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Natural and Manmade Features of UV and Gamma Radiation in Gonabad, Iran

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Abstract: Recently, negative effects of UV and gamma radiation are one of the human concerns in each reign. Therefore, detection of UV and gamma threshold in different geographical areas, for possible radiation crises management in risk full reigns is necessary. Therefore, natural and manmade features effects on UV and gamma radiation was studied in Gonabad. In this sectional study, the effect of natural (latitude, longitude, height and climate conditions) and manmade (village, urban, road and others) features on UV and gamma radiations in Gonabad located in Khorasan Razavi, Iran were measured using an emanation method. Distance between each two stations was 5 Km. Results showed that the relationship between UV and gamma radiation with longitude was significantly negative. Also, the relationship between UV and gamma radiations with latitude was significantly negative ($p<0.001$) and no significant respectively ($p>0.001$). But climate condition (cloudy, semi cloudy and lightly) had significant ($p<0.001$) and no significant effect ($p>0.001$) on UV and gamma radiation, respectively. In addition, effects of natural and manmade features on UV and gamma radiations was significant ($p<0.001$) and no significant ($p>0.001$), respectively. At the end it was cleared that changes range of UV and gamma radiations was 0.464 ± 0.2798 W/m^2 and 0.1321 ± 0.01936 msv. The results shown that the average of UV and gamma radiation in Gonabad are more than international mean value reported by UNSCEAR-2000.

Key words: Ultra violet, gamma radiation, manmade features, natural features, gonabad

INTRODUCTION

Natural background radiation comes from three sources are cosmic radiation, terrestrial radiation and internal radiation (Khaki *et al.*, 2016; Abedinzadih and Parnianpour, 1980). The earth and all living things on it are always affected by radiation from space, similar to rain. Produced particles from the sun and stars interact with the earth's atmosphere and magnetic field to form a collection of radiation, typically beta and gamma radiation (Rostamzadeh *et al.*, 2016; Mortazavi *et al.*, 2013). The dose from cosmic radiation varies in different parts of the world due to differences in elevation and to the effects of the earth's magnetic field. Radioactive solid is also found throughout nature (Changizi *et al.*, 2013).

It is in the soil, water and vegetation. Low levels of uranium, thorium and their decay products are found everywhere. Some of these materials are eaten with food and water while others such as radon are exhaled. The dose from terrestrial sources also varies in different parts of the world. The main isotopes of concern for terrestrial radiation are uranium and the decay products of uranium such as thorium, radium and radon (Wang, 2002; Gransty and LaMarre, 2004; Singer, 2005; Shahbazi-Gahrouei *et al.*, 2013; Rakhsha *et al.*, 2015).

In addition to the cosmic and terrestrial sources, all people also have radioactive potassium-40, carbon-14, lead-210 and other isotopes inside their bodies from birth. The variation in dose from one person to another is not as great as the variation in dose from cosmic and terrestrial sources. The average annual dose to a person from internal radioactive material is about 40 millirems/year (Hutchison and Hutchison, 1997; Gonzalez and Anderer, 1989; Eisenbud, 1984; Kendall *et al.*, 2006).

Although, all people are exposed to natural sources of radiation, there are two distinct groups exposed to man-made radiation sources. These two groups are

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members of the public and occupationally exposed individuals A member of the public is defined in 10 CFR Part 20 as any individual except when that individual is receiving an occupational dose. Occupational dose is the dose received by an individual in the course of employment in which the individual's assigned duties involve exposure to radiation or to radioactive material.

This does not include the dose received from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive materials from voluntary participation in medical research programs or as a member of the public (Shrader-Frechette, 2007; Kane *et al*., 1996; Devgun and Devgun, 1992)

By far, the most significant source of man-made radiation exposure to the public is from medical procedures such as diagnostic X-rays, nuclear medicine and radiation therapy. Some of the major isotopes would be I-131, Tc-99m, Co-60, Ir-192, Cs-137 and others (Mohammed, 2007; Ali, 2015; Gupta, 2013). In addition, members of the public are exposed to radiation from consumer products, such as tobacco (thorium), building materials, combustible fuels (gas, coal, etc.), ophthalmic glass, televisions, luminous watches and dials (tritium), airport X-ray systems, smoke detectors (americium), road construction materials, electron tubes, fluorescent lamp starters, lantern mantles (thorium), etc (Spengler and Sexton, 1983).

Studies show that of the total dose of about 360 millirems/year, natural sources of radiation account for about 82% of all public exposure while man-made sources account for the remaining 18% (King, 2012; Jubin, 1979). In this field, other studies have been performed in countries such as Vietnam and Turkey. In Vietnam, the outdoor and indoor annual effective doses were higher than its world standard. The results showed that Vietnam soil which is being used as a building material is a radiation secure for the human population (Huy and Luyen, 2006).

In another study, the natural gamma radioactivity levels were estimated in the Samsun City in Turkey. The external hazard index exhibited the radiation hazard in Samsun (Gorur *et al*., 2011; Kucukomeroglu *et al*., 2012).

According to review article of s Shahbazi Gahrouei a study in Iran has been performed on natural radioactivity in buildings including materials, namely cement, gypsum, cement blocks, brick and gravel the survey results showed that cement specimens had maximum values of radioactivity (Shahbazi-Gahrouei *et al*., 2013; Shahbazi-Gahrouei, 2003a, b).

With respect to different variables such as latitude, topographic features, ground covers, cloudy days and urban and industrials centers, dispersion of UV radiation in different Iran provinces is very difference. Therefore, installing only measurement station of UV in Isfahan is not a suitable index for all cities in Iran. The purpose of the present work is to improve our understanding of the interaction of UV and Gama radiation with the natural and manmade resources in Gonabad City for protection of human health (Mosavi *et al*. 2011).

MATERIALS AND METHODS

Gonabad is located in Khorasan Razavi, Iran. At the 2011, census, its population was 36,367 in 10,389 families. The samples were collected in various points of city. Distance between sample points or stations was approximately, 5000 m. Totally, the number of samples were 1800. Amount of UV and gamma were measured using an emanation method by KUHNAST UV-365A UV-light meter and radioactivity meter RD1503 (both made by Germany), respectively. Sample stations were selected in places where were near resident places or human transportation. In this study effect latitude and longitude on amount radiation UV and gamma in Gonabad City was measured.

RESULTS AND DISCUSSION

The comparison of relationship between longitude with UV and gamma radiation in Gonabad City According to obtained results about the relationship between longitude with UV and gamma radiation in Gonabad city it was cleared that with increasing longitude, amount of UV and gamma radiation was increased ($p<0.001$) (Fig. 1).

The comparison of relationship between latitude with UV and gamma radiation in Gonabad City: Figure 2 shows that UV radiation has a reverse realationship with latitude ($p<0.001$) but increasing latitude had not any effect on gamma radiation ($p>0.001$).

Relationships between altitude and UV and gamma: Studying effect of altitude on UV and gamma showed that with increasing height amount of UV and gamma radiation was increased ($p<0.001$) (Fig. 3).

The effect of manmade features on amount of UV and gamma radiation in Gonabad City: Obtained results showed that in rural areas amount of UV radiation was

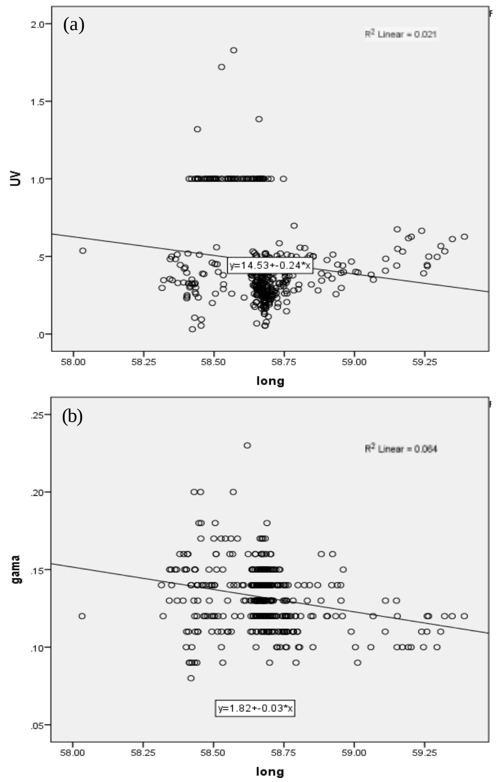

Fig. 1: The comparison of relationship between longitude with UV: a) and gamma b) radiation in Gonabad City

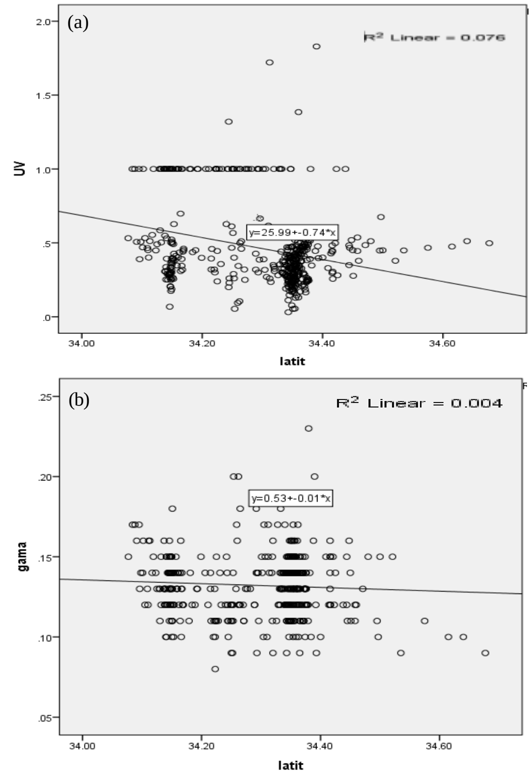

Fig. 2: The comparison of relationship between latitude with UV: a) and gamma b) radiation in Gonabad City

higher than other manmade features(pe$<$0.001). But about gamma radiation, manmade features hadn't any significant effect on this radiation(p$>$0.001).

The effect of weather conditions on amount of UV and gamma radiation in Gonabad City: According to Fig. 4 data it was cleared that cloudy condition had positive effect on increasing UV radiation ($p<0.001$) (Fig. 5).

But weather condition had not any significant effect on amount of gamma ($p>0.001$). In this study it was cleared that changes range of UV and gamma radiations was 0.464±0.2798 W/m^2 and 0.1321±0.01936 msv.

These results showed that average of UV and gamma was higher than standard. With respect to different variables such as latitude, topographic features, ground covers, cloudy days and urban and industrials centers, dispersion of UV radiation in different Iran provinces is very difference. With measurement of UV in Isfahan City was observed that during 2011 average of yearly UV index was detected 6 that was equal to its long time average. This decreasing in comparison of Tehran UV results was notable, because Isfahan latitude and longitude were lower and higher, respectively than Tehran. Satellite and ground data comparison shows that satellite data is 40% higher.

UV intensities are highest under cloudless skies. Cloudy sky usually reduce amount of UV radiation but light or thin clouds have a bit effect and may even enhance the UV amount. Hazy days mostly have higher water vapor; therefore UV scatter in the air increases and can result in a higher personal UV exposure (Wagner *et al*., 2002, 1998). These results are agreeing results of this study.

Sabziparvar and Labafi (1999) has studied the role of clouds and ozone on amount of UV. During this study he found that with formation of Astra cumulus clouds in 2-5 km, decreasing 5.9 Dobson and being longer path to reach the ground, amount of UV risk factors was decreased (Sabziparvar and Labafi). "The impact of clouds on radiation is highly variable: on overcast days with a snow free surface, erythema UV radiation at Dayosi s reduced to a level ranging between 8% (veryt hick cloud cover) and 70%(thin cloud layer) relativet o the radiation under clear-sky conditions" (Renaud *et al*., 2000). Results of this author were are disagree with our results. Because in our study, amount of UV radiation was increased in cloudy sky.

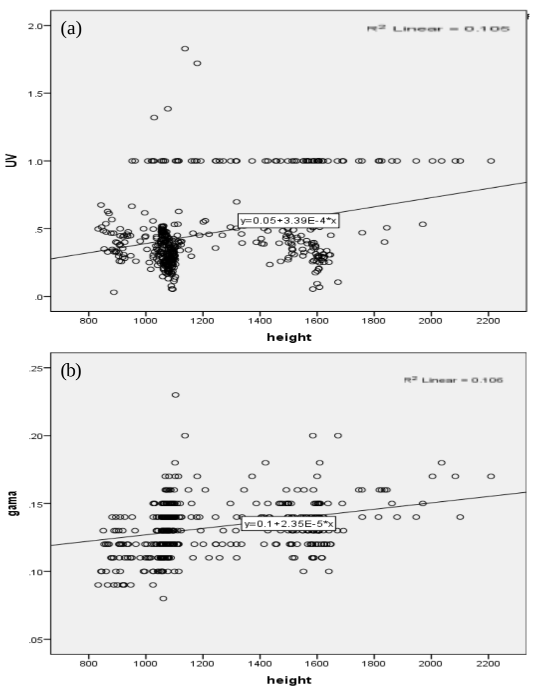

Fig. 3: The comparison of relationship between height with UV: a) and gamma and b) radiation in Gonabad City

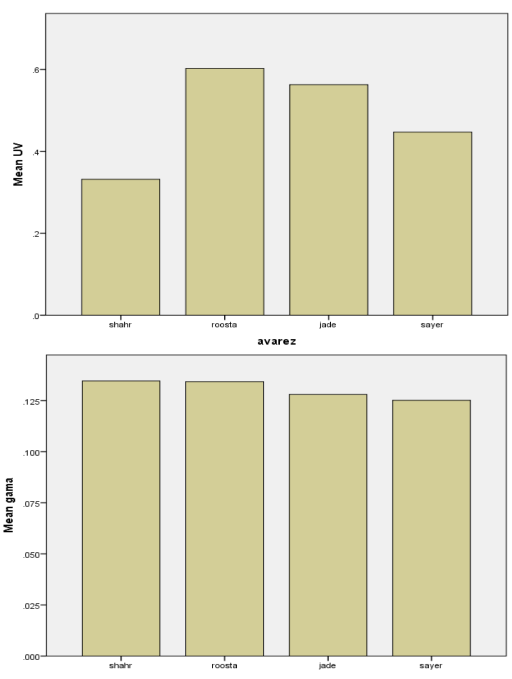

Fig. 4: The effect of manmade features (urban, village, road and others) on amount of UV and gamma radiation in Gonabad City

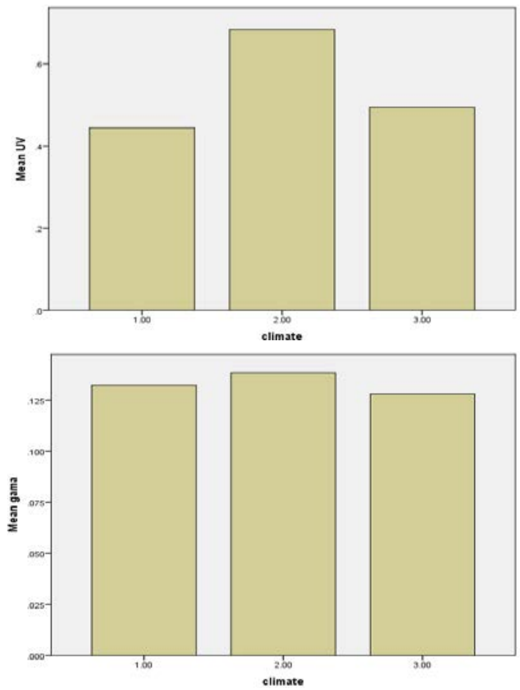

Fig. 5: The effect of weather conditions on amount of UV and gamma radiation in Gonabad City

According to previous studies, amount of gamma radiation is dependent on many factors (Wagner *et al*., 1998). Saghatchi study showed that "the mean value of dose rate and the annual effective dose due to background gamma radiation in different season in Zanjan were determined 126 nGy/h and 0.15 mSv, respectively. The minimum and maximum mean values of dose rate were found 120±21 and 134±18 nGy/h in summer and spring, respectively (Saghatchi *et al*., 2007). Totally these results confirm results of present study. According to results from this study it is necessary to research about analyzing quality and quantity of minerals in this city. This action is able to create a correct relationship between geographical features with UV and gamma radiation.

CONCLUSION

Obtained results from this study showed that natural and manmade features are mostly effective on UV and gamma radiations.

LIMITATIONS

One of the limitations of this studies was lack of study about indoor radiation, mine and building materials radiations. Therefore, in the future, more study in this field is necessary and to determine the total yearly effective dose of Gonabad residents, measuring the dose rate in indoor areas is necessary.

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