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### EFFECT OF MICROWAVE EXPOSED MICE FEED ON THE HEMATOLOGICAL PARAMETERS OF SWISS ALBINO MICE.

PRIYANKA RAGHUVANSHI, PRIYANKA MATHUR, RUCHISHA SETHI, VIDHI KUMAWAT,  
KUSUM CHOUDHARY

Department of Life Sciences, The IIS University, Jaipur.

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**Abstract:** Microwave is recent technological advancement which has reduced cooking time considerably. There are certain reservations related to use of microwave oven. In the present study mice were given the microwave exposed food for as their normal dietary intake for 2 weeks, 3 weeks 4 weeks and 4 weeks recovery (for 4 weeks microwaved food and 4 weeks normal food) after which autopsies were performed. Animals were divided into 3 groups namely Experimental, Control, and Sham. After the period of feeding the haematological profiles were investigated. The results revealed statistically significant decrease of red blood cells, haemoglobin, packed cell volume and increase of the white blood cells.

**Keywords:** Microwave Oven, Haematological profile, RBC, WBC



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Corresponding Author: Ms. PRIYANKA RAGHUVANSHI

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## INTRODUCTION

The electronic gadgets and technological advancements made human life easier and has also led to increase in dependence of man on these gadgets by many folds. These modern gadgets are based on use of electromagnetic radiations. It has a great impact on our lifestyle patterns. One such technology is microwave technology. Microwave (non-ionizing radiation) technology, widely used in national defense, industrial and agricultural production, transportation, communications, information industry, medical and scientific research fields. Microwave ovens heat food through a process of creating molecular friction, but this same molecular friction quickly destroys the delicate molecules of vitamins and phytonutrients (plant medicines) naturally found in foods<sup>(1)</sup>.

George et al<sup>2</sup> have reported that microwave exposure causes a higher degree of protein unfolding than usual thermal stress at the same temperature. Lita Lee in *Lancet* medical journal reported that heating baby formula in a microwave changed its chemistry. Microwaving converted some trans-aminoacids into synthetic substances similar to unhealthy trans-fatty acids; one amino acid, L-proline, reportedly converted to a substance that's reputed to be toxic to the nervous system and kidneys.<sup>3</sup> Furthermore the histological studies on microwaved broccoli and carrots revealed deformed molecular structures of

nutrients by high-frequency reversal of polarity, to the extent to the point of destroying the cell walls. This microwaves-induced reversal of the polarity causes the cells in the nutrients to become destructively polarized, possibly allowing for the creation of free radicals<sup>(4)</sup>. Switzerland and Russia report pointed towards instant effect of ingestion of microwave food on blood. Urine and blood tests are probably the most common toxicology tests used today. Blood parameters are probably the more rapid and detectable variations under stress and are useful in assessing the health<sup>5</sup>. It also acts as a pathological reflector of the whole body.<sup>6</sup>

## MATERIAL AND METHOD

Sexually mature male mice (*Mus musculus*) weighing between 25 to 30 g were randomly selected. They were housed separately in plastic cages under controlled condition of temperature and light. The animals were divided into 3 groups Control, Sham and Experimental. The experimental mice were given food pellets (Hindustan Lever Pvt. Ltd.) exposed in microwave at 320°watt for 10 minutes. The sham group was given the normal food in low quantity whereas control was given normal food in sufficient amount. The experimental group was administered with fixed amount of microwave cooked mice pellets daily for 2 week (Experiment 1), 3 week (Experiment 2), 4 weeks (Experiment 3). The recovery group (Experiment 4) was given the

microwave pellets for 4 weeks and after that they were given normal mice fed for 4 weeks. After the termination of each of experimentation group, the treated and control males were sacrificed by cervical dislocation and the blood was collected. Blood samples were emptied into blood sampling bottle treated with ethylene diamine tetra-acetic acid (EDTA) as an anticoagulant.

#### **Determination of haematological parameters**

The haematological parameters evaluated were the following: red blood cell count (RBC), packed cell volume (PCV), haemoglobin value (Hb), absolute and differential white blood cell (WBC) counts and blood platelet number, which were measured according to standard protocols using the method described by Dacie and Lewis<sup>7</sup>. For Red blood cell (RBC) count blood was diluted to 1:200 with Hayem's fluid and then counted with a Neubauer counting chamber under a light microscope. The counting of total white blood cells was done using a diluting fluid in a ratio of 1:20. The conventional method (Sahli's haemoglobinometer) was employed for estimation of haemoglobin (Hb) content of

the blood. PCV was determined using microcapillary tubes and centrifuging it.

The experimental protocol was approved by Institutional Animal Ethical Committee (IAEC) of International College for Girls, Jaipur with CPCSEA Registration No1689/PO/a/13/CPCSEA.

Data were expressed as mean  $\pm$  standard Error (SE) and analysed by two-way analysis of variance (ANOVA) for groups and weeks of treatment.

#### **Result**

Significant decrease in RBC, PCV, Hemoglobin Concentration occurred at all autopsy interval i.e. 2 week, 3 week and 4 week whereas WBC showed initial decrease followed by increase. The recovery group in sham shows significant increase whereas experimental group indicate the sign of recovery. Two-way ANOVA shows a significant effect of the period of feeding of microwave exposed food on the following parameters: red blood cells ( $F=56$ ,  $p<0.0001$ ); white blood cells ( $F=3.58$ ,  $p<0.0048$ ); PCV ( $F=5.84$ ,  $p<0.0001$ ); haemoglobin ( $F=6.28$ ,  $p<0.0001$ ). (Table 1)

**Table 1: Effect on Various Hematological Parameter of Male Swiss Albino Mice Fed on the Food Exposed to Microwave Radiations**

Parameters	Autopsy Interval	Control	Sham	Experimental	F	P
<b>RBC</b> million/mm <sup>3</sup>	2 week	3.85±.02	2.78±.07	2.86±.02	56	0.0001
	3 Week	3.77±.03	2.72±.05	2.66±.06		
	4 Week	3.68±.03	2.7±.04	2.62±.05		
	4 Week Recovery	3±.25	2.68±.06	3.14±.02		
<b>WBC</b> / mm <sup>3</sup>	2 week	4950±782.62	4060±.107.7	3140±269.44	3.58	0.0048
	3 Week	4233±525.15	4280±200	4840±260		
	4 Week	4200±527.26	4340±240.49	4880±220		
	4 Week Recovery	3900±876.36	4140±194.94	3960±766.81		
<b>PCV</b> %	2 week	36.83±.7	23.8±.73	2.86±.1.47	5.84	0.0001
	3 Week	36±1	24.2±.58	22.6±.06		
	4 Week	35.5±.81	24.4±.6	22.6±.06		
	4 Week Recovery	30±2	23±1.22	28.2±.73		
<b>Hemoglobin</b> gm%	2 week	11.82±.03	8.54±.59	10.1±.49	6.28	0.0001
	3 Week	11.53±.15	8.28±.2	8.1±.2		
	4 Week	11.47±.13	8.2±.2	7.7±.37		
	4 Week Recovery	11.37±.06	8.02±.12	9.56±.28		

## Discussion

Okeke et al.<sup>8</sup> noted that haematological parameters have been associated with health indices and are of diagnostic importance in the routine chemical evaluation of state of health. Yang<sup>9</sup> stated the relationship of these indices to the evolution and ecological adaptation of animals to the environment. They may be of assistance in understanding adaptation mechanisms and evolutionary processes<sup>10</sup>.

The transportation of oxygen into the tissues of body is main function of RBC. Shukla et al<sup>11</sup> asserted that any pathological or physiological condition affects the RBC also alters its function and this may be detrimental to the body. Anemia is known to result due to decreased production and/or increased loss or destruction of RBC<sup>12</sup> and this disease is characterized by the reduction in the concentration of Hemoglobin, circulating RBC and its indices (MCV, MCH and MCHC) and PCV per unit of the peripheral blood below the normal<sup>13,14</sup>. The anemia may be due to the inhibition of erythropoiesis and hemosynthesis and to an increase in the rate of erythrocytes destruction in hemopoietic organs.

The total numbers of WBCs, the haemoglobin content, and haematocrit value registered significant decreases ( $P < 0.001$ ) indicating the haemotoxicity. During the physiological dysfunction of the haemopoietic system the decreases in total erythrocyte count and haemoglobin concentration are often accompanied by

decreases in haematocrit<sup>15</sup>. The decrease in haematocrit is attributable to the reduction in RBC count caused either destruction or reduction in size this is supported by the decrease in haematocrit and mean value of haemoglobin<sup>16</sup>.

The reduced Hb, PCV and RBC could mean that incorporation of haemoglobin into red blood cells, the morphology and osmotic fragility of the red blood cells were altered<sup>17,18</sup>. The possible mechanism of the toxicity could be either microwave exposed food induces oxidative stress in blood cells<sup>19</sup> or may accrue in cell membranes and disturb structure of membrane<sup>20</sup> which could lead to lysis of erythrocytes as a result their number would be low in circulation. Low Hb concentration could be due to enhanced Hb destruction or decreased Hb synthesis<sup>21</sup>. Increased activity of bone marrow or haemolysis could lead to impaired Hb synthesis<sup>22</sup>. Microwave food induces oxidative stress reflected by low LPO and GSH<sup>23</sup>. The decrease in the value of RBC, HB and PCV may have severe consequence which results in the dilution of blood caused by the fluid of cells from body stores<sup>24</sup>.

The rate at which individual and or groups of rats metabolized the toxicant is age-dependent thus the variation with control group is observed at different autopsy interval<sup>25</sup>.

The toxicity of any compound depends on many factors, such as the chemical and physical form of the compound, route of

administration, dose and duration of exposure, time elapsed after exposure, dietary level of the interacting elements, physiological conditions (pregnancy, lactation etc.), nutritional status, age and sex of the exposed individuals<sup>26,27,28</sup>

Thus experimental animal shows haemotoxicity under the effect of consumption of microwave exposed food. The study suggests microwave exposed food continuous feeding cause's recoverable changes in blood level. The result of the study is applicable if animal intake only microwave exposed food.

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