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## X-Rays Induced Modifications in the Density and Surface Tension of Albino Rat's Blood

Ravi Jain<sup>1</sup>, Sharique A Ali<sup>2</sup>, Syed Nasir Ali<sup>3</sup>

1. Department of Applied Science, Samrat Ashok Technological Institute, Vidisha, M.P.

2. Department of Biotechnology, Saifia College of Science & Education, Bhopal, M.P.

3. Department of Physics, Saifia College of Science & Education, Bhopal, M.P.

### Abstract:-

A study has been carried out to analyze the effects of X rays radiation to the modification in the density and surface tension of Albino rat's blood. The value of blood density found for controlled animals was  $1.117 \pm 0.007$  gram per cm, while for fourth time exposure animals, the value was  $0.992 \pm 0.001$  gram per cm. Similarly the value of blood surface tension for controlled animals was  $52.996 \pm 0.678$  Dyne per cm, while for fourth time exposure animals, the value was  $51.689 \pm 0.151$  Dyne per cm. A decrease in the value of density and surface of blood were observed.

### Key words:-

Surface tension, Density, Albino rat's, X ray radiation, Blood.

### Introduction:-

Radiations have been associated with men's since ages. A large number of studies were conducted on the adverse health effects of radiation on man and animals. (Kelner 1949 a, Kelner 1949 b, Novick 1949, Blum et al 1950, Bawden kleczkask 1952). Several extensive studies describe extensive cellular damage due to excessive exposure to X rays. They can induce cell death causing loss of reproductive integrity that is capacity of sustained cell division and induction of chromosomes breaks, leading to serious consequences for the cells, because chromosomes carrying the genes. (Kelner 1953, Lea 1956, Witkin 1969, Attri and morkarjee 1981, Bhatnagar et al 1983).

Throughout life human being are continuously exposed to different type of electromagnetic radiations, including natural and manmade. More is known about the actual as well as the late somatic effect of ionization radiation, then about any other environmental agent, yet many gap remain in our knowledge, concerning their effects. (Saxena et al 1998, Goyal et al 1998, Ahuja et al 1999). The knowledge of physical, chemical and biological properties and its dynamics are of great importance.

The physical properties of blood like density, Surface tension, Viscosity are of important parameters, which are affected during x rays exposure. The existing data demonstrated the blood density range between  $1.043 - 1.060$  gm per  $\text{cm}^3$ . (Kelner T 1989, Johar R.S. et al. 1993, Dominic J. et.al. 2015). Blood surface tension is one of the crucial and physical blood parameter, affects many functions of the human body. The surface tension of the normal blood serum is found to be 52 Dyne per cm at  $20^\circ\text{C}$  and 48 Dyne per cm at  $37^\circ\text{C}$ . (Henry N.H. et.al. 1929, Wesolowski A 2019). Over the time the human body undergoes different natural thermal conditions, therefore the knowledge of about density and temperature dependence of blood surface tension is important.

The usefulness of surface tension as a parameter in forensic experiments was evaluated by various authors. Raymond et al 1996 used surface tension among other physical parameters (Viscosity and Density) to support the use of porcine blood is representing the freshly spilled human blood in crime related cases. The influence of surface tension and its relation to the blood/ bile ethanol ratio were evaluated by Winek et al, (1983).The whole blood surface tension of 15 healthy subjects recorded by ring method was investigated in temperature range from 20<sup>0</sup> C to 40<sup>0</sup> C. The value of surface tension had found decrease as the temperature increased. (Rosina J et al, 2007).

The present study shows the variation in the density and surface tension during the chronic exposure of x rays radiation on the blood of Albino rats.

**Materials and methods:-**

A well developed colony of same strain and species of first and second generation white male Albino rats were used for the experiments. These animals were maintained on standard balanced diet..The animals were divided into five groups consisting of four male rats in each group. The first group was maintained unexposed to X-rays radiation and treated as control group. The second group was single exposed animals. The third group was the two times exposed animals at the interval of ten days. The fourth group was the three times exposed animals at the interval of ten days. The fifth group was the fore times exposed animals at the interval of ten days. (Jain R, 2003).

The rats were anesthetized with chloroform. Blood specimen from controlled and exposed group were drawn and collected directly into appropriate EDTA vials.

The density estimation was done by specific gravity bottle. The surface tension estimation was done by capillary rise method. The formula used for density is  $d = [Weight\ of\ the\ blood\ (W3 - W1) / Weight\ of\ the\ equal\ volume\ of\ the\ water\ (W2 - W1)] * Density\ of\ the\ water\ at\ 20^{\circ}C$ .

Where W1=weight of the empty density bottle, W2=Weight of the bottle with water, W3= weight of the bottle with blood. (Jain R, 2003)

The formula used for surface tension is as follows.

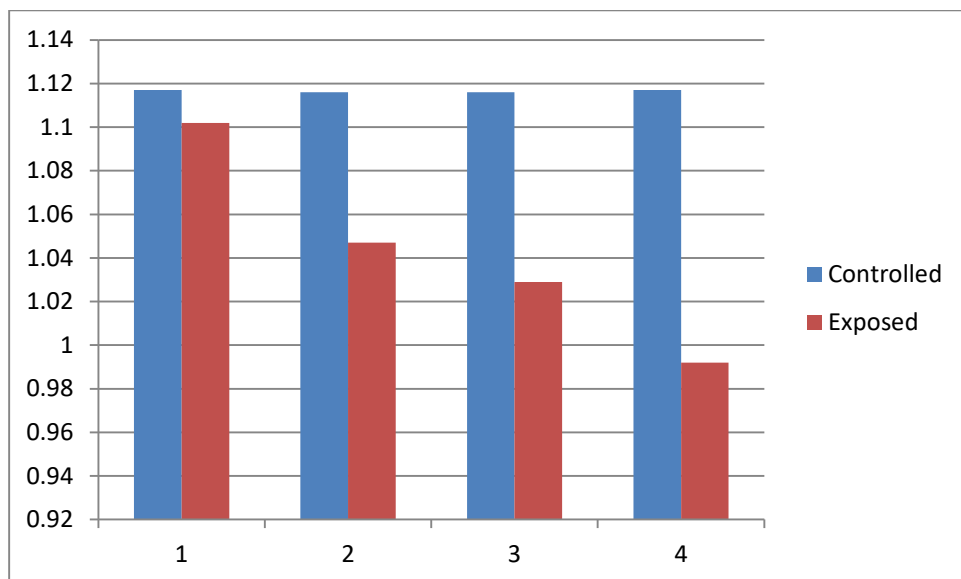
$T = rhdg/2$ . Where r is the radius of the capillary tube, h is the height of the meniscus of liquid, d is the density of the blood at constant temperature(20<sup>0</sup>C) and g is the acceleration due to gravity.(Jain R, 2003).

**Table No.1:-**Density of controlled and exposed animals

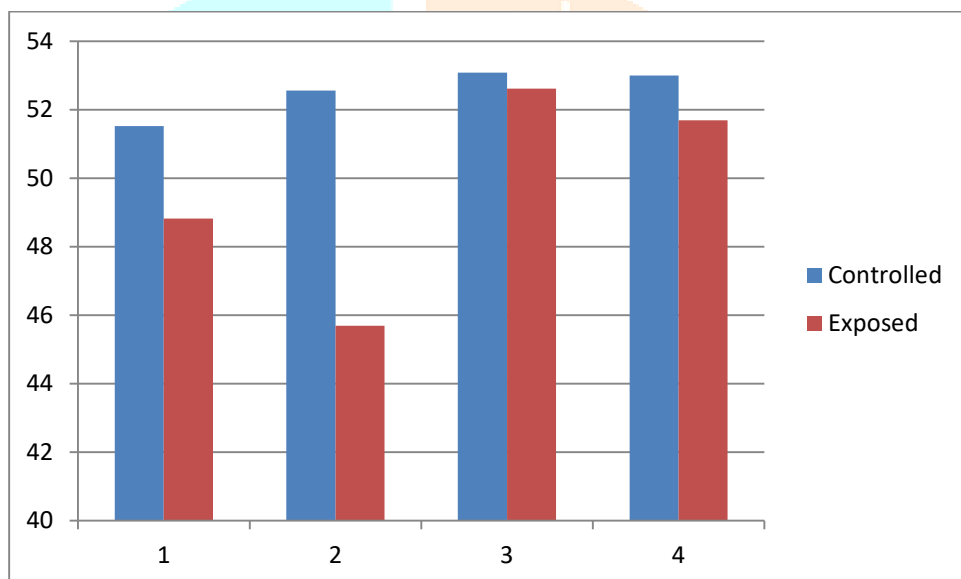
S.No.	Type of exposure	I <sup>st</sup> exposed subject	II <sup>nd</sup> exposed subject(After 10 days of I <sup>st</sup> exposure)	III <sup>rd</sup> exposed subject(After 10 days of II <sup>nd</sup> exposure)	IV <sup>th</sup> exposed subject(After 10 days of III <sup>rd</sup> exposure)
1	Controlled subject (Gm per cm <sup>3</sup> )	1.103-1.140 Mean=1.117±0.007	1.103-1.142 Mean=1.116±0.007	1.101-1.139 Mean=1.116±0.007	1.102-1.141 Mean=1.117±0.007
2	Exposed subject (Gm per cm <sup>3</sup> )	1.084-1.116 Mean=1.102±0.006	1.038-1.059 Mean=1.047±0.004	0.997-1.106 Mean=1.029±0.022	0.989-0.995 Mean=0.992±0.001

**Table No.2:-**Surface tension of controlled and exposed animals

S.No.	Type of exposure	I <sup>st</sup> exposed subject	II <sup>nd</sup> exposed subject(After 10 days of I <sup>st</sup> exposure)	III <sup>rd</sup> exposed subject(After 10 days of II <sup>nd</sup> exposure)	IV <sup>th</sup> exposed subject(After 10 days of III <sup>rd</sup> exposure)
1	Controlled subject (Dyne per cm)	49.317-53.821 Mean=51.524±0.797	50.398-54.559 Mean=52.553±0.745	51.305-55.057 Mean=53.080±0.681	51.325-53.111 Mean=52.996±0.678
2	Exposed subject (Dyne per cm)	45.998-51.867 Mean=48.823±1.051	43.970-46.065 Mean=45.693±0.415	51.784-52.511 Mean=52.617±0.274	51.247-51.774 Mean=51.689±0.151



**Graph No.1:-** Dependence of blood density on x rays radiations.



**Graph No.2:-** Dependence of blood surface tension on x rays radiations.

**Result and Discussion:-**

Table No. 1 shows the changes in the levels of density in the Albino rat’s blood, exposed to diagnostic range of X rays along with controlled unexposed rats. Density parameter shows the quality of blood i.e. lighter or denser position of blood after exposure. It is very important parameter in the circulation point of view.

It was found that the density level of blood after first x rays exposed rats ranged between 1.084-1.116 gm per cm<sup>3</sup>. On the other hand the control rats had the density range of 1.103 – 1.140 gm per cm<sup>3</sup>. the average being 1.117±0.006 gm per cm<sup>3</sup>. Thus it is evident that there is a deviation of 1.35% in the I<sup>st</sup> x rays exposed subject from the control non x rays exposed rats. (Table No. 1, Graph No.1).

In the next group of rats who were exposed to two times x radiation, it was found that density level in II<sup>nd</sup> time x rays exposure decreased from a control level 1.116 gm per cm<sup>3</sup> to 1.047 gm per cm<sup>3</sup> in exposed subjects. In terms of absolute percentage decrease the value was 6.18%, which is quite greater than the I<sup>st</sup> x rays exposed group.

Similarly in the third times x rays exposed group, the decrease in the density level was found from 1.116 to 1.029 gm per cm<sup>3</sup>. Percentwise the decrease was 7.80%. In the four time x rays exposed group, the decrease in the density level was maximum from 1.117 to 0.992 gm per cm<sup>3</sup>. Percentwise the decrease was 10.74%, which is quite deviated then the unexposed control value. (Table No. 1, Graph No.1) Thus from the present data, it is evident that the density levels decreased gradually in response to the x rays. The data also reveal that the decrease in density level is exposure dependent.

The surface tension of liquid increase with soluble impurities while contamination of liquid surface by impurities decreases the surface tension. In present study, the surface tension of blood in the first exposure ranged between 45.998 to 51.867 dyne per cm. The average value was found to be 48.823±1.051 dyne per cm. On the other hand the control subject had surface tension in the range of 49.317 to 53.821 dyne per cm. Thus the average value being 51.524± 0.797. (Table No. 2, Graph No.2)

The surface tension of blood in the second exposure ranged between 50.398-54.559 dyne per cm. The average value was found to be 52.553±0.745 dyne per cm. On the other hand the control subject had surface tension in the range of 43.970 to 46.065 dyne per cm. Thus the average value being 45.693±0.415.

The surface tension of blood in the third exposure ranged between 51.784 to 52.511 dyne per cm. The average value was found to be 52.617±0.274 dyne per cm. On the other hand the control subject had surface tension in the range of 51.305 to 55.057 dyne per cm. Thus the average value being 53.080± 0.681.

The surface tension of blood in the fourth exposure ranged between 51.247 to 51.774 dyne per cm. The average value was found to be 51.689±0.010 dyne per cm. On the other hand the control subject had surface tension in the range of 51.325 to 53.111 dyne per cm. Thus the average value being 52.996± 0.678. (Table No. 2, Graph No.2)

Knowledge of normal physiological value of blood surface tension seems to be very important. In the entire experimental group the decrease in the density of blood had found strongly exposure dependent. The circulatory cell population had decreased because of X rays radiations. Recently, The study of Manunta et. al., 2021, shows that the blood density is somehow proportional to haematocrit. They found that the changes in the circulating cell population in COVID-19 patients may affect the total protein concentration of blood, may determine a variation in the blood density and could inhibit an optimal mononuclear cell separation through the density gradient. Therefore the simplest explanation for the modification of the buoyant density of PBMCs is the result of massive alternation in the cell composition of the circulatory blood that occurs in the COVID-19 patients.

There is evidence that blood surface tension shows higher for patients with acute myocardial infarction compared to the control group. (Esitesvili and msuknishvili, 2002). The suggestion given by Roshina J et al, 2007 show that the blood surface tension monitoring could for the adjustment of the therapeutic levels of rheological pharmaceuticals. Our study show that the every after ten days of x-rays exposure , the value of surface tension had found decrease as compared to the controlled group, suggest that lowered the value of surface tension, the force applied by the heart to pump the blood will altered and hence the pressure will also altered.

### **Conclusion:-**

The value of blood density found for controlled animals was 1.117±0.007 gram per cm, while for fourth time exposure animals, the value was 0.992±0.001 gram per cm. Similarly the value of blood surface tension for controlled animals was 52.996±0.678 Dyne per cm, while for fourth time exposure animals, the value was 51.689±0.151 Dyne per cm. A decrease in the value of density and surface of blood were observed. Our study show that the every after ten days of x-rays exposure , the value of surface tension had found decrease as compared to the controlled group, suggest that lowered the value of surface tension, the force applied by the heart to pump the blood will altered and hence the pressure will also altered.

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