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Evaluating Radon Concentrations in Blood Samples from Various Districts in Basra Governorate

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ABSTRACT:
This study aimed to evaluate radon levels in blood samples collected from various districts in Basra Governorate, including the Almdinah District and Abu Al-Khasib District. The blood samples were carefully collected and preserved in specialized tubes to maintain their integrity. Radon activity in the blood samples was measured using the Rad7 device. The results revealed that males residing in Abu Al-Khasib District exhibited relatively higher radon levels compared to males in the Almdinah District. Additionally, smokers demonstrated higher radon levels compared to non-smokers. Women, on the other hand, generally displayed lower radon levels compared to men, as indicated in the provided table. Age was found to potentially play a minor role in the elevation of radon levels in the blood. These findings provide valuable insights into the distribution of radon levels in different districts and highlight the impact of smoking on radon exposure. It is important to note that further research is required to explore the underlying factors contributing to the observed variations in radon levels and to establish comprehensive strategies for radon exposure prevention and mitigation in the region.

Introduction

Radiation exposure, specifically from the radioactive gas radon and its decay products, is a significant environmental and public health concern. Radon gas, a radioactive noble gas, is naturally occurring and can seep into indoor environments from the Earth's crust, building materials, groundwater, and even natural gas. Prolonged exposure to elevated levels of radon has been associated with an increased risk of lung cancer, making it crucial to assess and monitor radon concentrations, particularly in regions where potential exposure is elevated. This study focuses on evaluating radon concentrations in blood samples collected from various districts in Basra Governorate [1]. Radon, as a radioactive gas, can find its way into the bloodstream through inhalation, potentially leading to adverse health effects. The assessment of radon levels in the blood provides valuable insights into the extent of exposure among the population and allows for a better understanding of the factors influencing radon concentrations. In this investigation, we aim to determine the quantity of radioactive activity in blood samples and explore how these concentrations may vary based on factors such as age, residence, and smoking habits. By collecting and analyzing blood samples from different districts within Basra Governorate, we seek to shed light on the regional disparities in radon exposure, if any, and assess whether certain demographic or lifestyle factors contribute to higher or lower radon levels in the bloodstream [2]. This research not only contributes to our understanding of radon exposure patterns in Basra Governorate but also has broader implications for public health and radiation safety practices. The findings can inform targeted mitigation strategies and raise awareness about the importance of monitoring indoor radon levels to reduce health risks associated with radon exposure. Through rigorous data collection and analysis, this study endeavors to provide valuable insights into the radon-related health risks faced by the population in Basra

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Governorate and the potential need for preventive measures and public health interventions [3]. The aim of the study titled "Evaluating Radon Concentrations in Blood Samples from Various Districts in Basra Governorate" is to investigate and analyze the levels of radon in the blood samples of individuals residing in different districts within Basra Governorate. The primary objectives of the study include:

Assessment of Radon Exposure: To determine the quantity of radioactive radon in the blood samples of individuals from various districts, providing insights into the extent of radon exposure in the region. Regional Variations: To identify and analyze potential regional variations in radon concentrations within Basra Governorate, shedding light on whether certain districts have higher or lower levels of radon exposure.

Demographic Factors: To explore how radon concentrations in blood samples may vary based on demographic factors such as age, gender, and smoking habits, allowing for a better understanding of the factors influencing radon exposure. Health Implications: To assess the potential health risks associated with radon exposure in the study area, particularly in districts with elevated radon levels, and to provide insights into any correlations between radon exposure and health outcomes [4-8]. Public Health Awareness: To raise awareness about the importance of monitoring indoor radon levels and the potential health risks associated with radon exposure, with the aim of informing public health practices and preventive measures. Policy and Mitigation Strategies: To inform policy decisions and mitigation strategies aimed at reducing radon exposure in the study area, if necessary, based on the findings and regional variations identified in the research. Ultimately, the study seeks to contribute valuable data and knowledge regarding radon exposure in Basra Governorate, enhance public awareness about radon-related health risks, and potentially influence policies and practices to mitigate these risks, thereby promoting the well-being and safety of the population in the region.

The study area for the research on evaluating radon concentrations in blood samples from various districts in Basra Governorate is Basra Governorate itself. Basra Governorate is located in the southern part of Iraq and is known for its diverse districts and regions. The study would likely encompass multiple districts within Basra Governorate, as mentioned in your initial statement. These districts may include, but are not limited to: Basra City District: The capital and largest city in the governorate, known for its urban environment and high population density.

Abu Al-Khasib District: A district known for its distinct features and characteristics, which may differ from the city center. Other Districts: Depending on the scope of the study, additional districts within Basra Governorate may be included to capture a representative sample of the population and assess regional variations in radon concentrations. Each of these districts may have unique characteristics, including population demographics, housing structures, and environmental conditions, which can influence radon exposure levels. By examining multiple districts within Basra Governorate, the study aims to provide a comprehensive assessment of radon exposure in this geographical area.

Methodology

1. Study Design:

Cross-Sectional Study: Collect data and blood samples from participants across different districts in Basra Governorate simultaneously.

2. Participant Selection:

Random Sampling: Randomly select participants from various age groups, genders, and smoking habits within each district.

Ensure Informed Consent: Obtain informed consent from all participants, explaining the study's purpose and procedures.

3. Data Collection:

Demographic Data: Gather demographic information, including age, gender, residential address, and smoking status, through interviews or questionnaires.

Blood Sample Collection: Collect blood samples from participants using standard phlebotomy procedures, ensuring proper storage and transportation.

4. Radon Concentration Measurement:

Laboratory Analysis: Analyze the collected blood samples in a well-equipped laboratory to determine

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radon concentrations using suitable techniques and equipment.

5. Data Analysis:

Statistical Analysis: Perform statistical analyses to:

Calculate radon concentration means, medians, and standard deviations.

Explore correlations between radon levels and demographic factors.

Compare radon levels across different districts.

Assess any significant differences in radon concentrations between smokers and non-smokers.

Use appropriate statistical tests (e.g., t-tests, ANOVA) and regression analysis as needed.

6. Health Outcome Assessment:

If applicable, assess any health outcomes or potential correlations with radon exposure based on available data or participant medical histories.

7. Reporting and Interpretation:

Present the findings in a clear and comprehensible manner, including tables, charts, and graphs.

Interpret the results, discussing the implications and significance of the radon concentrations in blood samples.

Material and Methods

Measuring radon gas levels inside blood samples using the RAD7 device involves a specialized procedure that typically requires laboratory equipment and expertise in radon detection. Here's an overview of the general steps involved:

1. Sample Collection:

Collect blood samples from participants using standard phlebotomy procedures.

Ensure proper handling, labeling, and storage of blood samples to prevent contamination.

2. Sample Preparation:

Transfer a portion of each blood sample into a suitable container, such as a vial or test tube, for radon analysis.

3. Radon Extraction:

Use a laboratory setup to extract radon gas from the blood samples. This process often involves the following steps:

Inject a known volume of the blood sample into a sealed vial or container.

Allow the radon gas within the sample to equilibrate with the headspace of the container.

Use a vacuum system or other method to extract the radon gas from the headspace of the container.

4. Radon Detection with RAD7:

Introduce the extracted radon gas into the RAD7 device.

The RAD7 device uses a solid-state alpha spectrometer to detect alpha particles emitted by radon and its decay products.

The device quantifies the radon concentration based on the alpha particle emissions and provides a readout in units such as becquerels per cubic meter (Bq/m^3).

5. Calibration and Quality Control:

Ensure that the RAD7 device is properly calibrated and validated for accurate measurements.

Implement quality control measures to verify the precision and reliability of the radon measurements.

6. Data Analysis:

Analyze the radon concentration data obtained from the RAD7 device for each blood sample.

Calculate the radon levels and record the results for further analysis.

7. Statistical Analysis:

Perform statistical analysis to interpret the data, identify trends, and draw conclusions.

Explore potential correlations between radon levels and demographic or exposure factors.

8. Reporting and Interpretation:

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Present the radon concentration results in a clear and comprehensible manner, along with any relevant statistical findings.

Interpret the results and discuss their implications for the study's objectives.

Please note that measuring radon in blood samples is a complex procedure that requires specialized laboratory equipment and trained personnel. It's crucial to follow established protocols, maintain quality control, and ensure the accuracy and reliability of the measurements. Collaborating with experts in radon analysis and laboratory techniques is recommended for conducting this type of research.

The RAD7 is a highly precise and versatile device that can be used for various purposes. It serves primarily for measuring radon gas in water, continuous monitoring of radon in the air, detecting inhaled radon and thoron gases, testing soil gas, and measuring emissions of radon and thoron gases from materials, surfaces, and shapes. The external appearance of the RAD7 detector, as illustrated in (3-2), is operated using four main keys. By selecting one of these keys, the device functions according to the type of test (Fig. 1) [9].

Figure 1 Rad 7 Device

Figure 2 shows measurements of radon gas in the blood samples using RAD 7.

Figure 2 Blood samples measured By RAD 7

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Results and Discussion

Table 1 shows radon gas concentration from different blood samples from Basrah city in Iraq. The high radon gas concentration found to be (106 Bq m^{-3}) in Site B1. Whereas the low radon gas concentration found to be (0 Bq m^{-3}) in Site B2, B3, and B9.

Table 1 Information about the details of the samples with radon concentration

Sc	Location	Sex	Smoking	Age	Rn (Bq m^{-3})
B1	Abu Al-Khasib	Male	Yes	32	**106**
B2	Abu Al-Khasib	Female	No	19	**0**
B3	Abu Al-Khasib	Male	No	13	**0**
B4	Abu Al-Khasib	Male	Yes	11	**106**
B5	Abu Al-Khasib	Female	No	20	**35.4**
B6	Abu Al-Khasib	Female	No	10	**35.4**
B7	Almdinah	Male	Yes	17	**35.4**
B8	Almdinah	Male	No	11	**70.8**
B9	Almdinah	Male	Yes	23	**0**
B10	Almdinah	Male	No	13	**35.4**

Figures 3-7 show the data for radon concentration in all blood samples for 10 sites in Basrah, Iraq.

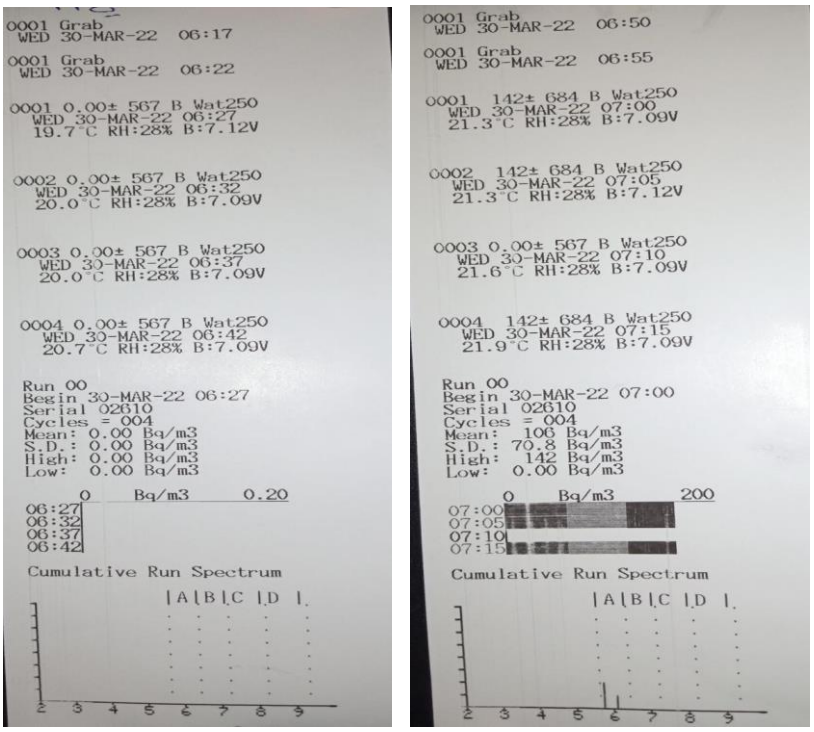

Figure 3 Cumulative run spectrum for sample B1 and B2

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Figure 4 Cumulative run spectrum for sample B3 and B4

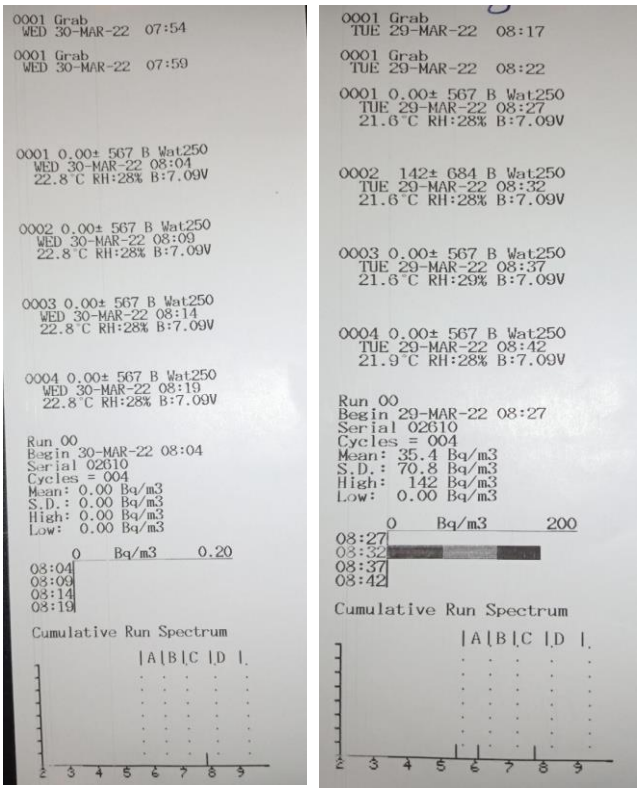

Figure 5 Cumulative run spectrum for sample B5 and B6

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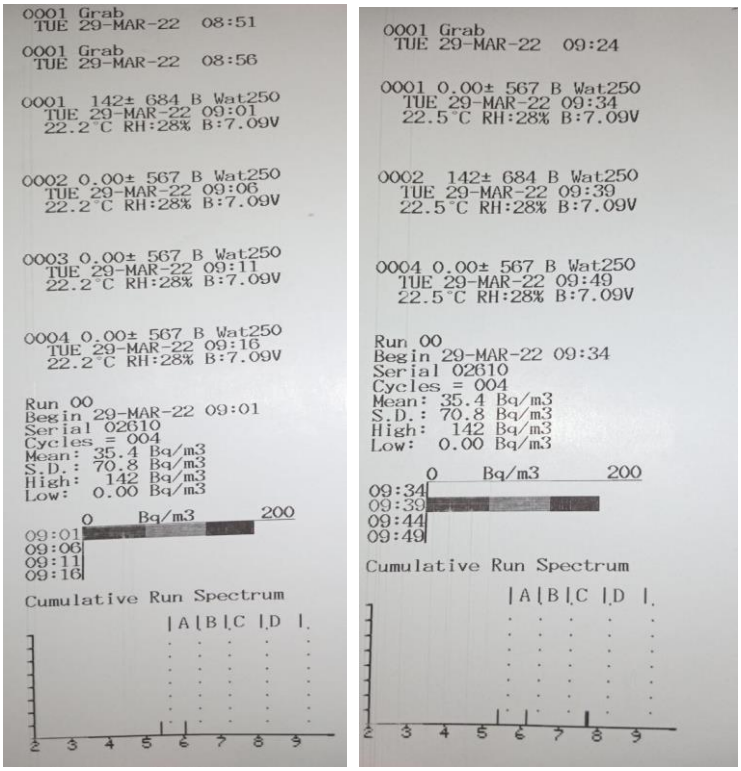

Figure 6 Cumulative run spectrum for sample B7 and B8

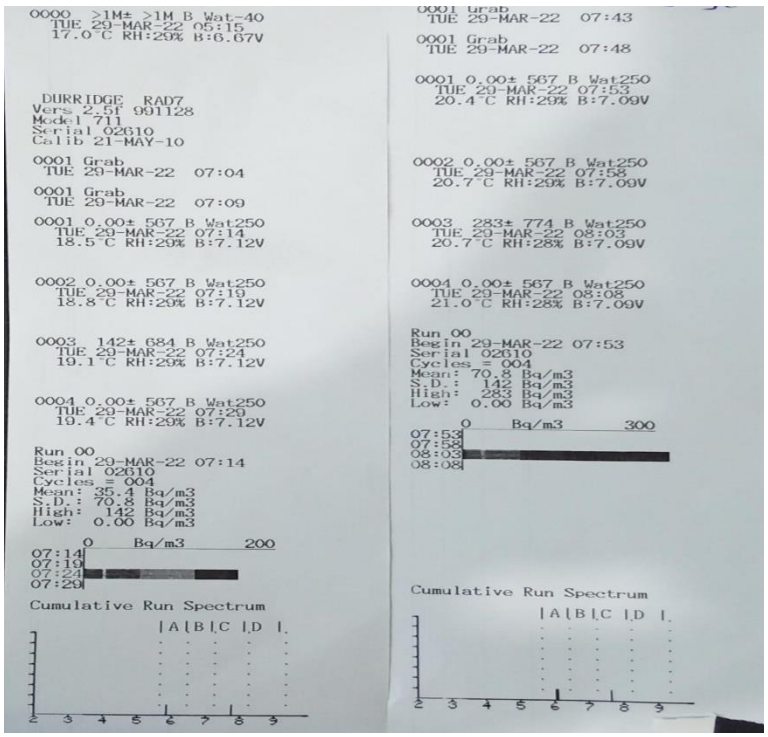

Figure 7 Cumulative run spectrum for sample B9 and B10

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We found there is no high radon level in the blood samples. The radon level was in recommended limit from EPA.

Recommendations and Policy Implications:

Provide recommendations for public health practices or mitigation strategies based on the study's findings.

Discuss policy implications, if relevant, and suggest potential measures to reduce radon exposure in high-risk areas.

Ethical Considerations:

Ensure that the study adheres to ethical guidelines, including participant confidentiality and informed consent.

Conclusions

Certainly, here are the conclusions based on the provided information:

1. Radon Levels in Basra Governorate:

- The study reveals variations in radon concentrations within Basra Governorate, with higher levels observed in the Abu Al-Khasib district compared to Almdinah district in Basra.

2. Impact of Smoking on Radon Exposure:

- Smokers tend to exhibit higher radon levels in their blood samples compared to non-smokers. This observation highlights the influence of smoking habits on radon exposure.

3. Gender-Based Differences:

- The data indicates that males in Abu Al-Khasib district generally have higher radon levels relative to males in Basra City district, as indicated in B1 and B4.

4. Age as a Factor:

- Age may play a minor role in the elevation of radon levels in the blood, suggesting that older individuals might have slightly higher radon concentrations.

These conclusions provide valuable insights into the distribution of radon exposure in Basra Governorate, with specific attention to regional variations, the influence of smoking habits, gender differences, and the potential impact of age on radon levels in the blood samples. These findings can serve as a basis for further research, awareness campaigns, and potential mitigation measures to address radon-related health risks in the region.

References

1. National Cancer Institute (NCI). (2021). Radon and Cancer. Retrieved from https://www.cancer.gov/about-cancer/causes-prevention/risk/substances/radon
2. United States Environmental Protection Agency (EPA). (2021). A Citizen's Guide to Radon. Retrieved from https://www.epa.gov/sites/production/files/2016-12/documents/2016_a_citizens_guide_to_radon.pdf
3. World Health Organization (WHO). (2009). WHO Handbook on Indoor Radon: A Public Health Perspective. Retrieved from https://www.who.int/ionizing_radiation/env/radon/en/
4. Darby, S., Hill, D., Deo, H., & Auvinen, A. (2005). Residential Radon and Lung Cancer—Detailed Results of a Collaborative Analysis of Individual Data on 7148 Persons with Lung Cancer and 14,208 Persons without Lung Cancer from 13 Epidemiologic Studies in Europe. Scandinavian Journal of Work, Environment & Health, 1-16.
5. Almayahi BA, Ali AH. Fabrication of biosensor for the assessment of radon and lead levels in the blood. Heliyon. 2023 Aug 29;9(9):e19591. doi: 10.1016/j.heliyon.2023.e19591. PMID: 37681124; PMCID: PMC10480637.
6. Asmaa H. Abboud, Basim A. Almayahi, Relationship between heavy metals and alpha emission rates in breast milk and blood of women, Heliyon, Volume 7, Issue 3, 2021, e06590, https://doi.org/10.1016/j.heliyon.2021.e06590.
7. Amjad H. Ali, Basim A. Almayahi. Future directions for research on radon gas in human blood using Airthing device. International Journal of Academic Health and Medical

Research. Vol. 7 Issue 2, February - 2023, Pages: 51-52.

8. Almayahi B. A. Quantification of Alpha Particle Emission in Human Blood Samples in the City of Najaf, Iraq. Journal of Environmental Indicators, 9: 26, 2015.
9. DURRIDGE Company Inc. 900 Technology Park Drive Billerica, MA 01821. 2023 DURRIDGE Company Inc. www.durridge.com/support/product-manuals/Revision 2023-03-27