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Boosting Immune System: Camel Milk Alleviation of Abnormal Growth and Fertility System Changes Induced by Gamma Radiation in Male Albino Rats

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ABSTRACT

Radiotherapy is one of the essential therapeutic modalities for tumors treatments, but it has some influences on the healthy tissues. The aim of the present study is the evaluation of the efficacy of camel milk ingestion against gamma-radiation, induced abnormality in growth, and serum immunoglobulin and sperm system of male albino rats. Methods of this work: Ninety six of healthy male albino rats were classified into 16 groups and ingested with camel milk doses for 35 days after gamma-irradiation. Collected blood serum was used for biochemical determinations (testosterone, glucose, Fructosamine, acid phosphatase and lactate dehydrogenase) and serum immunoglobulin (IgG, IgA and Ig M). Sepermatogenic damages (testes weight, sperm count, epididymis weight (g) and seminal weight (g) were determined. Also, frequencies of morphological sperm abnormalities were examined .Body weight gain, food intake and feed efficiency of each rat of each group were determined. Results: There were significant decrease in the body weight gain, feed efficiency, testes weight and sperm count in gamma radiated rats. The same trend was observed for testosterone, fructosamine contents as well as the activities of acid phosphatase and LDH. The present disturbed observations were dose dependent .Camel milk treatment by ingestion into IRR-rats alleviated the harmful effect of the gamma rays exposure .The growth rates and feed efficiency was improved. The parameters of spermatogenic damage (testes, weight, sperm count, epidydimis weight and seminal weight) were improved. The male fertility parameters also improved by camel milk treatment. Camel milk reduced the disturbed effects of the sperm shaped abnormalities in head and tail. Conclusion: The desirable therapeutic effect of camel milk treatment were dose dependent for all parameters examined.

Keywords
Gamma–radiation, camel milk, sperm, abnormal, immune, growth, fertility.

1. Introduction

Radiotherapy is one of the essential therapeutic modalities for tumors treatments. It enhances tumor cell susceptibility and effectively kill tumors. It may cause acute side influences on healthy tissues as it may cause damages to some normal cells along the course of treatments [1]. Gamma radiation exposure may induce physiological and metabolic pathways dysfunction including immune and hematopoietic systems [2], oxidative stress, disorders in growth, spermatogenic damage and sperm abnormalities in animals [3, 4]. Safe radio protector's drugs are not easily available. Thus, there is an imperative need for nontoxic, effective, natural bioactive compounds which sensitize tumor cells and protect the normal tissues in radiotherapy [5].Camel milk so called white gold of the desert is more similar to human milk than any other milk [6]. Fresh and fermented camel milk provide several potential health benefits to human as it had anti-carcinogenic, antimicrobial, hypoglycemic, hypo-cholesterolemic and hypo-allergenic effects...etc. [7]. It differs from other ruminant milk because it contains low cholesterol, low

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sugar, high minerals and high vitamins content [6]. Its total minerals content ranged between 0.6 and 0.9%[8]. These minerals are Ca, K, Na, Fe, Mg, Mn, Zn, Cu and P and present in good values [9]. Iron plays an important role in several biological systems. Also, Mn and Zn are considered are the key in cellular metabolism and protection [10].Camel milk contains various vitamins including vitamins C, A, E, D and B group [9, 11] in good values. These combinations of anti oxidative vitamins combats the oxidative stress in blood and body tissues including testes [12].It also contain protective proteins like as lactoferrin, lactoperoxidase and immunoglobulins. It has been acknowledged for a long time to provide a potential treatment for a series of diseases [6]. The present study was designed to evaluate the efficacy of camel milk ingestion against gamma-radiation induced abnormalities in growth, immune system, spermatogenic damage and sperm abnormalities in male albinorats.

2. Materials and Methods

2.1. Materials

Testosterone, glucose, fructosamine, acid phosphatase, lactate dehydrogenase and serum immunoglobulins (IgA, IgG and IgM)were purchased from Biodiagnostic Co., Dokki- Giza - Egypt. During the experimental period (35 days) camel (camelusdromedarius) milk samples were collected from areas around faculty of agricultural farm (Kerdasa, Giza, Egypt).

2.2. Methods

2.2.1. Animals:

Ninety six of Sprague Dawly adult male albino rats (weighting 160-170g) were utilized in the present study. The tested rats were obtained from Research Institute of Ophthalmology Giza, Egypt. The animals were housed under standard conditions for light (dark 12 h and light 12 h) fresh air ventilation, temperature 25-30 ^{o}C and 60-65% humidity. The experimental rats were allowed free access to a standard requirement diet and water. All experiments on animals were carried out in accordance with the National Institutes of Health guide for the care and use of laboratory animals (NIH publications No. 8023 revised 1978). All the studied animals were conducted in accordance with criteria of Investigation and Ethics committee of community laws governing the use of experimental animals.

2.2.2. Irradiation:

Whole-body gamma-irradiation (from 137Cs source of Radiation) was performed at the National center for Radiation Research and Technology (NCRRT), Nasr city, Cairo, Egypt, using an AECL Gamma cell-40 biological irradiator. The rats were kept into cages that were placed in the irradiated chamber of the gamma-cell, where rats were irradiated at an acute single doses of 3, 5 and 7 Gy delivered at a dose rate of 0.012 Gy/s throughout the period of irradiation (IRR).

2.2.3. Experimental design:

The studied rats were divided into 4 groups (normal healthy rats without gamma irradiation) and 12 groups (gamma-irradiated rats); 6 rats in each group as follows: G1: Normal healthy group

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ingested by saline solution as normal control. G2, G3 and G4: Normal healthy groups ingested by 2, 4 and 6 ml of camel milk/100g body weight respectively. G5, G6 and G7: (gamma-irradiated control groups): IRR groups irradiated with single doses of 3, 5 and 7Gy, respectively. G8, G9 and G10: IRR groups (3Gy single dose) treated by ingestion by 2, 4 and 6ml of camel milk/100g body weight, respectively. G11, G12 and G13: IRR groups (5Gy single dose) treated by ingestion by 2, 4 and 6 ml of camel milk/100g body weight, respectively. G14, G15 and G16: IRR groups (7Gy single dose) treated by ingestion by 2, 4 and 6 ml of camel milk/100g body weight, respectively. Rats were ingested with camel milk doses for 35days after gamma-irradiation. By the end of the experimental period (35 days) all rats were subjected to overnight fasting before being scarified by decapitation. Blood samples from each rat was collected and immediately centrifuged to separate serum. Fertility parameters, such as testosterone, glucose, fructosamine, acid phosphatase [13], and lactate dehydrogenase activities are measured [14]. Also, serumimmunoglobulins (IgA, IgG and IgM) was determined according to[15]. The epididymal contents were examined immediately after sacrificing the experimental rats. Testes and accessory gland (prostateand seminal vesicles) were removed and weighed. The tail of epididymis was opened and squeezed gently in a clean watch. The count and motility of sperm were determined according to [16]. For sperm shape analysisepididymis were excised and minced in about 10 ml of physiological saline, dispersed and filtered to exclude large tissues fragments. Smears were prepared after staining the sperms with Eosin Y (aqueous), according to the method of [17,18] at least 4000 sperms per group were assessed for morphological abnormalities. Epididymal sperm Count was determined by hemocytometer.

The obtained results were analyzed statistically using the statistical package for Social Science (SPSS, 1999) program Version 10, to find the significance between treated and normal groups.

3. Results and Discussion

The present study was carried out to evaluate harmful effects of exposures to gamma -radiation and the protective effects of camel milk ingestion on body weight gain, food intake and feed efficiency or feed Conversion. Gamma rays toxicity was carried out by exposing animals to the radiation. The pathological examination and clinical laboratory measurement should indicate the development of any pathological lesions [1]. Results of body weight gain of albino rats exposed to gamma-radiation(different doses) as well as treated by camel milk (different doses) are illustrated in Table (1).Gamma-radiation exposure showed significant effects on rat growth and these changes were doses dependent. This means that, 7Gy of gamma-radiation exposure produced body weight gain lower than those of 3Gy and 5Gy. These influences of gamma rays on growth rate may be due to the disturbances on metabolic systems [1, 19]. The treatments with camel milk ingestion into gamma -irradiated rats ameliorated the gamma-rays harmful effect and improved the body weight gain. The net body weight gain of IRR-rats is significantly less compared to normal and IRR rats treated with camel milk. Data in Table (1) summarized food intake and feed efficiency or conversion of the different experimental groups. At the end of the experimental period (35 days) the amount of food intake was insignificantly differed between each other for all the experimental groups, since the food intakes were not paralleled to growth rate of the experimental animals. Results of Table (1) showed feed efficiency of IRR-rats significantly lower than that of the normal rats. The decreased values of feed efficiency were relative and dose dependent. Whereas, the treatments with camel milk ingestion, alleviated the harmful effects of gamma-rays, on their feed efficiency. It means that groups of normal rats either

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those treated or not with camel milk showed the highest feed efficiency than other IRR-groups. 7Gy dose exposure had more inhibitory effect of food digestion than others. These results were supported the hypothesis that the digestion of diet may be inhibited in a certain manner by gamma-radiation exposures [4, 20].

3.1.Effect of gamma radiation on fertility system activity

The testes produce sperm and hormones that regulate male sexual life. The major secretary hormone is testosterone. Spermatogenesis takes approximately 70 days from the beginning of differentiation of the spermatocyte to the formation of motile sperm. The transport of the sperm through the epididymis to the ejaculatory duct requires 12 to 2l days and intrinsic sperm motility, sperm maturation during passage through the epididymis involves developments of capacity for sustained motility, modification of the structural state of the nuclear chromatin and tail organelles [21]. Many factors affect junction dynamics in germ cell movement such as phosphatases, lactate dehydrogenase, fructosamine and glucose which play a role in that process [22].

Table 1. Body weight gain, food consumption and feed efficiency of the experimental rats.

	Initial body weight (g)	Final body weight (g)	Body weight gain (g)	Feed intake (g)	Feed efficiency	Feed conversion
G1	165±0.32	226.1±3.44	61.1	392	0.156	6.41
G2	163±0.32	225.3±3.36	62.3	396	0.157	6.36
G3	166±0.20	228.7±2.90	62.7	395	0.158	6.30
G4	164±0.42	227.0±2.11	63.0	397	0.159	6.30
G5	168±0.40	221.9±3.15	53.9	400	0.135	7.42
G6	167±0.66	215.9±2.05	48.9	397	0.123	8.19
G7	166±0.43	210.1±3.24	44.1	401	0.110	9.09
G8	167±0.46	222.3±2.90	55.3	396	0.140	7.16
G9	165±0.52	222.0±3.17	57.0	397	0.144	6.96
G10	168±0.60	227.2±3.12	59.2	395	0.150	6.67
G11	166±0.46	219.2±2.10	53.2	400	0.133	7.52
G12	165±0.37	220.1±2.64	55.1	396	0.134	7.19
G13	164±0.56	220.9±2.35	56.9	397	0.143	6.98
G14	167±0.43	218.7±3.09	51.7	399	0.130	7.71
G15	168±0.49	221±2.56	53.9	397	0.134	7.46
G16	166±0.63	221.1±3.11	55.1	396	0.139	7.19

Values are means of ± SD. P value <0.05. G1, Normal Control (NC); G2, NC+2 ml milk; G3, NC+4 ml milk; G4, NC+6 ml milk; G5, Irradiated control (IRR) 3GY; G6, IRR 5Gy; G7, IRR 7Gy; G8, IRR 3Gy + 2 ml milk; G9,IRR 3Gy +4 ml milk; G10, IRR 3Gy +6 ml milk; G11, IRR 5Gy +2 ml milk; G12, IRR 5Gy +4 ml milk; G13, IRR 5Gy +6 ml milk; G14, IRR 7Gy +2 ml milk;G15, IRR 7Gy +4 ml milk; G16, IRR 7Gy +6 ml milk.

3.1.1. Serum fructosamine

The carbohydrates presented in male animals accessory secretions and seminal serumare partly free or bound to protein. Free sugar is predominantly fructose with small amount of glucose and other mono sugars are also encounters in mammalian semen. Amino sugars are mostly protein-bound but some occur free. Seminal serum contains reducing sugar, sometimes in levels

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exceeding the blood glucose level, which identified as fructose in animals [23]. Fructose is the principal seminal sugar which produces energy to drive motility in the middle piece of the sperm tail [21, 23].Results presented in Table (2) revealed that gamma-radiation exposures induced a significant decrease of fructosamine at the three doses (3,5 and 7Gy) after 35 days experimental period with the exposure to 7Gy dose of gamma rays had the highest effect.

3.1.2. Serum testosterone

The testes secrete several male sex hormones including testosterone which is more abundant than the other hormones and is considered the most significant one. Results presented in Table (2) showed gamma-radiation exposures at different doses led to significant decrease of the testosterone secretions under the effect of 7Gy dose but insignificant decrease by 3 and 5Gy doses. The ingestion treatments of camel milk reduced the gamma–rays harmful effect and were dose dependent.

3.1.3. Blood glucose

Glucose is the key molecule in carbohydrate metabolism, itis formed as a result of the digestion of complex carbohydrate and as a result of its synthesis within the body (gluconeogenesis).It is converted into glycogen by glycogenesis which is the storage form of glucose [24]. Results in Table 2 showed that in the IRR–rats there were significant increases in blood glucose levels. Camel milk treatments into IRR-rats ameliorated the abnormal influences of gamma rays and the desirable effects of camel milk were dose dependent.

3.1.4. Serum acid phosphatase activity

Acid phosphatase is found in the prostate gland and in semen in high concentration. It is found in lesser extent in bone marrow, RBCs, liver and spleen [24]. Results presented in Table (2) revealed the gamma–radiation exposures on male albino rats at the three different doses showed significant inhibition under the gamma-rays exposure. The highest effect was observed by 7Gydose. Moreover, the same trend was found by 5Gy and 3Gy doses but less than 7Gydose. The ingestion of camel milk into IRR-rats alleviated these disturbances of gamma-rays exposures and that effect was doses dependent.

3.1.5. Serum lactate dehydrogenase (LDH) activity

Most tissues contain LDH and therefore measurement of the enzymeactivity has low specificity. The LDH is presented as tetramers and one family member, LDH-c, is abundant in spermatocytes, spermatids and sperm, but also is found in modest amounts in oocytes. LDH activity was inhibited in serum after treatment with toxicant in rats [25]. LDH is important for male animal fertility but not for female and LDH-homo-tetramer is responsible for most of the LDH activity in sperm which changed under the effects of free radical oxidative stress [26]. As shown in Table (2) data revealed that lactate dehydrogenase (LDH) activity was inhibited slightly under the exposures of gamma rays. The highest effect was observed by 7Gy dose exposures and the lowest one by 3Gy dose of gamma rays. The Camel milk ingestion treatment attenuated the gamma rays harmful effect and improved the LDH activity and the influences were increased

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with the increasing of camel milk ingestion doses. That means that the changes induced by gamma rays or camel milk ingestion are dose dependent.

Table 2.Serum testosterone, glucose, fructosamine, acid phosphatase and lactate dehydrogenase activities of the experimental rats.

	Testosterone (ng/dl)	Glucose (mg/dl)	Fructosamine (Umol/L)	Acid phosphatase	Lactate dehydrogenase
G1	126.11	101.11	200.00	10.68	470.00
G2	125.78	100.24	199.76	11.00	472.11
G3	126.00	100.47	201.21	10.87	480.21
G4	125.89	101.01	202.00	10.99	476.34
G5	110.16	113.11	192.43	9.61	440.12
G6	118.32	120.23	184.11	9.02	400.00
G7	115.77	127.72	175.21	8.36	368.11
G8	125.90	111.00	191.11	10.76	435.14
G9	125.94	109.99	194.89	10.61	454.00
G10	126.00	108.26	199.67	10.46	461.21
G11	120.48	117.98	189.21	9.19	418.00
G12	122.63	116.78	190.11	9.38	427.21
G13	124.74	114.00	142.00	9.58	439.77
G14	118.56	125.06	177.43	8.61	380.14
G15	120.00	123.21	178.26	8.86	392.02
G16	122.46	121.11	181.94	9.10	401.00

G1, Normal Control (NC); G2, NC+2 ml milk; G3, NC+4 ml milk; G4, NC+6 ml milk; G5, Irradiated control (IRR) 3GY; G6, IRR 5Gy; G7, IRR 7Gy; G8, IRR 3Gy + 2 ml milk; G9,IRR 3Gy +4 ml milk; G10, IRR 3Gy +6 ml milk; G11, IRR 5Gy +2 ml milk; G12, IRR 5Gy +4 ml milk; G13, IRR 5Gy +6 ml milk; G14, IRR 7Gy +2 ml milk;G15, IRR 7Gy +4 ml milk; G16, IRR 7Gy +6 ml milk.

3.1.6. Serum immunoglobulin

Gamma radiation exposures at certain dose levels, directly induce oxidative stress like symptoms and immunosuppressive influences in albino rats [27, 28]. Immunoglobulin results of the present study presented in Table (3). Gamma radiation exposure reduced IgG, IgA and IgM contents in male albino rats blood relative to normal healthy control and the harmful effect of gamma rays was paralleled with the doses increased. The ingestion camel milk reduced this harmful effect and improved the three immunoglobulin of the immune system about near to control health group.

3.1.7. Spermatogenic damages

The male reproductive organs weight may be useful for reproductive risk assessment included the testes, epidydimis and seminal vesicles. Testes weight should be a sensitive indicator of gonadal injury. The damage to testes may be detected as a weight change at different of exposure doses [29].

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4. Relative testes weight and sperm count

The relative (weight /100g body weight) testes weights of gamma irradiated rats (IRR) were significantly decreased relative to normal healthy control (Table 4) The decreasing rates were doses dependent, that the IRR-rats exposed to 7Gy dose of gamma -rays showed more decreasing than the lower doses (3Gy and 5Gy) . Using camel milk for treatments against gamma rays effects showed that the ingestion of milk into IRR rats attenuated these disturbed influences of gamma rays exposure and camel milk treated was dose dependent. Table (4) observed the sperm examination in the experimental rats. At least 4000 sperms used to be examined pre treatment for shape abnormality. To determine the spermatogenic damage, sperms counts were also recorded, which included the deviation from healthy normal shape in tail and head. The sperm abnormalities of head included small, big, without hook, amorphous and banana shaped head. At the same trend tail abnormalities were included coiled tail. Table (4) presented the numbers of total abnormal sperm in the all experimental rat groups. The sperm counts of normal and abnormal shapes were examined. The total sperm count was reduced significantly under the exposure of gamma-rays. The highest decreasing was recorded for 7Gy-rays exposure. The same trend was observed for 3Gy and 5Gy exposures but less than the effects of 7Gy exposure. Camel milk treatments for IRR-rats resulted significant reductions against the above harmful effects of gamma rays in which the sperm counts were improved significantly but to a values less than normal healthy rats.

Table 3. Immunoglobulin of the experimental rats.

	IgG (mg/dl)	IgA (mg/dl)	IgM (mg/dl)
G1	2502	324	222
G2	2562	330	227
G3	2584	335	230
G4	2600	338	233
G5	2267	267	202
G6	2170	202	186
G7	2067	184	172
G8	2364	250	206
G9	2401	231	209
G10	2481	306	213
G11	2143	220	191
G12	2266	236	195
G13	2376	244	200
G14	2154	204	178
G15	2202	212	186
G16	2300	227	190

G1, Normal Control (NC); G2, NC+2 ml milk; G3, NC+4 ml milk; G4, NC+6 ml milk; G5, Irradiated control (IRR) 3GY; G6, IRR 5Gy; G7, IRR 7Gy; G8, IRR 3Gy + 2 ml milk; G9,IRR 3Gy +4 ml milk; G10, IRR 3Gy +6 ml milk; G11, IRR 5Gy +2 ml milk; G12, IRR 5Gy +4 ml milk; G13, IRR 5Gy +6 ml milk; G14, IRR 7Gy +2 ml milk;G15, IRR 7Gy +4 ml milk; G16, IRR 7Gy +6 ml milk.

About the motility value of the experimental animals, there was significant decrease relative to healthy rats (Table 4) for IRR-rats by 7Gy exposure, but the both gamma irradiated groups (3Gy

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and 5Gy) observed slightly significant differences to those of control value. The motility values of IRR-rats were improved by camel milk treatments and the improvements were paralleled with the ingestion amount of camel milk.

Regarding to epididymis changes, (Table 4), gamma rays exposure showed insignificant decrease relative to control. The IRR–rats with 5Gy and 7Gy showed slightly decreasing effects which returned to normal value under the treatments by camel milk. In case of seminal vesicles values, all groups of the present experiment had insignificant different values when compared with the normal healthy control as shown in Table (4).

Table 4. Spermatogenic damages of the experimental animals.

	Relative testes weight (g)	**Sperm count X 10^6/ml**	**Motility value**	**Epidydimis value (g)**	**Seminal vesicles value (g)**
G1	2.13	50.89	65.00	2.81	2.00
G2	2.11	51.12	66.01	2.87	2.01
G3	2.27	51.83	65.91	2.86	2.01
G4	2.32	52.09	65.88	2.90	2.05
G5	1.84	38.65	60.21	2.76	2.00
G6	1.76	34.34	54.13	2.62	1.98
G7	1.55	28.65	50.11	2.55	1.96
G8	1.90	40.99	60.97	2.78	1.99
G9	1.96	43.01	61.56	2.77	1.97
G10	2.04	45.64	62.74	2.80	2.01
G11	1.79	36.01	56.66	2.65	2.00
G12	1.85	33.33	58.74	2.71	1.99
G13	1.97	40.98	61.51	2.78	1.95
G14	1.65	32.17	53.24	2.59	2.00
G15	1.76	35.24	57.00	2.69	1.97
G16	1.84	38.99	60.47	2.77	1.97

G1, Normal Control (NC); G2, NC+2 ml milk; G3, NC+4 ml milk; G4, NC+6 ml milk; G5, Irradiated control (IRR) 3GY; G6, IRR 5Gy; G7, IRR 7Gy; G8, IRR 3Gy + 2 ml milk; G9,IRR 3Gy +4 ml milk; G10, IRR 3Gy +6 ml milk; G11, IRR 5Gy +2 ml milk; G12, IRR 5Gy +4 ml milk; G13, IRR 5Gy +6 ml milk; G14, IRR 7Gy +2 ml milk;G15, IRR 7Gy +4 ml milk; G16, IRR 7Gy +6 ml milk.

The frequencies of sperm morphology abnormalities of the experimental rats were presented in Table (5). Sperm abnormalities reflected insult occurring in spermatogonial stage [30]. These abnormalities include small head, banana head, amorphous head, big head and head without hook, but the abnormalities of tail included coiled tail and all presented in Table (5). The sperm abnormalities for tail and head observed the highest values for IRR-control rats. These abnormalities were attenuated by the ingestion treatments with camel milk and the attenuations were dose dependent.

Camel milk contains several anti oxidative vitamins (C, A, E and B group)[9,11,31]. These vitamins induced desirable activity against gamma rays harmful effect in animals as free radical scavenging agents. Also, camel milk contains Ca, k, Na, Fe, Mg, Mn, Zn and Cu) with Fe, Cu, Mn and K of camel milk were higher than bovine milk [9].Iron (Fe) plays an essential role in

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some biological system such as oxygen transport and storage as well and DNA Synthesis [10], Mnis used in cellular metabolism, Zn and Mn are important for functions of several enzymes [10],Ca, Pand Mg are used for bone metabolism [7]. For that, the ingestion of camel milk into IRR-rats improved the disturbed functions induced by gamma-radiation harmful effect.

Table 5. Frequencies of sperm morphological abnormalities of the experimental rats.

	Total No. of abnormal sperms	Amorphous head	Banana –shaped head	Head without hook	Big head	Small head	Abnormal tail
G1	76	19	17	18	-	12	10
G2	74	20	15	17	-	11	11
G3	70	18	16	16	-	11	9
G4	68	18	14	15	-	12	9
G5	901	266	201	111	120	102	101
G6	1082	340	228	122	128	109	105
G7	1166	420	253	131	135	117	110
G8	703	200	160	96	101	86	60
G9	594	171	131	80	91	70	51
G10	462	125	109	68	61	55	44
G11	818	241	202	105	107	96	69
G12	717	212	171	91	100	80	63
G13	578	138	150	82	78	68	52
G14	851	239	191	118	125	102	76
G15	786	229	180	107	114	88	68
G16	718	211	168	99	104	75	61

G1, Normal Control (NC); G2, NC+2 ml milk; G3, NC+4 ml milk; G4, NC+6 ml milk; G5, Irradiated control (IRR) 3GY; G6, IRR 5Gy; G7, IRR 7Gy; G8, IRR 3Gy + 2 ml milk; G9,IRR 3Gy +4 ml milk; G10, IRR 3Gy +6 ml milk; G11, IRR 5Gy +2 ml milk; G12, IRR 5Gy +4 ml milk; G13, IRR 5Gy +6 ml milk; G14, IRR 7Gy +2 ml milk;G15, IRR 7Gy +4 ml milk; G16, IRR 7Gy +6 ml milk.

Camel milk contains also other therapeutic materials including casein and whey protein. Casein is the major protein in camel milk with higher value than bovine milk [19, 32]. Camel milk casein like bovine milk contains all amino acids(either essential or non-essential).The whey protein of camel milk has high cysteine which responsible for increase GSH biosynthesis that in turn elevate the free radical scavenging which formed by gamma radiation exposure [23,33].

The antioxidant agents of camel milk (vitamins and minerals …et) can alleviate the uncontrolled synthesis of the free radical and activated oxygen species (ROS) and reduced their reaction with biological structures, those affected the immune system. The antioxidantagent of camel milk had several biological influences which showed immune stimulation alteration in metabolic activities and anti-cytotoxic activity in animals. Also, these agents can prevent genetic changes by reduction of DNA, protein, membrane and fat damage by ROS [34].

The harmful effects of gamma rays exposure on growth, immune system spermatogenic damage and sperm abnormalities of male albino rats can be arranged in a decreasing order as follows: for gamma -rays exposure, 7Gy> 5Gy> 3Gy exposure but for camel milk treatments against gamma-

rays disturbances were 6ml > 4 ml > 2 ml. Also, camel milk treatments had not toxic effects on normal healthy rats which in significantly improved these parameters.

5. Conclusions

The present data concluded that gamma radiation exposures induced significant oxidative stress damage and abnormality in growth, immune system spermatogenicity and sperm shapes. These changes were attenuated by treatments with camel milk ingestions as it constituents free radical scavenging and antioxidant activities. Finally, camel milk is truly the white gold of the desert than any other bovine milk as determined [6].

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Conflicts of Interest

The authors declare that there is no conflict of interests regarding the publication of this manuscript.

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