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EFFECT OF GAMMA-RADIATION ON HATCHABILITY AND SOME HEMATOLOGICAL AND BIOCHEMICAL PARAMETERS IN DIFFERENT STRAINS OF CHICKENS

BAKIR A.A.M.[1], I.E. EZZAT[2], N.S. ISSHAK[3], FATMA M. ABD EL-NABY[3] AND B.A. YOUSSEF[1]

1 Animal production Research Institute, Agricultural Research Centre, Ministry of Agriculture, Dokki, Giza, Egypt.

2 Applied Biological Department Nuclear Research Centre, Atomic Energy Authority.

3 Kafer El-Sheikh, Faculty of Agriculture, Tanta University.

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Abstract

A total of 864 hatching eggs of each strain of White Leghorn, Gimmiza, Mandara and El-Salam, was subjected just before incubation to gamma-irradiation at dose levels of 0, 0.25, 0.50, 1.00, 2.00,4.00, 6.00 and 8.00 Gray.

Hatchability, R.B.C's W.B.C's, Hb, P.C.V., plasma total proteins, albumin, globulin and liver enzymes including ALT, AST and alkaline phosphatase were determined at hatching.

Exposing fertilized eggs to gamma-radiation up to 4 gray improved hatchability. More than 4 gray caused hatchability depression. Mandara was the most resistant strain to the harmfull effect of the high doses of gamma-rays.

The hematological parameters such as R.B.C's count and P.C.V.% were decreased, while, W.B.C's count was increased. Strains were variable in their response to the irradiation concerning these parameters.

Plasma total proteins, albumin, globulin, G.P.T. and G.O.T. levels were significantly affected by irradiation of the fertilized eggs. Significant differences between strains were also detected.

Keywards: Gamma-radiation, chicken, hatchability and blood parameters.

INTRODUCTION

Fowl eggs are the most convenient biological system for tracing the ionizing radiation since early. Irradiation of fertile eggs seems to provide information about the biological responses that are the result of physiological alternation rather than the direct result of reproductive cell death. Moreover, exposing the fertilized eggs to low doses of ionizing radiation may activate cell division and this technique may serve as a stimulat-

ing procedure instead of traditional growth activators such as antibiotics and growth promoters.

The response of birds hatching eggs towards ionizing irradiation has been investigated from serveral decades untill now by numerous researchers including the beneficial and hazardous effects. The improvement in hatchability was achieved following the exposure of fertilized eggs before incubation to low levels of x-radiation or gamma-rays (Ezzat, *et al.,* 1996).

The radiosensitivity of the blood forming tissue was recognized when living organisms are exposed to ionozing radiation more than the permissible levels. Meky, *et al.* (1994a), found that exposing fertilized eggs of Japanese quails to different levels of Gamma-rays ranged between 25 to 800 rads has no significant effect on each of RBC's and WBC's count, PCV% and Hb concentration in hatched quails. However, the high doses of this rays caused significant increase in WBC's but, significant decrease in RBC's. Ezzat (1983), stated that plasma total proteins and globulin of broilers hatched from eggs exposed to 500-1000 rads of Gamma-rays before incubation did not significantly differe than the control. When the dose of Gamma-irradiation increased, plasma albumin significantly decreased. Meky *et al.* (1994b) reported that, exposing fertilized quail eggs to gamma-irradiation exhibited a fluctuating effect on plasma ALT and AST of hatched quails.

The aim of this study was to improve the rate of hatching in the fertilized eggs of some strains of chickens by the means of exposure to ionizing irradiation, especially with the lower doses of gamma-rays.

MATERIALS AND METHODS

This experiment was carried out to investigate the effect of gamma-rays on fertilized eggs in 4 strains of chickens, White Leghorn, Gimmiza, Mandara and El-Salam. The hatching eggs were obtained from Sakha Poultry Breeding Research Station, Animal Production Research Institute, Agricultural Research Center.

A total of 864 hatchings eggs of each strain was randomly assigned to 8 exposure treatments itemed as a, b, c, d, e, f, g and h. Each treatment contained 4 repli-

cates of 27 eggs each. The eggs were exposured just before incubation (at zero day), to different single doses of gamma-rays as shown in Table 1. The source of radiation used was 60 Co gamma-cell 200 instulated in the Physics Department of the Egyptian Atomic Energy Authority at Inshas.

Table 1. Doses of gamma-rays.

Treatments	a	b	c	d	e	f	g	h
Gamma-Irradiation doses	Zero	0.25	0.5	1.0	2.0	4.0	6.0	8.0

After completion of irradiation treatment the eggs were placed in the standered incubator at 37.8 C° and 65% relative humidity. On the 18th day of incubation, eggs were candled to determine the number of fertilized eggs. After removing the infertilized eggs and those with dead embryos, the rest were transported to the hatchary and separated in labled perforated blastic bags according to the treatments and remained to the end of the 21st day. Hatched chicks were counted and hatchability was calculated as a percentage from the fertilized eggs.

At hatching time, 12 chicks within each treatment were taken at random for blood analysis. The chicks were sacrificed and blood samples were collected indiviually in sterile sliconized tubes containing heparin as an anti-coagulant. A part of each sample was used to determine the hematological parameters, RBC's and WBC's counts, P.C.V.% and Hb. concentration. The other part of the blood sample was centrefuged to obtain the plasma for the determination of plasma total proteins, albumin and globulin concentrations. The transaminases (ALT) and (AST) and alkaline phosphatase activity levels were also determined.

The statistical analysis of data was made according to mixed model least square means (L.S.M.) and maximum Lookelihood Computer Programs of Harvey (1987). Differences among means were partitioned using Duncan's multiple range procedure (Duncan, 1955).

RESULTS AND DISCUSSION

1. Hatchability

Table 2 shows that the improvement in hatchability percent was achieved following the gamma exposure of fertilized eggs to 4 gray or less before incubation. The 1 gray exposure dose gave significantly the best hatchability being 89.06%, while, it was 79.74% in the control treatment on the average for the different strains. It seems that the 1 gray dose of gamma-rays is the most suituable stimulated dose for improving hatchability in this study. Chotinski and Tsvetanov (1983) mentioned that, exposing broiler eggs to low doses of gamma-rays (0.04-0.18 gray) preincubation, improved the vitality of hatched chicks. It is possible that ionizing radiations in low doses may act as antibiotics which may activate or accelerate the enzyme activities in the body (Meky *et al.*, 1994a), or may influence the content of DNA or the DNA itself in a useful way (Ezzat *et al.*, 1996).

Table 2. Hatchability (L.S. mean as percent of fertile eggs ± S.E.) in irradiated eggs of different strains of chickens as affected with irradiation dose.

Strain / Dose	El-Salam	Mandara	White Leghorn	Gimmiza	Overall L.S.M.
Zero gray	78.63	75.20	79.63	85.50	79.74^{B}±3.17
0.25 gray	77.50	78.80	85.03	83.31	81.16^{B}±3.17
0.5 gray	86.03	83.55	86.80	86.58	85.74^{C}±3.17
1 gray	91.15	85.33	90.13	89.63	89.06^{D}±3.17
2 gray	75.30	87.28	92.45	84.65	84.92^{C}±3.17
4 gray	67.58	84.93	85.90	79.15	81.64^{B}±3.17
6 gray	67.85	75.35	75.30	71.26	72.44^{B}±3.17
8 gray	66.78	67.98	69.98	57.86	65.65^{A}±3.17
Overall L.S.M.	77.48±2.24	79.80±2.29	83.46±2.33	79.44±2.24	80.04±1.14

S.E. for L.S.M. = 6.34

A, B, C and D overall L.S.M. within doses having different letters are significantly different ($P \leq 0.05$).

On the other hand, the decrease in hatchability percent due to exposing the fertiliezed eggs of different strains to high doses of gamma-rays, 6 and 8 gray, in this

study is in agreement well with previous reports (Shebaita *et al.*, 1979).

There were no significant differences detected in hatchability between strains. However, careful examination of the results in Table 2 showed that Gemmiza strain was the least in its response to the dose of 1 gray as compared with the other experimental strains. The hatchability of this strain increased only by 4.13% under this dose, the correspondings were 12.52%, 10.13% and 10.5% in the hatchability of El Salam, Mandara and White Leghorn, respectively.

The high doses of gamma-rays (6-8 gray) did not depresse the hatchability of Mandara strain as occurred in the other experimental strains when compared with their controls. Mandara is the most resistant experimental strain to the harmfull effect of high doses of gamma-rays concerning hatchability in this study.

2. Hematological parameters

The hematological parameters including RBC's, WBC's count, hemoglobin (Hb.) concentration (g/dl) and packed cell volume percent (P.C.V.%) in the blood of chicks of different strains hatched from fertilized eggs exposed to various Gamma-rays doses before incubation are illustrated in Tables 3-6, respectively. Gamma-rays significantly decreased RBC's count and P.C.V.%. At the same time, WBC's count significantly and Hb. concentration were insignificantly increased. The 8 gray exposure dose was responsible for the highest decrease in RBC's count (2.2), and the highest increase in both WBC's count (24.31) and hemoglobin concentration (13.53). The increasing in irradiation dose was accompained with such effects as compared to the control treatment group.

On the other hand, the Gimmiza strain was significantly much affected by exposing its fertilized eggs to gamma-rays as it registered the lowest RBC's and the highest WBC's count compared to the other experimental strains as shown in Tables 3 and 4, respectively. This significant effect was obvious also in the other strains but less sharply. In this respect, exposing the fertilized eggs of Mandra strain to gamma-rays, resulted in a significant increase in Hb. concentration (13.36) and P.C.V.% (34.03) as shown in Tables 5 and 6, respectively. Moreover, the significant effect of the interaction between strain and dose on P.C.V.% reflects the additive influence of both of them on this parameter.

The significant decrease in erythrocyte counts with increasing the applied doses of gamma-rays of this study is in agreement with Shebaita, *et al.* (1979). The reduction in RBC's count is due to the decrease or cessation of production of red cells, increased destruction or hemorrhage (Wald *et al.*, 1962). Moreover, ionizing radiations produce intravascular red cell damage and shorten red cell life span as reported by Stohlman *et al.* (1957). The obvious increase in WBC's count may be attributed to the mobilization of the leucocytes from the storage depots as a part of the early reaction to injury rather than the primary stimulation of blood formation (Bloom and Jacobson, 1984). The significant decrease in P.C.V.% noticed in this study could be due to alterations in cell numbers, cell size or dehydration of the chick embryo as a result of gamma-rays exposure (Christensen *et al.*, 1982). This decrease could be also due to reduction corpuscular volume or to an increase in plasma due to embryonic uptake of the remaining fluid contents of the egg prior to pipping. Ezzat (1983), mentioned that, any changes in blood hematology due to gamma-rays exposures in the chicken are considered a transient change and the repair mechanism takes place as quickly as possible within 2 weeks and becomes normal through 5-6 weeks post-irradiation.

Table 3. Effect of irradiation on L.S. mean ± S.E. of RBC's ($x10^6$/mm3) count in the blood of the chicks hatched from irradiated eggs of different strains of chickens.

Strain / Dose	El-Salam	Mandara	White Leghorn	Gimmiza	Overall L.S.M.
Zero gray	3.29	3.36	3.39	3.09	$3.28^{C}\pm0.09$
0.25 gray	3.00	2.90	3.18	2.55	$2.91^{B}\pm0.09$
0.5 gray	3.10	2.93	3.21	3.15	$3.10^{C}\pm0.09$
1 gray	2.73	2.97	2.97	2.81	$2.83^{B}\pm0.09$
2 gray	2.69	2.97	3.09	2.92	$2.92^{B}\pm0.09$
4 gray	2.33	2.71	2.42	2.60	$2.52^{B}\pm0.09$
6 gray	2.62	2.28	2.82	2.04	$2.44^{B}\pm0.09$
8 gray	2.01	2.50	2.19	2.10	$2.20^{A}\pm0.09$
Overall L.S.M.	$2.72^{A}\pm0.07$	$2.80^{B}\pm0.07$	$2.91^{B}\pm0.07$	$2.66^{A}\pm0.07$	2.77±0.03

S.E. for L.S.M. = 0.19

A, B, C and D overall L.S.M. within doses having different letters are significantly different ($P\leq0.05$).

Table 4. Effect of irradiation on L.S. mean values ± S.E. of WBC's ($x10^3$/mm3) count in the blood of the chicks hatched from irradiated eggs of different strains of chickens.

Strain / Dose	El-Salam	Mandara	White Leghorn	Gimmiza	Overall L.S.M.
Zero gray	13.17	14.25	14.00	14.08	13.88^{A}±0.79
0.25 gray	15.17	15.08	14.75	16.50	15.38^{A}±0.79
0.5 gray	16.42	14.33	13.58	17.17	15.38^{A}±0.79
1 gray	14.83	15.67	16.92	22.58	17.50^{B}±0.79
2 gray	16.00	16.33	18.67	18.00	17.25^{B}±0.79
4 gray	15.58	17.17	18.46	20.00	17.80^{B}±0.79
6 gray	17.75	18.58	22.17	23.42	20.48^{C}±0.79
8 gray	23.00	22.33	23.00	28.92	24.31^{D}±0.79
Overall L.S.M.	16.49^{A}±0.56	16.72^{A}±0.56	17.69^{B}±0.56	20.08^{C}±0.56	17.75±0.28

S.E. for L.S.M. = 1.57

A, B, C and D overall L.S.M. within doses having different letters are significantly different (P≤0.05).

Table 5. L.S. mean ± S.E. of Hb (gm/dl) in the blood of the chicks hatched from irradiated eggs of different strains of chickens.

Strain / Dose	El-Salam	Mandara	White Leghorn	Gimmiza	Overall L.S.M.
Zero gray	11.76	12.98	11.08	11.60	11.85±0.56
0.25 gray	10.03	13.44	11.71	11.69	11.72±0.56
0.5 gray	11.33	16.15	10.31	12.06	12.46±0.56
1 gray	11.35	14.10	13.71	12.43	12.90±0.56
2 gray	11.71	12.46	10.66	11.46	11.57±0.56
4 gray	12.12	12.69	12.50	14.19	12.87±0.56
6 gray	11.54	12.27	13.34	12.39	12.39±0.56
8 gray	14.88	12.83	11.81	14.60	13.53±0.56
Overall L.S.M.	11.84^{A}±0.40	13.36^{B}±0.40	11.89^{A}±0.40	12.55^{B}±040	12.41±0.20

S.E. for L.S.M. = 1.12

A, B, C and D overall L.S.M. within doses having different letters are significantly different (P≤0.05).

Table 6. L.S. mean ± S.E. of packed cell volume % (P.C.V.%) in the blood of the chicks hatched from irradiated eggs of different strains of chickens.

Strain / Dose	El-Salam	Mandara	White Leghorn	Gimmiza	Overall L.S.M.
Zero gray	33.92^{b}	33.75^{b}	36.83^{d}	34.67^{b}	$34.79^{C}\pm0.71$
0.25 gray	30.92^{a}	32.83^{a}	34.00^{c}	32.67^{a}	$32.60^{B}\pm0.71$
0.5 gray	31.33^{b}	33.17^{b}	27.17^{a}	31.33^{a}	$30.75^{A}\pm0.71$
1 gray	32.17^{b}	31.00^{a}	31.25^{c}	29.58^{a}	$31.00^{B}\pm0.71$
2 gray	30.42^{a}	34.42^{c}	32.33^{c}	33.17^{b}	$32.58^{B}\pm0.71$
4 gray	29.08^{a}	34.83^{c}	28.15^{a}	32.46^{a}	$31.13^{A}\pm0.71$
6 gray	34.42^{c}	35.92^{c}	32.08^{c}	31.33^{a}	$33.44^{B}\pm0.71$
8 gray	31.08^{b}	36.33^{d}	29.58^{a}	33.25^{b}	$32.56^{B}\pm0.71$
Overall L.S.M.	$31.67^{A}\pm0.50$	$34.03^{C}\pm0.50$	$31.43^{A}\pm0.50$	$32.31^{B}\pm0.50$	32.36±0.25

S.E. for L.S.M. = 1.41.

• Strain x Dose interaction is significant (P≤0.05).

a, b, c and d L.S.M within doses and strains having different letters are significantly different (P≤0.05)

A, B, C and D overall L.S.M. within doses having different letters are significantly different (P≤0.05).

3. Plasma proteins

The plasma proteins parameters including total proteins, albumin and globulin levels in the chicks of different strains hatched from fertilized eggs exposed to various gamma-rays doses before incubation are given in Tables 7-9 consequently. Gamma-rays significantly affected total proteins, albumin and globulin levels in the plasma, mostly with a reduction in their levels. The most effective exposure dose of gamma-radiation on the reduction of each of plasma total proteins, albumin and globulin was 4, 8 and 4 gray, respectively.

The present results are in agreement with the findings of Stearner and Christian (1968). The decrease in plasma total proteins is indicative of edema (Guyton, 1976). This decrease causes fluids to leave the circulatory system and localize in tissue spaces (Christensen *et al.*, 1982).

In the present study, there were significant differences between strains in their response to the exposre of their fertilized eggs to gamma-irraddiation concerning the

levels of total proteins, albumin and globulin fractions in the plasma of hatched chicks. It can be noticed that Gimmiza strain was more affected by exposing its fertilized eggs to gamma-rays as it registered the lowest levels of both plasma total proteins and globulin comparing to other strains as shown in Tables 7 and 9, respectively. However, the lowest level of plasma albumin was noticed in El-Salam strain followed by White Leghorn (Table 8).

On the other hand, Mandara strain was more resistant to the gamma-irradiation than the other studied strains as it recorded the highest levels of plasma total proteins and albumin as shown in Tables 7 and 8, respectively.

Statistical analysis proved significant interaction between strain and gamma dose only inplasma total proteins and globulin.

4. Plasma enzymes

Tables 10-12 clear the average of ALT, AST and alkaline phosphatase at hatching following the exposure of the fertilized eggs of different chicken strains to various doses of gamma-rays delivered immediately before incubation.

Table 7. L.S. mean ± S.E. of total proteins (gm/100ml) in the plasma of the chicks hatched from irradiated eggs of different strains of chickens.

Strain / Dose	El-Salam	Mandara	White Leghorn	Gimmiza	Overall L.S.M.
Zero gray	4.33^{c}	3.22^{a}	3.90^{b}	3.81^{b}	$3.81^{B}\pm0.10$
0.25 gray	3.65^{b}	3.56^{a}	3.08^{b}	4.03^{c}	$3.58^{A}\pm0.10$
0.5 gray	3.50^{b}	3.51^{a}	3.56^{b}	3.96^{b}	$3.63^{A}\pm0.10$
1 gray	3.99^{b}	3.97^{a}	4.16^{c}	3.49^{b}	$3.90^{B}\pm0.10$
2 gray	3.49^{b}	3.81^{a}	3.85^{b}	3.33^{b}	$3.62^{A}\pm0.10$
4 gray	2.95^{a}	3.89^{a}	2.75^{a}	2.81^{a}	$3.10^{A}\pm0.10$
6 gray	3.43^{b}	4.37^{b}	3.28^{b}	3.57^{b}	$3.66^{A}\pm0.10$
8 gray	3.84^{b}	3.78^{a}	3.54^{b}	3.14^{b}	$3.57^{A}\pm0.10$
Overall L.S.M.	$3.65^{B}\pm0.07$	$3.76^{B}\pm0.07$	$3.52^{A}\pm0.07$	$3.52^{A}\pm0.07$	3.61 ± 0.03

S.E. for L.S.M. = 0.19

• Strain x Dose interaction is significant ($P\leq0.05$).

a, b and c L.S.M within doses and strains having different letters are significantly different ($P\leq0.05$)

A, and B overall L.S.M. within doses having different letters are significantly different ($P\leq0.05$).

Table 8. L.S. mean ± S.E. of albumin (gm/100ml) in the plasma of the chicks hatched from irradiated eggs of different strains of chickens.

Strain / Dose	El-Salam	Mandara	White Leghorn	Gimmiza	Overall L.S.M.
Zero gray	1.51	1.92	1.98	1.79	$1.80^{B}\pm0.60$
0.25 gray	1.48	1.85	1.62	1.91	$1.72^{B}\pm0.60$
0.5 gray	1.71	1.93	1.60	1.71	$1.74^{B}\pm0.60$
1 gray	1.63	2.03	1.58	1.82	$1.76^{B}\pm0.60$
2 gray	1.58	1.94	1.39	1.80	$1.68^{B}\pm0.60$
4 gray	1.39	1.83	1.46	1.61	$1.57^{A}\pm0.60$
6 gray	1.66	2.00	1.56	1.93	$1.79^{B}\pm0.60$
8 gray	1.41	1.51	1.39	1.83	$1.53^{A}\pm0.60$
Overall L.S.M.	$1.54^{A}\pm0.05$	$1.88^{B}\pm0.05$	$1.57^{A}\pm0.05$	$1.80^{B}\pm0.05$	1.70±0.20

S.E. for L.S.M. = 0.13

A and B overall L.S.M. within doses having different letters are significantly different ($P\leq0.05$).

Table 9. L.S. mean ± S.E. of globulin (gm/100 ml) in the plasma of the chicks hatched from irradiated eggs of different strains of chickens.

Strain / Dose	El-Salam	Mandara	White Leghorn	Gimmiza	Overall L.S.M
Zero gray	2.78^{d}	1.34^{a}	1.92^{b}	2.02^{c}	$2.02^{B}\pm0.10$
0.25 gray	2.17^{c}	1.71^{b}	1.46^{a}	2.12^{c}	$1.87^{A}\pm0.10$
0.5 gray	1.79^{b}	1.58^{a}	2.01^{c}	2.17^{c}	$1.89^{A}\pm0.10$
1 gray	2.45^{c}	1.95^{b}	2.61^{c}	1.67^{b}	$2.17^{B}\pm0.10$
2 gray	1.91^{b}	1.86^{b}	2.46^{c}	1.53^{b}	$1.94^{A}\pm0.10$
4 gray	1.58^{a}	2.05^{c}	1.34^{a}	1.20^{a}	$1.54^{A}\pm0.10$
6 gray	2.02^{c}	2.37^{c}	1.64^{b}	1.64^{b}	$1.92^{A}\pm0.10$
8 gray	2.44^{c}	2.26^{c}	2.15^{c}	1.31^{a}	$2.04^{B}\pm0.10$
Overall L.S.M.	$2.14^{B}\pm0.07$	$1.89^{A}\pm0.07$	$1.95^{A}\pm0.07$	$1.71^{A}\pm0.07$	1.92±0.040

S.E. for L.S.M. = 0.2.

• Strain x Dose interaction is significant ($P\leq0.05$).

a, b, c and d L.S.M within doses and strains having different letters are significantly different ($P\leq0.05$)

A and B overall L.S.M. within doses having different letters are significantly different ($P\leq0.05$).

Table 10. L.S. mean ± S.E. of G.P.T. (I.μ/ml) in the plasma of the chicks hatched from irradiated eggs of different strains of chickens.

Strain / Dose	El-Salam	Mandara	White Leghorn	Gimmiza	Overall L.S.M.
Zero gray	13.32^{a}	17.01^{a}	20.31^{c}	16.09^{b}	$16.68^{A}\pm0.47$
0.25 gray	15.01^{b}	18.24^{b}	15.33^{a}	18.75^{c}	$16.83^{A}\pm0.47$
0.5 gray	17.57^{c}	19.23^{b}	20.13^{c}	20.05^{c}	$19.24^{B}\pm0.47$
1 gray	15.63^{b}	20.48^{c}	19.04^{b}	17.38^{b}	$18.13^{B}\pm0.47$
2 gray	14.65^{a}	17.37^{a}	14.77^{a}	17.48^{b}	$16.07^{A}\pm0.47$
4 gray	15.03^{b}	17.32^{a}	20.39^{c}	13.83^{a}	$16.64^{A}\pm0.47$
6 gray	17.06^{c}	19.25^{b}	17.28^{b}	15.04^{b}	$17.16^{B}\pm0.47$
8 gray	20.41^{d}	18.80^{b}	20.41^{c}	14.12^{a}	$18.43^{B}\pm0.47$
Overall L.S.M.	$16.08^{A}\pm0.33$	$18.46^{B}\pm0.33$	$18.46^{B}\pm0.33$	$16.59^{A}\pm0.33$	17.40±0.17

S.E. for L.S.M. = 0.93

• Strain x Dose interaction is significant (P≤0.01).

a, b and c L.S.M within doses and strains having different letters are significantly different (P≤0.05)

A and B overall L.S.M. within doses having different letters are significantly different (P≤0.05).

It was observed that the experimental doses of gamma-irradiation significantly affected the AST and ALT mostly with increasing their levels as compared with the control. The exposure to 0.5 gray of gamma-rays produced the highest AST level being 19.24, while 1 gray dose recorded the highest ALT level being 371.85. Moreover, significant differences between the experimental chicken strains in AST and ALT were also observed. In this respect, Mandara and White Leghorn strains registered the highest value for AST, and Gimmiza strain manifested the highest value for ALT. It is noticeable that, White Leghorn strain the only one which was significantly lower in ALT. In addition, the interaction effect between strain and radiation dose on both AST and ALT was significant (Tables 10 and 11). However, no significant difference was observed in alkaline phosphatase level due to the exposure of the fertilized eggs to various doses of gamma-rays (Table 12). On the other hand, significant differences between the experimental strains were noticed in alkaline phosphatase. In this respect, Gimmiza and Mandara strains were significantly higher than White Leghorn and El-Salam strains.

The increase in plasma transaminases level might be attributed to the increase of cell membrane permeability which is brought about by the action of gamma-rays (Meky *et al.*, 1994b). This increase may be also due to the change in the enzymes biosynthesis (Gerber and Altman, 1970). In addition, Stearner and Christian (1968) reported that chicken exposure to ionizaing radiation leads to permeability changes in the vascular endothelium and adjacent perivascular tissue which followed by a decrease in plasma volume which decreased blood supply to the liver, and this could lead to the release of ALT and AST enzymes from the damaged tissues. On the other hand, the same anthers added that the decreased level of AST and ALT might be due to the decrease in cell membrane permeability and/or a fall in the enzymes synthesis specially in the liver cell.

From the present study, it can be concluded that the most valuable and economical result is the obvious improvement in hatchability percent of the fertilized eggs of the experimental strains due to applying the low level of gamma-rays just before incubation. However, the direct reasons for such improvement still not clear. More and deep analysis with large number of fertilized eggs are required to manifest the real causes for such beneficial effect. Moreover, the physiological response of the chicken embryo at very early age to gamma-rays depends upon its genetic constitution.

Table 11. L.S. mean ± S.E. of G.O.T. (I.μ/ml) in the plasma of the chicks hatched from irradiated eggs of different strains of chickens.

Strain / Dose	El-Salam	Mandara	White Leghorn	Gimmiza	Overall L.S.M.
Zero gray	327.75^{a}	363.75^{a}	361.25^{b}	338.33^{a}	$347.77^{A}\pm4.81$
0.25 gray	341.25^{a}	367.08^{a}	352.50^{b}	356.25^{b}	$354.27^{A}\pm4.81$
0.5 gray	361.25^{b}	345.00^{a}	329.58^{a}	363.75^{b}	$349.9^{A}\pm4.81$
1 gray	415.83^{b}	344.92^{a}	346.25^{a}	380.41^{b}	$371.85^{B}\pm4.81$
2 gray	354.16^{a}	340.00^{a}	362.50^{b}	345.00^{a}	$350.42^{A}\pm4.81$
4 gray	355.42^{a}	361.67^{a}	349.23^{a}	374.09^{b}	$360.10^{B}\pm4.81$
6 gray	335.00^{a}	336.25^{a}	362.08^{b}	383.75^{b}	$354.27^{A}\pm4.81$
8 gray	361.25^{a}	380.83^{b}	348.75^{a}	378.75^{b}	$367.40^{B}\pm4.81$
Overall L.S.M.	$356.49^{B}\pm3.4$	$354.94^{B}\pm3.4$	$351.52^{A}\pm3.4$	$365.04^{B}\pm3.4$	357.00 ± 1.70

S.E. for L.S.M. = 9.62

• Strain x Dose interaction is significant ($P\leq0.01$).

a and b L.S.M within doses and strains having different letters are significantly different ($P\leq0.05$)

A and B overall L.S.M. within doses having different letters are significantly different ($P\leq0.05$).

Table 12. L.S. mean ± S.E. of alkaline phosphatase (I.μ/ml) in the plasma of the chicks hatched from irradiated eggs of different strains of chickens.

Strain / Dose	El-Salam	Mandara	White Leghorn	Gimmiza	Overall L.S.M.
Zero gray	49.77	61.67	53.01	61.96	56.67±2.31
0.25 gray	51.28	52.59	54.31	60.36	54.64±2.31
0.5 gray	55.27	58.71	55.17	55.41	56.14±2.31
1 gray	55.83	54.93	52.80	58.46	55.50±2.31
2 gray	50.18	57.54	54.04	58.85	55.15±2.31
4 gray	55.55	53.69	57.00	58.65	56.22±2.31
6 gray	48.68	62.84	51.98	63.59	56.77±2.31
8 gray	53.48	63.18	54.79	54.79	56.56±2.31
Overall L.S.M.	52.51^{A}±1.63	58.15^{B}±1.63	54.14^{A}±1.63	59.01^{B}±1.63	55.95±0.82

S.E. for L.S.M values = 4.62.

A and B overall L.S.M. within strains having different letters are significantly different ($P \leq 0.05$).

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تأثير أشعة جاما على نسبة الفقس وبعض مقاييس الدم والكيمياء الحيوية له فى بعض سلالات الدجاج المختلفة

على عبد المؤمن بكير[١] ، إسماعيل عز الدين عزت[٢] ، نبيه صبرى إسحق[٣] ، فاطمة عبد النبى[٣] ، بلال عبد الرحيم يوسف[١]

١ *معهد بحوث الإنتاج الحيوانى، مركز البحوث الزراعية، وزارة الزراعة، الدقى، جيزة، مصر.*
٢ *قسم التطبيقات البيولوجية، مركز البحوث النووية، هيئة الطاقة الذرية.*
٣ *كلية الزراعة، كفر الشيخ، جامعة طنطا.*

استخدم فى هذه الدراسة ٨٦٤ بيضة تفريخ من كل سلالة من سلالات دجاج اللجهورن الأبيض والجميزة والمندرة والسلام حيث تم تعريض البيض قبل تفريخه مباشرة إلى أشعة جاما لمرة واحدة عند مستوى صفر، ٠,٠٢٥، ٠,٠٥٠، ٠,١٠٠، ٠,٢٠٠، ٠,٤٠٠، ٠,٦٠٠، ٠,٨ جراى.

وعند الفقس تم تقدير كل من نسبة الفقس وعدد كرات الدم الحمراء وعدد كرات الدم البيضاء و مستوى كل من البروتين الكلى والألبيومين والجلوبيولين وإنزيمات الكبد فى بلازما دم الكتاكيت الفاقسة. وقد تم التحصل على النتائج التالية:

١- تعريض البيض إلى أشعة جاما حتى مستوى ٤ جراى أدى إلى تحسين نسبة الفقس.

٢- الجرعات الأعلى من ٤ جراى أدت إلى حدوث إنخفاض فى نسبة الفقس.

٣- أظهرت سلالة المندرة أنها أكثر تحملا للجرعات المرتفعة من أشعة جاما مقارنة بالسلالات الأخرى.

٤- حدث إنخفاض فى عدد كرات الدم الحمراء ونسبة الهيماتوكريت، بينما إرتفع عدد كرات الدم البيضاء نتيجة التشعيع، وإختلفت السلالات فيما بينها فى درجة تحملها للإشعاع بالنسبة لهذه الصفات.

٥- تأثرت مستويات البروتينات الكلية والألبيومين والجلوبيولين وإنزيمات الكبد فى البلازما تأثرا معنويا بأشعة جاما، وكان هناك إختلافا معنويا بين السلالات فى هذه الصفات.