries referred to is due to the geological structure that is similar between them because they are adjacent and close together. As well as the similarity of the prevailing climate. In addition, its agricultural activities are almost the same, leading to the use of the same fertilizer in agriculture, unlike other countries.

Whereas the average specific activity values of ^{40}K in this study were relatively higher than the sex regions (Algeria, Egypt, India, Jordan Northern, Malaysia and Saudi Arabia Riyadh) and less than the other regions listed in Table 4. The big variation in the specific activity values of ^{40}K in agricultural lands from one region to another, despite the similarity of the geological structure and climate in some countries, is largely due to the quantitative and qualitative multiplicity of potash fertilizers used in agricultural activities. Finally, the average specific activity value of ^{40}K in this study is slightly below the worldwide average value.

Conclusions

Agricultural soils in the Ghammas town has a significant increase in potassium concentrations due to the use of potash fertilizers in agricultural activities. As for uranium and thorium, their concentrations are low in this region compared with other countries in the world. This may be due to the large quantities of water that are used to wash and dispose of the land during the cultivation of rice. All values of hazard indices are less than the permissible limits, only one sample has the indoor absorbed dose greater than the permissible limit.

Replacing potash fertilizer with another fertilizer or using it less may reduce the values of potassium concentrations in agricultural soils, as well as the indoor absorbed dose values.

References

Ahmad, N., M. Jaafar and M. Alsaffar (2015). Natural radioactivity in virgin and agricultural soil and its environmental implications in Sungai Petani, Kedah, Malaysia. *Pollution,* **1:** 305-313.

Akhtar, N., M. Tufail and M. Ashraf (2005a). Natural environmental radioactivity and estimation of radiation exposure from saline soils. *International Journal of Environmental Science & Technology,* **1:** 279-285.

Akhtar, N., M. Tufail, M. Ashraf and M.M. Iqbal (2005b). Measurement of environmental radioactivity for estimation of radiation exposure from saline soil of Lahore, Pakistan. *Radiation measurements,* **39:** 11-14.

Al-Hamarneh, I. F. and M.I. Awadallah (2009). Soil radioactivity levels and radiation hazard assessment in the highlands of northern Jordan. *Radiation measurements,* **44:** 102-110.

Al-Jundi, J., B. Al-Bataina, Y. Abu-Rukah and H. Shehadeh (2003). Natural radioactivity concentrations in soil samples along the Amman Aqaba Highway, Jordan. *Radiation measurements,* **36:** 555-560.

Alaamer, A. (2008). Assessment of human exposures to natural sources of radiation in soil of Riyadh, Saudi Arabia. *Turkish Journal of Engineering and Environmental Sciences,* **32,** 229-234.

Beretka, J. and P. Matthew (1985). Natural radioactivity of Australian building materials, industrial wastes and by-products. *Health physics,* **48,** 87-95.

Bikit, I., J. Slivka, L. Èonkiæ, M. Krmar, M. Veskoviæ, N. Žikiæ-Todoroviæ, E. Varga, S. Æurèiæ and D. Mrdja (2005). Radioactivity of the soil in Vojvodina (northern province of Serbia and Montenegro). *Journal of environmental Radioactivity,* **78,** 11-19.

Boukhenfouf, W. and A. Boucenna (2011). The radioactivity measurements in soils and fertilizers using gamma spectrometry technique. *Journal of environmental Radioactivity,* **102,** 336-339.

Efremova, M. and A. Izosimova (2012). Contamination of Agricultural Soils with Radionuclides. In: *Ecosystem Health and Sustainable Agriculture*, C. Jakobsson, Ed, Uppsala University, Baltic University press, pp. 253-486.

Gaffar, S., M. Ferdous, A. Begum and S. Ullah (2014). Transfer of natural radionuclides from soil to plants in North Western parts of Dhaka. *Malaysian Journal of Soil Science,* **18,** 61-74.

Garg, R., G. Singh, N. Kalra, D. Das and S. Singh (1996). Effect of soil amendments on soil physical properties, root growth and grain yields of maize and wheat. *Asian Pacific J. Environ. Develop,* **3,** 54-59.

Hamidalddin, S.H. (2014). Determination of agriculture soil primordial radionuclide concentrations in Um Hablayn, north Jeddah west of Saudi Arabia. *Int J Curr Microbiol App Sci,* **3,** 623-633.

Harb, S., A. El-Kamel, E. Zahran, A. Abbady and F. Ahmed (2015). Assessment of Agriculture Soil Primordial Radionuclide Concentrations in Aden Governorate South Of Yemen Region. *Int. J. New. Hor. Phys,* **2,** 81-86.

Hussain, H. H. and W.S.A. Alzhraa (2017). Natural radioactivity levels of agricultural and virgin clay soil samples at al Najaf governorate. *American Journal of Research*, **3**-15.

Hussain, R.O. and H.H. Hussain (2011). Investigation the natural radioactivity in local and imported chemical fertilizers. *Brazilian Archives of Biology and Technology,* **54,** 777-782.

Huy, N. Q., P.D. Hien, T. Luyen, D. Hoang, H.T. Hiep, N.H. Quang, N.Q. Long, D.D. Nhan, N.T. Binh and P.S. Hai (2012). Natural radioactivity and external dose assessment of surface soils in Vietnam. *Radiation protection dosimetry,* **151,** 522-531.

Issa, S.A. (2013). Radiometric assessment of natural radioactivity levels of agricultural soil samples collected in Dakahlia, Egypt. *Radiation protection dosimetry,* **156,** 59-67.

Jibiri, N. and A. Ajao (2005). Natural activities of 40K, 238U and 232Th in elephant grass (Pennisetum purpureum) in Ibadan metropolis, Nigeria. *Journal of environmental Radioactivity,* **78,** 105-111.

Jibiri, N., I. Farai and S. Alausa (2007). Activity concentrations of 226 Ra, 228 Th, and 40 K in different food crops from a high background radiation area in Bitsichi, Jos Plateau, Nigeria. *Radiation and environmental biophysics,* **46,** 53-59.

Kalra, N., H. Joshi, A. Chaudhary, R. Choudhary and S. Sharma (1997). Impact of flyash incorporation in soil on germination of crops. *Bioresource Technology,* **61,** 39-41.

Khater, A.E. and H. Al-Sewaidan (2008). Radiation exposure due to agricultural uses of phosphate fertilizers. *Radiation measurements,* **43,** 1402-1407.

Mehra, R. and M. Singh (2011). Measurement of radioactivity of 238U, 226Ra, 232Th and 40K in soil of different geological origins in Northern India. *Journal of Environmental Protection,* **2,** 960.

Mishra, L. and K. Shukla (1986). Effects of fly ash deposition on growth, metabolism and dry matter production of maize and soybean. *Environmental Pollution Series A, Ecological and Biological,* **42,** 1-13.

Musa, M., Z. Hamzah and A. Saat (2011). Measurement of natural radionuclides in the soil of Highlands agricultural farmland. *Sustainable Energy & Environment (ISESEE), 2011 3rd International Symposium & Exhibition in*, pp. 172-176.

Nagwa. (2010). Radiation dose assessment due to local consumption of farm products in Qena governorate. In: *physics*, Vol. Ph.D, South Valley University, Egypt.

Najam, L., F. AL-Jomaily and E. AL-Farha (2011). Natural radioactivity levels of limestone rocks in northern Iraq using gamma spectroscopy and nuclear track detector. *Journal of radioanalytical and nuclear chemistry,* **289,** 709-715.

OECD. (1979). Exposure to radiation from the natural radioactivity in building materials: report. In: *Organisation for Economic Co-operation and Development*, OECD, Paris, France.

Okeme, I.C., I.V. Sule, N.N. Jibiri and H.O. Shittu (2016). Radioactivity concentrations in soil and transfer factors of radionuclides (40K, 226 Ra and 232Th) from soil to rice in Kogi state, Nigeria. *Archives of Applied Science Research,* **8,** 34-38.

Psichoudaki, M. and H. Papaefthymiou (2008). Natural radioactivity measurements in the city of Ptolemais (Northern Greece). *Journal of environmental Radioactivity,* **99,** 1011-1017.

Pulhani, V., S. Dafauti, A. Hegde, R. Sharma and U. Mishra (2005). Uptake and distribution of natural radioactivity in wheat plants from soil. *Journal of environmental Radioactivity,* **79,** 331-346.

Razak, S.A. and A.H. Muheisen (2016). Geographical analysis in the efficiency of rice agriculture in Khams. *Journal of Basic Education College for Educational and Humanities Sciences***,** 178-195.

Sikka, R. and B. Kansal (1994). Characterization of thermal power-plant fly ash for agronomic purposes and to identify pollution hazards. *Bioresource Technology,* **50,** 269-273.

Singh, S., A. Rani and R.K. Mahajan (2005). 226Ra, 232Th and 40K analysis in soil samples from some areas of Punjab and Himachal Pradesh, India using gamma ray spectrometry. *Radiation measurements,* **39,** 431-439.

Sinha, S. and A.K. Gupta (2005). Translocation of metals from fly ash amended soil in the plant of Sesbania cannabina L. Ritz: effect on antioxidants. *Chemosphere,* **61,** 1204-1214.

Syed, H. (1999). Comparison studies adsorption of thorium and uranium on pure clay minerals and local Malaysian soil sediments. *Journal of radioanalytical and nuclear chemistry,* **241,** 11-14.

Tawalbeh, A., S. Samat and M.S. Yasir (2013). Radionuclides level and its radiation hazard index in some drinks consumed in the central zone of Malaysia. *Sains Malaysiana,* **42,** 319-323.

Tufail, M., N. Akhtar and M. Waqas (2006). Measurement of terrestrial radiation for assessment of gamma dose from cultivated and barren saline soils of Faisalabad in Pakistan. *Radiation measurements,* **41,** 443-451.

UNSCEAR. (1988). Sources, effects and risks of ionizing radiation, United Nations Scientific Committee on the Effects of Atomic Radiation.

UNSCEAR. (2000). *Sources and effects of ionizing radiation: sources*. United Nations Publications, United Nations. Scientific Committee on the Effects of Atomic Radiation.

Zainal, F., Z. Hamzah, A. Saat, K. Wood and M. Alias (2016). Study on vertical distribution of radionuclides (40K, Th and U) in soil.