Ministry of Higher Education

University of Kufa

Collage of Science

Department of Physics

Evaluating the Length of Isolation for Different Patients Treated by Variant Radioactive 131 Doses

A Research

Submitted to the council of the Faculty of Science /University of Kufa in Partial Fulfillment of the Requirements for the Degree of Bachelor's degree in physics

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1446 هـ **2025م**

الاية الكريمة

بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

﴿ وَإِذَا مَرِضْتُ فَهُوَ يَشْفِينِ ٨٠ ﴾

سُورَةُ الشُّعَرَاءِ

Acknwledgment

First and foremost, I would like to express my deepest gratitude to Asst.lectuer Noor Ali Jaafar for her invaluable guidance, continuous support, and encouragement throughout this research. Her expertise and insightful feedback have been instrumental in shaping .this work

I extend my heartfelt appreciation to Al-Amal Al-Hayat Hospital for providing the necessary resources and assistance that facilitated the completion of this study. Their cooperation and support were crucial in gathering essential data and conducting the .research effectively

A special thanks to Mr. Hussein Hamid for his generous assistance, advice, and unwavering support. His contributions and valuable insights have played a significant .role in the successful completion of this project

I would also like to express my sincere gratitude to the Department of Physics – College of Science, University of Kufa, for providing a supportive academic environment that .has significantly contributed to the success of this research

Lastly, I am grateful to my family, friends, and everyone who has supported me throughout this journey. Their encouragement and belief in me have been a great source of motivation

.Thank you all

Dedication

To those who have walked this journey of knowledge with us, sharing the challenges and …triumphs along the way

To our esteemed professors, our supportive families, and our dedicated .colleagues—your encouragement and guidance have been our greatest motivation

This research is the result of our joint effort, a testament to our commitment and perseverance. Together, we have poured our time and energy into this work, hoping it .will contribute to the ever-growing pursuit of knowledge

We dedicate this study to everyone who believes in the power of learning and the impact .of determination. May it serve as a stepping stone for future discoveries

,With gratitude and respect

Abstract

Radioactive iodine 131 is an isotope commonly used in treating thyroid cancer, Graves disease, and for diagnosis. Because it emits two types of radiation (Ɣ, β).The study focuses on measuring the radiation in various patients that treated with radioactive iodine (I-131) by different doses (20, 30, 100, 150) mCi, The patients was divided into four groups; each group refers to the patient dose. Each group containing five samples excepted group C that containing ten sample. The equivalent dose was measured in microsieverts (µSv/hr) using a RAD-30 device. It was observed that the highest equivalent dose rate in Group A (780 µSv/hr) decayed to (3 µSv/hr) after 32 days. During this period, the metabolic rate was recorded at (1414 kcal/day), and this duration was sufficient for radiation levels to approach background levels. Based on this, we can conclude that patients treated with a 20 mCi iodine dose require a longer isolation period, considering their metabolic rate. Meanwhile, patients who received iodine doses of 30 mCi, 100 mCi, or 150 mCi require a shorter isolation period compared to those treated with 20 mCi.

CONTENTS

Figures

Summary	The definition
BMI	Body mass index
BMR	Basal metablic ratio
Mci	Maillicurie
Pt	Patient
Equivalent dose	EqD
Radio active iodine	RAI

CHAPTER ONE

Introduction of radiation

1.1-Introduction of Radiation:

Radiation represent energy emitted by a source and transmitted through space in the form of wave or particales. From the point of view of radiation protection, radiation is divided into categories: non-ionizing and ionizing, to emphasize the danger to human health. Electomagnatic radiation: light, ultraviolet and infrared radiathion, radio wave, microwaves, ultrasound belong to non-ionization. When radiation hits an atom, it transfers some of its energy to it. If the energy transferred by the radiation is high enough,ionization occur –the process of removing an electron from the atom that leaves behind electrically chargy particales –an electron and positive ion. The presence of large numbers of such electrically chargrd particales can cause damage to living tissues. Radiation that can transfer enough energy to do this is called ionizing radiation, and those with a lower energy level are called non-ionization radiation. Although certain types of non-ionization radiation can be harmful in high dose, ionizing radiation is usually much more dangerous. When people talke about radiation, they usually refer to ionizing radiation. In everyday life we encounter different types of radiayion, both non-ionization – such as light, radio wave, microwaves, and ionizing such as x-rays, gamma.[1]

1.2-Type of Radiation:

Radiation is energy that travels in the form of waves or particales. People are exposedto radiation from cosmic ray , as well as to radioactive matirials found in the soil, water, food, air and also inside the body. There are two type of radiation :

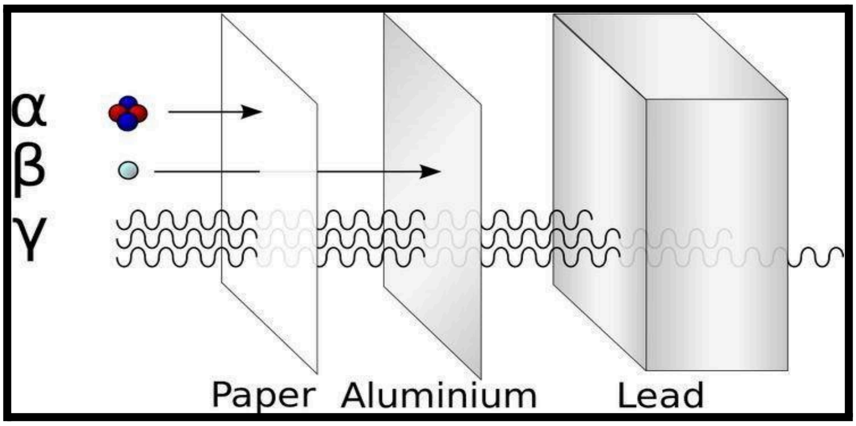
1.2.1-Non-Ionizing radiation:

The radiation energy is too low to trigger the ionization process in the medium which it passes (to trigger the emission of an electron frome an atom). Non-ionization refers to the energy required to excite atoms or electrons in adequate amounts , but is not sufficient to expel electrons from theirorbitals.[2]

1.2.2-Ionizing radiation:

This type of radiation is emitted by the atoms of radioactive element. Ionizing radiation has sufficiently high energyto cause damage to the human body when it penetrates and it can simply be discovered using electronic equipment (plateman,1959). Ionizing radiation possesses sufficient energy to interact with the body, specifically in the living body , and can produce ions; that is, it can detach an electron from. Examples of ionizing radiation include alpha , beta and gamma radiation [fig1.1].[3]

Fig1.1



alpha,beta and gamma particale

1.2.2.a-Alpha particale:

Alpha decay occur for those nuclides which have an atomic number greater than 82. Such heavy nuclides have no stable consfiguration of neutrons and protons, and as a result , emit an alpha particle consisting of 2 proton and 2 neutrons(fig 1.2). Generally , a series of alpha (as well as beta)decay are required until a lighter, stable element is reached. Unlike beta particles, alpha particles are emitted with a discrete energy. [4]

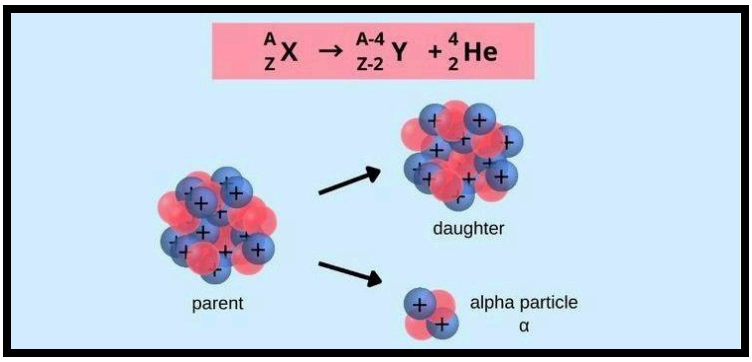


Fig 1.2 Alpha particale

1.2.2.b-Beta particale:

Nucleus emits neutrions and electrons. These two species have to have been produced at the time of decay as they are not found in the nucleus. The exchange the weak interaction, which is distinct from the gravitational, electromagnetic, or nuclear forces, is the cause of beta decay (fig 1.3). The available decay energy is shared by the the released beta particles. This is explained by the quantum statistical mechanical theory of beta decay. The half-life in beta decay decreases with increasing overall decay energy. The beta decay half lifeare also influenced by the similarity between the nucleus of the father and daughter. Given that the weak contact is unable to provide

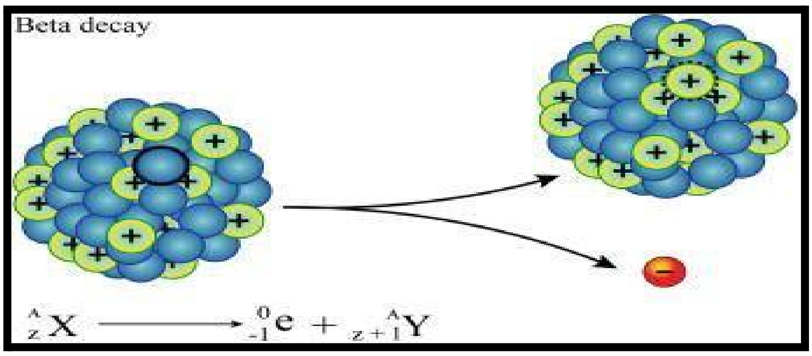


Fig 1.3 Beta particle

:c-Gamma ray.1.2.2

gamma radiation is electromagnetic radiation that is emitted by an unstable nucleus of an atom during radioactive decay. A nucleus in an unstable state may fall to a more stable state by the emission of energy as gamma radiation. Radionuclide decay processes often leave the product nuclide in an excited energy state. The product nuclide in such an exited state either falls directly to the ground state or descends in steps to lower energy states through the dissipation of energy as gamma radiation. (fig 1.4) a nuclide in an exited energy state is refrrred to as a nuclear isomer, and the transition (or decay) from a high to a lower energy state is referred to as isomeric transition. The energy of a gamma ray may be described as the difference in energy states of the nuclear .

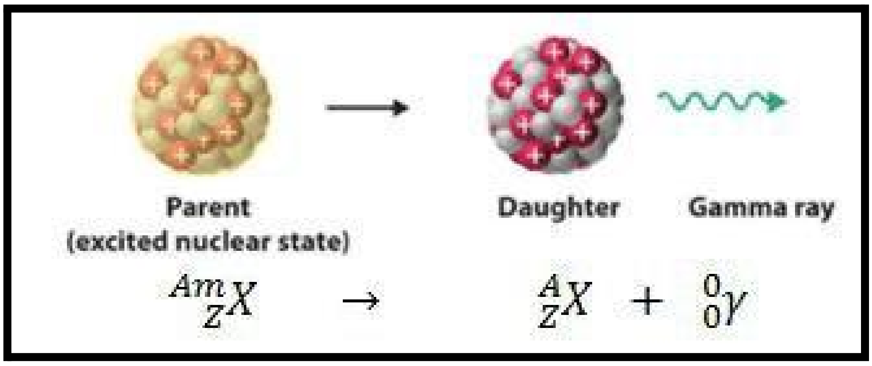


Fig 1.4

Gamma decay

1.3-The objectives of the research

1. **Studying the Isolation period for patients that treated by different doses of radioactive Iodine therapy I131**

2. **Reducing the isolation period for those patients**

CHAPTER TWO

Radioactive iodine and Thyroid gland

:Radioactive iodine-2.1

In the United States, radioactive iodine is the treatment of choice for most patients with Graves' disease and toxic nodular goiter. It is inexpensive, highly effective, easy to administer, and safe. There has been reluctance to use radioactive iodine in women of childbearing years because of the theoretical risk of cancer of the thyroid, leukemia, or genetic damage in future offspring. The treatment of hyperthyroidism in children remains controversial, but radioactive iodine is becoming more acceptable in this group. A gland-specific dosage based on the estimated weight of the gland and the 24-hour uptake may allow a lower dosage and result in a lower incidence of hypothyroidism but may have a higher recurrence rate . Higher dose ablative therapy increases the chance of successful treatment and allows the early hypothyroidism that results from this regimen to be diagnosed and treated while the patient is undergoing close monitoring. Some studies have shown that the eventual incidence of hypothyroidism is similar regardless of the radioactive iodine dosage. The high-dose regimen is clearly favored in older patients, those with cardiac disease, and other groups who need prompt control of hyperthyroidism to avoid complications. Patients with toxic nodular goiter or toxic adenomas are more radio resistant and generally need high-dose therapy to achieve remission. They have a lower incidence of eventual hypothyroidism because the rest of the gland has been suppressed by the toxic nodules and protected from the effects of radioactive iodine.[7]

2.2-Isotopes:

An atomic species is defined by two whole numbers: the number of protons in the nucleus (known as Z, or atomic number) and the total number of protons plus neutrons (known as Z, or mass number). The atomic number of an element is the same, but different mass numbers are called isotope of an element. Radioisotopes are the unstable form of an element that emit radiation to transform into a more stable form. Radiation is easily traceable and can cause changes in the substance it falls upon. These special attributes make radio isotopes useful in medicine, industry and other areas.[8]

2.3-Types of isotopes:

2.3.1-Stable isotopes:

Stable isotopes are isotopes of an element that do not undergo radioactive decay, meaning they do not spontaneously change into other elements over time. These isotopes have a stable nucleus and do not emit radiation. Each stable isotope of an element has a specific number of protons, but the number of neutrons in the nucleus can vary. For example, carbon has two stable isotopes: carbon-12 (12C) and carbon13 (13C). Both isotopes have six protons, but carbon-12 has six neutrons, while carbon-13 has seven neutrons. [9,10]

:Radioisotope-2.3.2

A radioisotope is an atom with an unstable nucleus. In most cases, an unstable nucleus has a natural tendency to reach stability by rearranging itself by emitting either a β-particle or an α-particle. However, in some cases, the rearrangement is through the absorption of one of the orbital electrons by the nucleus (electron capture) followed by the emission of characteristic x-rays. This property of a radioisotope is generally known as radioactivity (or simply activity).[11]

2.4-Radioactive iodine isotopes:

Radioisotopes of iodine have been widely used in clinical diagnosis and treatment for various diseases, and in biomedical and environmental studies as a tracer of iodine or labeled compounds. The most frequently used radioisotopes of iodine are I131 and I125. Due to special nuclear properties of I123 and I124, the application of these two radioisotopes of iodine is increasing. I131 have been used for the diagnosis and treatment of thyroid diseases for more than 60 years (Sawin and Becker, 1997). it is still a main method used for the diagnosis of thyroid cancer, hypothyroidism, hyperthyroidism and for treatment in Graves' disease, papillary and follicular thyroid carcinoma; it has become a standard method for the treatment of persistent hyperthyroidism (Moka et al., 2002). Higher energy γ-rays (364.5 and 637 keV) of I131 are used for imaging of the thyroid, to show thyroid activity and, thus, show the location, size, and disease. I131 therapy is based on the emission of suitable energy beta particles, and more than 1000 times higher concentration of thyroid to iodine compared to other issues I125 is another widely-used radioisotope of iodine in clinical medicine and biological studies. I125is also used for imaging of the thyroid; Due to its decay by electron capture, the radiation dose to the thyroid required is much lower than I131. However, its low γ-ray energy (35.5 keV) makes its measurement and the diagnosis of some thyroid diseases more difficult to understand. I124 decays by emitting positrons (22%), it is therefore used for positron emission tomography (PET) of thyroid (Freudenberg et al., 2004). I124 can also be used for imaging of the thyroid by using its γ-rays (623 (63%), 723 (10%), and 1691 keV (11%). Due to γrays emission of I123, it can also be used for imaging of the thyroid. The short halflife (13.27 h), electron capture decay, and low γ-ray energy (159 keV) of I123 signifi cantly reduce the radiation dose required during thyroid imaging to about 1/100 of I131 when using the same amount of radioactivity. In addition, I123 is a very useful analog label for producing radiotracers. Its nuclear properties are also almost ideal for single photon emission computed tomography (SPECT) studies. Compared to I131 and I125, the application of I123 and I124 in clinical medicine and biomedical studies is very limited, not only because results from their nuclear properties, but also because of lower availability.[12]

:Iodine131-2.5

I131 is a radioactive isotope of iodine that decays with a physical half-life of 8 days to stable Xe131 and releases radiation during the decay process by emitting beta particles and gamma radiation. The emitted gamma radiation can be detected by a gamma camera and can be used diagnostically. The beta particles travel a distance of about 2mm in tissue, thereby ensuring local treatment of the tissue. Advantages of iodine is good tolerability, ease of application, safety and efficacy of therapy. Currently, iodine-131 is available as sodium iodide in gelatine capsules and drinking solution for oral application as well as in intravenous injections. Thyroid is the critical organ for iodine. Iodine is taken up by the thyroid follicular cells. Retention of iodine in the cells depends on the metabolic activity of the cells. It is as¬sumed that 30 % of iodine is trapped by the thyroid, and 70% directly excreted in the urine. [13], [14] Radioactive isotope iodine-131 simultaneously emits two types of radiation: radiation beta minus used for the treatment and gamma used for diagnosis. Physical half-life (Tf) I-131 is 8.04 day. effective half-life (Te) of iodine in the living body is about 3.6 day. [15], [16]

2.6-Radioactive iodine uses:

2.6.1-Diagnosis uses:

Radioiodine has proven to be a valuable agent in the diagnosis of thyroid function. The methods devised fall largely into three categories, all of which are essentially rates determinations made following oral ingestion of I131. They involve the determination of the rate of urinary excretion, uptake by the thyroid gland and incorporation into the “hormonal” iodine of the blood. The rate of urinary excretion has been studied by Means [17] observed that numerous investigators. McArthur, Rawson, Fluharty and with a range of 7 to 45 per cent, and in euthyroid patients the average excretion was 59 per cent, with a range of 23 to 98 per cent. There was significant overlapping of the two groups in the range of 20 to 40 per cent. The excretion by hypothyroid patients varied from 75 to 95 per cent. Thus, a low urinary excretion of radioactive iodine is indicative of increased thyroid activity. Conversely, a high urinary excretion is suggestive of a hypofunctioning thyroid gland. Measurement of the rate and extent of uptake by the thyroid gland following a small dose of I131 is a more direct index of thyroid activity.[18]

2.6.2-Therapy uses:

Radioactive iodine is used for due to toxic nodular goiter and Graves' disease especially in elderly and patients with coexisting cardiac disease. It is also useful in hyperthyroidism due to adenoma or carcinoma when surgery is not feasible. [18]

: Tyroid gland-2.7

The thyroid is a 2-inch-long , butterfly-shaped gland weighting lesser than an ounce . Located in the front of the neck below the larynx , or voice box , it is composed of two lobes , one on eacg side of the windpipe (Fig.2.1). It is one of the glands that make up the endocrine system. The thyroid gland produces two thyroid hormons , triiodthronine (T3) and thyroxine (T4). These hormones affect metabolism , brain development , breathing , heart and nervous system functions , body temperature , muscle strength , skin dryness , menstrual cycles , weight , and cholesterol levels. A third hormone produced by the thyroid gland , calcitonin , is not considered a thyroid hormone as such , as it affects calcium levels in the blood and controls the build-up of calcium in the bones.[7]

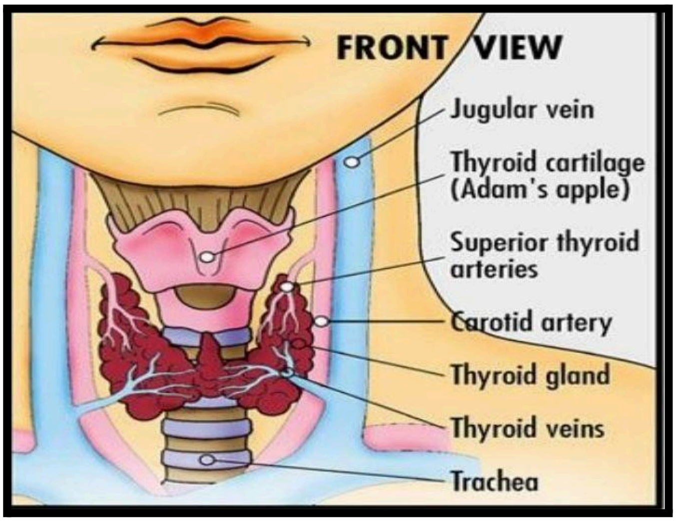


Fig.2.1 Thyroid Gland-anatomy

:Thyroid gland function-2.8

The gland has twofold important functions. The first is to release the TH, which keeps up the dimension of metabolism in the tissues that are ideal for their ordinary capacity. TH stimulates O2 consumption by furthermost of the cells in the body,helps directing lipid these lines impacts weight.the accompanying capacity of the thyroid organ is to create calcitonin , a hormone that manages circulating levels of calcium.[19]

2.9-Neoplasm of thyroid gland:

2.9.1-Benign tumour:

The most common thyroid tumors are cystic and the tumor may be single or multiple.

2.9.1.a-Micro adenoma:

That divided into three sections: Parenchymatous trabecullar micro adenomas , Colloidal micro adenomas , Intermediate micro adenomas.

2.9.1.b-Embryonal adenomas:

Classified into type: Papillary cystadenomas and Solid adenomas.

2.9.2-Malignant adenoma:

Malignant tumors affecting the thyroid gland are usually of ill-defined circumference and are attached to the surrounding tissues and organs due to their increasing size:

2.9.2.a-Papillary carcinoma:

The most common malignant types , the form of single nodules, this type occurs twice as often in females as in males.

2.9.2.b-Follicular carcinoma:

This cancer is more common in th elderly.

2.9.2.c-Anaplastic carcinoma:

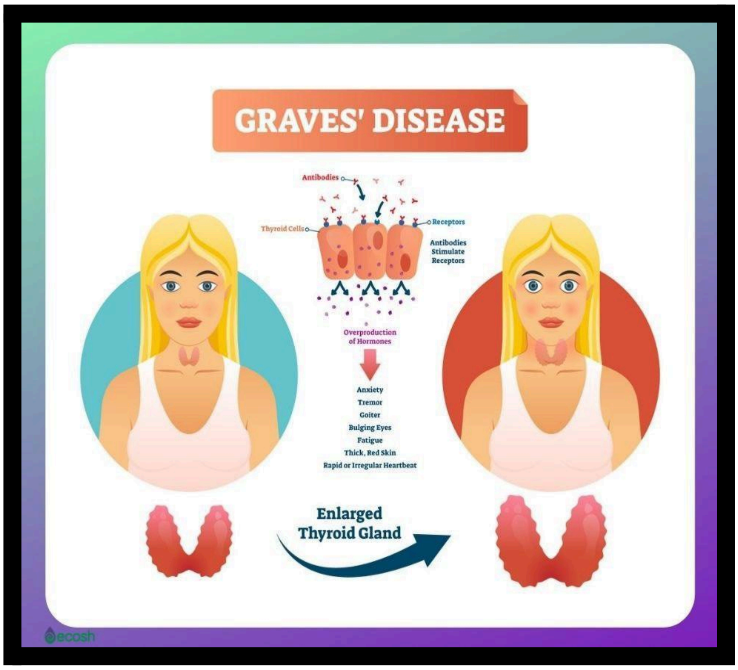
Less common than the previous two types, and surgery is often not useful with this typ of cancer.

2.9.2.d-Medullary carcionoma:

this type is rare and may be hereditary.[20]

:Grave's disease-2.10

Also called Graf_Basedov disease and primary toxic goite,in Graves' disease, goiter is observed in all parts of the thyroid gland. The weight of the gland may reach 60-80 grams, or about 2-3 times its normal weight.[21]



grave's disease **Fig2.2**

CHAPTER THREE Thyroid treatment and Metabolisim

3.1-The role of (I-131) in the treatment of thyroid diseases:

3.1-1-Tratment of hyperthyroidism:

A specific dose of iodine is given that is much larger than that given for diagnostic purposes and often ranges between 5 and 12 millicuries.

3.1.2-Thyroid cancer treatment:

It has been observed that some thyroid cancers can concentrate radioactive iodine and thus their activity is limited by destroying the cancer cells that are attracted to the aforementioned iodine. The amount of iodine dose used in such cases ranges between

150 and 200 millicuries, which is a very large amount when compared to what is given in other cases such as diagnosis or treatment of hyperthyroidism.[22]

3.2-Metabolism:

Metabolism, or what we call food conversion, is one of the most important vital processes that occur in the body. Through these processes, the basic materials necessary to build the body are manufactured or those materials are destroyed to benefit from their components in providing the body with other important materials, and providing it with the energy it needs to perform its vital functions. There are multiple, countless mechanisms that take place inside the body of a living organism to do this.

Thyroid hormones play an important role in this regard, as it has been observed that a deficiency or absence of these hormones causes a deficiency in the food conversion processes of carbohydrates, fats and proteins in the tissues of the living body, as they decrease by 40% from the normal rate of normal gland function, while hyperthyroidism causes an increase in the rate of these processes.[23]

For meal:

BMR=(10*wight)+(6.25*height)-(5*age)+5……..equation1

For famel:

BMR=(10*wight)+(6.25*height)-(5*age)-161……equation2

The numerical constants in the equation (such as 10, 6.25, 5, and 161) are scientifically determined coefficients based on research studies. These constants help adjust the calculation to accurately estimate the body's basal metabolic rate (BMR) by accounting for differences in weight, height, age, and gender.

3.3-Survey meter device:

The Mirion RDS-30 is a portable personal radiation dose rate meter used to measure ambient radiation levels. It detects ionizing radiation and displays readings in microsieverts per hour (µSv/h) or millirems per hour (mrem/h). This device is commonly used in radiation safety applications, including nuclear power plants, hospitals, and industries dealing with radioactive materials[25]

Figure 3.1 survey meter(RDS-30) device

CHAPTER FOUR
Experimental part

4.1-Introduction:

This part of the project includes important steps (experimental part), which have been followed to analyze the equivalent dose, collection and preparation of the samples, systems of measurement, which are used in this study, and also a theoretical consideration.

4.2-Sample Collection:

Twenty fife samples of patient treated with radioactive iodine-131(I-131) were collected frome Amal Al-Hayat Hospital.

4.3-Measurement systems used:

The RDS-30 survy meter was used in this study.

4.4-Experimental part of sample measurement:

Sample were collected from the patients treated with radioactive iodine-131(I-131) at different doses the sample was dividedinto four groups (20, 30, 100, 150) with each group containing five sample exepted group(100) that is ten. The samples were given code then collected data frome (gender,age,weight,height,dose) after then measured the BMI and BMR from equation1,2, and then measured using a RDS-30 survy meter for period of 32 days. The measurement duration was fixed 30 seconds for each sample . each sample was measured individually after taking the background radiation reading of the location where the measurementwere collected,as shown in the table below.

pt sample	gander	age/year	hight/cm	wight/kg	theraputicdose (activety)/mci
pt1	female	28	164	69	20
pt2	male	60	170	83	20
pt3	male	51	175	69	20
pt4	female	24	160	80	20
pt5	male	34	180	78	20
pt6	male	19	184	88	30
pt7	female	30	160	70	30
pt8	male	59	175	89	30
pt9	male	44	170	100	30
pt10	female	25	160	60	30
pt11	female	34	156	63	100
pt12	female	24	150	65	100

pt13	male	29	185	86	100
pt14	female	42	160	70	100
pt15	female	24	154	82	100
pt16	male	19	160	118	100
pt17	female	23	150	43	100
pt18	male	57	178	79	100
pt19	female	40	160	100	100
pt20	male	38	185	115	100
pt21	female	37	170	80	150
pt22	female	22	165	56	150
pt23	male	30	184	90	150
pt24	female	64	160	100	150
pt25	female	40	165	55	150

Table1. data of sample patient

4.5.Collection of the samples:

Twenty fife samples are collected from patient divided into four groups(A,B,C,D) then divided into five sample for each group excepted group (C) it was ten sample. As show in table (2) table(3) table(4) and table(5).

Pt sample	BMR/kcal/day	after 4 daysEqD/µsv/hr(near thyroi(d	after 8 daysEqD/µsv/hr(near (thyroid	after 12 daysEqD/µsv/hr(near (thyroid	after 16 daysEqD/µsv/hr(near (thyroid	after 20 daysEqD/µsv/hr(near (r thyroid	after 24 daysEqD/µsv/hr(near (thyroid	after 28 daysEqD/µsv/hr(near (thyroid	after 32 daysEqD/µsv/hr(near thyroi(d
pt1 (20 (mci	1414	780	206.26	100	42	30.5	15	7	3

pt2 (20 (mci	1597.5	303.3	132.2	50.1	12.5	4.08	2.5	1.3	0.95
pt3(20 (mci	1533.75	600	170	60	20	8.3	6.1	0.9	0.122
pt4(20 (mci	1519	606	85.3	69.32	33.2	14.2	5.6	2.1	0.352
pt5(20 (mci	1740	450	65.8	34.1	13.7	6.8	3.4	1.1	0.02

Table 2. measurement of patients treated with radioactive 20 mci

pt sampl	BMR/kcal/day	after 4 daysEqD/µsv/hr(near (thyroid	after 8 daysEqD/µsv/hr(near (thyroid	after 12 daysEqD/µsv/hr(near (thyroid	after 16 daysEqD/µsv/hr(near (thyroid	after 20 daysEqD/µsv/hr(near (thyroid	after 24 daysEqD/µsv/hr(near (thyroid	after 28 daysEqD/µsv/hr(near thyroi (d	after 32 daysEqD/µsv/hr(near thyroi (d
pt6(3 (0 mci	2005	28.4	4.3	1.09	0.72	0.08	0.04	0.02	0.01
pt7(3 (0 mci	1389	350	57.8	14.8	5.99	2.9	1.76	0.98	0
pt8(3 (0 mci	1693.75	177	25.9	16.9	7.98	4.3	2.2	0.56	0.001
pt9(3 (0 mci	1847.5	197	45	23.65	12.76	7.98	3.1	0.98	0.004
pt10(30 (mci	1314	63.2	13.5	1.6	1.09	0.99	0.05	0.004	0

Table 3. measurement of patient treated with 30 mci

pt sample	BMR(kg/m^2	after 4 daysEqD/µsv/hr(near (thyroid	after 8 daysEqD/µsv/hr(near (thyroid	after 12 daysEqD/µsv/hr(near (thyroid	after 16 daysEqD/µsv/hr(near (thyroid	after 20 daysEqD/µsv/hr(near (thyroid	after 24 daysEqD/µsv/hr(near (thyroid	after 28 daysEqD/µsv/hr(near (thyroid	after 32 daysEqD/µsv/hr(near (thyroid
pt11(100 (mci	1274	11.52	5.3	1.88	1.09	0.64	0.01	0.01	0.001
pt12(100 (mci	1306.5	20	4.8	2.2	1.02	0.03	0.01	0.01	0.001
pt13(100 (mci	1876.25	10.6	3.8	1.2	0.98	0.01	0.001	0.001	0.001
pt14(100 (mci	1329	9.9	4.01	0.77	0.08	0.04	0.02	0.001	0.001
pt15(100 (mci	1501.5	7.6	1.22	0.98	0.68	0.43	0.21	0.09	0.01
pt16(100 (mci	2090	24.5	4.32	0.98	0.09	0.098	0.02	0.001	0.001
pt17(100 (mci	1091.5	55	44.2	20.4	8.9	2.1	1.2	0.01	0.001
pt18(100 (mci	1622.5	189.7	89.4	56	16.5	8	4.6	2.4	0.98
pt19(100 (mci	1639	11.08	7.78	3.4	1.1	0.33	0.06	0.003	0.008
pt20(100 (mci	2121	258.3	98.9	56.3	22.3	9.8	5.2	2.3	0.98

Table 4. measurement of patient treated with radioactive 100 mci

pt sample	BMR(kg/m^2)	after 4 daysEqD/µsv/hr(near thyroid)	after 8 daysEqD/µsv/hr(near thyroid)	after 12 daysEqD/µsv/hr(near thyroid)	after 16 daysEqD/µsv/hr(near thyroid)	after 20 daysEqD/µsv/hr(near thyroid)	after 24 daysEqD/µsv/hr(near thyroid)	after 28 daysEqD/µsv/hr(near thyroid)	after 32 daysEqD/µsv/hr(near thyroid)
pt21 (150mci)	1516.5	64.5	30.2	10.1	4.5	1.1	0.96	0.09	0.008
pt22(150 mci)	1320.25	157	87.9	10.7	3.33	0.45	0.005	0.001	0
pt23(150 mci)	1905	195.2	85.3	32.8	11.6	5.23	1.2	0.05	0.001
pt24(150 mci)	1519	20.5	10.615	2.34	1.25	0.86	0.45	0.28	0.006
pt25(150 mci)	1220.25	34.3	24.5	8.1	6.5	2.2	0.98	0.07	0.008

Table 5. measurement of patient treated with radioactive 150 mci

:(survey meter (RDS-30-4.6

Description

The RDS-30 is a Digital Handheld Dose Rate Meter designed for a wide range of applications involving a possibility for abnormal radiation levels. Compact, lightweight, waterproof, its performance and its friendly user interface make the RDS-30 perfectly suited to radiation survey in field conditions, in nuclear industry and for protection against radiological hazards by personnel, who may be exposed to gamma and/or X-ray radiation in their work. RDS-30 is microprocessor controlled. The user interface consists of one push button and an easy-to-use menu structure that displays information on the LCD of the meter. The six-digit display shows the dose rate and various messages. Different alarm situations are indicated by a combination of audio-visual effects on the LCD and a buzzer (dose rate, dose, low battery, defect, dose rate overflow). RDS-30 provides user configurable (with RDS-CSW SW) list of alarm levels for dose and dose rate. Fixed or multilevel alarm options. It is possible to store dose rate values into the histogram memory for later analysis of the readings. The use of a RDS-CSW software is required for downloading the data into a PC via IrDA port.

Fig 4.1.RDS-30

CHAPTER FIVE

Result and Discussion

5.1.Introduction:

This chapter presents the radioactive activity concentrations of twenty-fife samples of patients treated with radioactive iodine-131 (1-131). Exposure to ionizing radiation can cause damage to the skin, blood, cataracts, infertility, congenital defects, and cancer. The likelihood of harmful health effects from radiation exposure is proportional to the dose received, but there is no level of radiation exposure that is completely safe. The radioactive activity of samples patient is measured using the RAD-30TM™ Radiation Survey Meter. The RDS-30 is a portable, digital dose rate meter designed for a wide range of applications involving potential abnormal radiation levels.

5.2.part of the measurement of patient treated with radio active iodine-131(I-131):

As shown in the figure below, the equivalent dose in (μSv) was calculated for group (A (20mCi)) samples of patients treated with radioactive iodine-131 (I-131) with an activity of 20(mCi) The measurements were taken four days after the administration of dose.

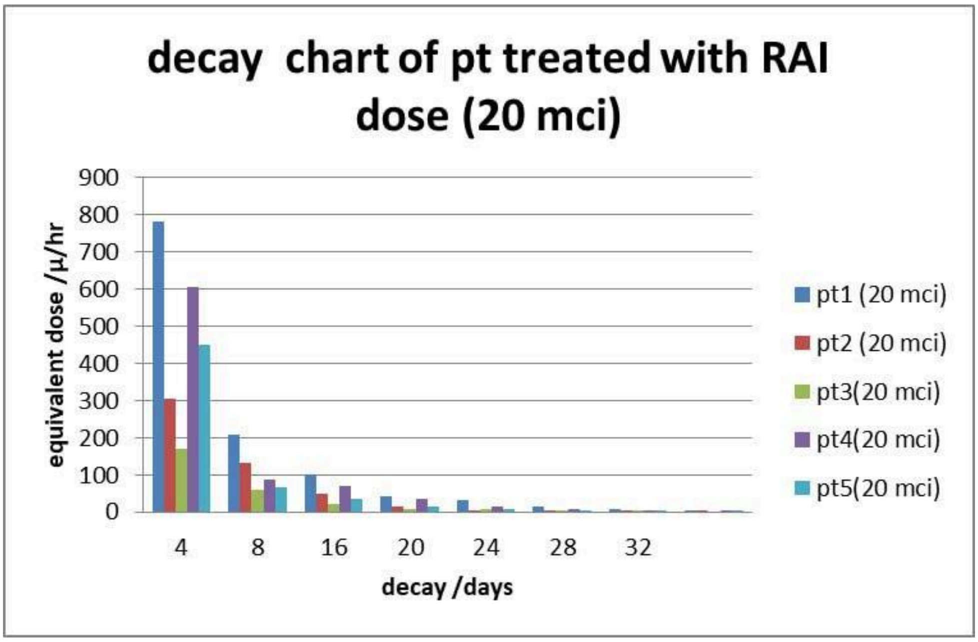


Figure 5.1 group(A(20mci)) samples of patient treated with radioactive iodine-131(I-131) with an activity of 20 mci

It was found that the highest equivalent dose was in sample, with a value of (780 μSv/hr) for (pt1) in first day of measurement. A decay was observed, as it decreased to

(3.00 μSv/hr). The lowest equivalent dose was for pt3, with a value of (303.3 μSv/hr), and a decay was observed, as it decreased to (0.95 μSv/hr).

As shown in the figure below, the equivalent dose in (μSv/hr) was calculated for group(B(30 mci)) samples of patients treated with radioactive iodine-131 (1-131) with an activity of 30 (mCi). The measurements were taken four days after the administration of dose.

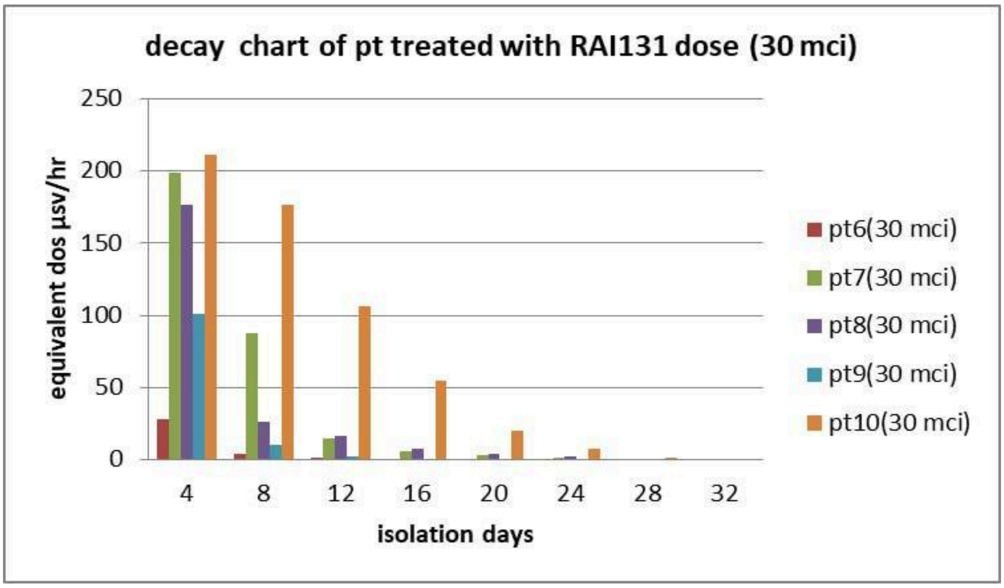


Figure 5.2. group(B (30mci)) samples of patient treated with radioactive iodine-131(I-131) with an activity of 30 mci

It was found that the highest equivalent dose was in sample , with a value of (350 μSv/hr) for (pt7) in first day of measurement. A decay was observed, as it decreased to (0 μSv/hr). The lowest equivalent dose was for(pt6), with a value of (28.4 μSv/hr), and a decay was observed, as it decreased to (0.01 μSv/hr).

As shown in the figure below, the equivalent dose in (μSv/hr) was calculated for group(C(100 mci)) samples of patients treated with radioactive iodine-131 (1-131) with an activity of 100 (mCi). The measurements were taken four days after the administration of dose.

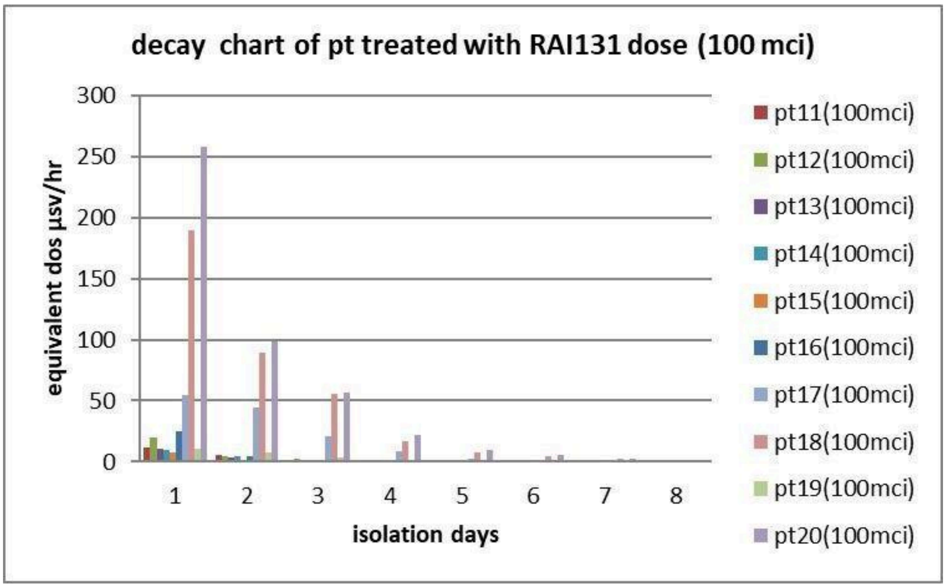


Figure 5.3. group(C (100mci)) samples of patient treated with radioactive iodine-131(I-131) with an activity of 100 mci

It was found that the highest equivalent dose was in sample, with a value of (258.3µSv/hr) for (pt20) in first day of measurement. A decay was observed, as it decreased to (0.98 µSv/hr). The lowest equivalent dose was for(pt15), with a value of (7.6 µSv/hr), and a decay was observed, as it decreased to (0.01 µSv/hr)

As shown in the figure below, the equivalent dose in (µSv/hr) was calculated for group(D(150 mci)) samples of patients treated with radioactive iodine-131 (1-131) with an activity of 150 (mCi). The measurements were taken four days after the administration of dose.

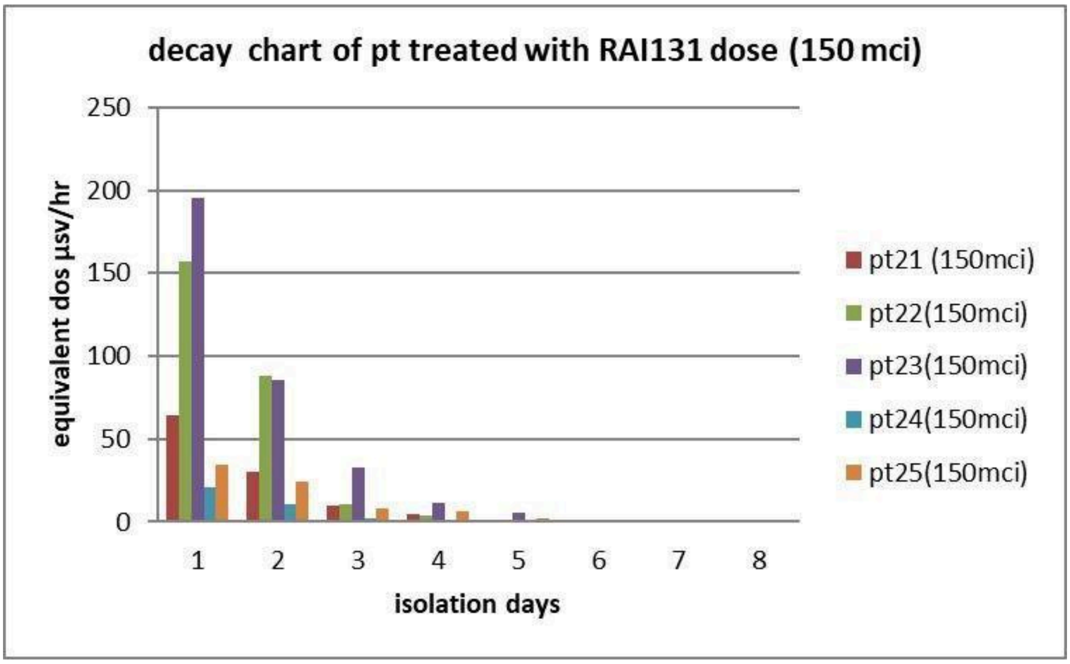


Figure 5.4. group(D (150mci)) samples of patient treated with radioactive iodine-131(I-131) with an activity of 150 mci

It was found that the highest equivalent dose was in sample, with a value of (195.2µSv/hr) for (pt23) in first day of measurement. A decay was observed, as it decreased to (0.001 µSv/hr). The lowest equivalent dose was for(pt24), with a value of (20.5 µSv/hr), and a decay was observed, as it decreased to (0.006 µSv/hr).

It was observed that the highest equivalent dose rate in Group A (780 µSv/hr) decayed to (3 µSv/hr) after 32 days. During this period, the metabolic rate was recorded at (1414 kcal/day), and this duration was sufficient for radiation levels to approach background levels. Based on this, we can conclude that patients treated with a 20 mCi iodine dose require a longer isolation period, considering their metabolic rate. Meanwhile, patients who received iodine doses of 30 mCi, 100 mCi, or 150 mCi require a shorter isolation period compared to those treated with 20 mCi.

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الخلاصة

اليود المشع 131 هو نظير يستخدم عادة في علاج سرطان الغدة الدرقية ومرض جريفز وللتشخيص. لأنه ينبعث منه نوعين من الإشعاع (β، γ). تركز الدراسة على قياس الإشعاع في مختلف المرضى الذين عولجوا باليود المشع (I-131) بجرعات مختلفة (20، 30، 100، 150) ميكروكوري، تم تقسيم المرضى إلى أربع مجموعات؛ تشير كل مجموعة إلى جرعة المريض. كل مجموعة تحتوي على خمس عينات باستثناء المجموعة ج التي تحتوي على عشر

عينات. تم قياس الجرعة المكافئة بالميكروسيفرت (µSv/hr) باستخدام جهاز RAD-30. لوحظ أن أعلى معدل جرعة مكافئة في المجموعة أ (780 ميكروسيفرت/ساعة) انخفض إلى (3 ميكروسيفرت/ساعة) بعد 32 يومًا. خلال هذه الفترة، تم تسجيل معدل الأيض عند (1414 كيلو كالوري/يوم)، وكانت هذه المدة كافية لمستويات الإشعاع للاقتراب من مستويات الخلفية. بناءً على ذلك، نستنتج أن المرضى الذين عولجوا بجرعة يود مقدارها 20 ميكروكوري يحتاجون إلى فترة عزل أطول، بالنظر إلى معدل أيضهم. في المقابل، يحتاج المرضى الذين تلقوا جرعات يود مقدارها 30، أو 100، أو 150 ميكروكوري إلى فترة عزل أقصر مقارنةً بمن عولجوا بجرعة 20 ميكروكوري.

وزارة التعليم العالي والبحث العلمي

جامعة الكوفة

كلية العلوم

قسم الفيزياء

تقييم مدة العزل للمرضى الذين عولجوا بجرعات مشعة متغيرة من المادة 131

بحث مقدم

الى مجلس كلية العلوم / جامعة الكوفة

كجزء من متطلبات نيل شهادة البكالوريوس في الفيزياء

مقدم من قبل

زهراء واثق عبيد

زيد فلاح نعمة

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