

Original Research Article

EFFECTS OF THE INGESTION OF *MICROWAVED* FOOD ITEMS ON SOME HAEMATOLOGICAL PARAMETERS IN ALBINO WISTAR RATS.

ABSTRACT

Aims: To determine if there is a correlation between the ingestion of *microwaved* food items and haematological parameters.

Study Design: Twenty male albino rats weighing between 180-200g were used for the study and randomly assigned into 2 study groups of 10 animals each.

Place and Duration of Study: Federal University of Technology, Owerri, Nigeria, between September 2013 and December 2013.

Methodology: Group 2 animals were fed on *microwaved* food items while group 1 animals were fed on similar *unmicrowaved* food items for 3 months. Blood samples of the 2 groups were analyzed in the laboratory.

Results: A significant decrease ($P = .05$) in the means of RBC (Red Blood Cell), WBC (White Blood Cell), PCV (Packed Cell Volume), Hb (Blood Haemoglobin), lymphocytes, monocytes and eosinophils counts of group 2 animals was shown when compared to group 1 animals. The differential WBC results showed a significant increase ($P = .05$) in neutrophils count in group 2 when compared to group 1. There was no significant decrease ($P = .05$) in basophils count in group 2 when compared to group 1.

Conclusion: These results suggest that the ingestion of *microwaved* food items affects some haematological parameters.

Keywords: Albino wistar rats; differential; haematological parameters; microwave.

1. INTRODUCTION

Microwaves which are like light waves or radio waves occupy a part of the electromagnetic spectrum of energy, they are very short waves and travel at the speed of light (3×10^8 m/s). Microwaves are essentially used for cooking foods at a frequency of 2450×10^6 Hz [1]. Radiation is energy that comes from a source and travels through space and may be able to penetrate various materials.

Radiation can cause ionization which is what takes place when a neutral atom gains or loses electrons. Non-Ionizing radiation (NIR) refers to radiative energy that, instead of producing charged ions when passing through matter, has sufficient energy only for excitation. Nevertheless, it is known to cause biological effects [2]. The ability of NIR to penetrate an object and the subsequent effects are very much frequency dependant. Near ultraviolet, visible light, infrared, microwave, radio waves and low-frequency radio frequency are all examples of non-ionizing radiation. By contrast, far ultraviolet light, x-rays, gamma-rays and all particle radiation from radioactive decay are regarded as ionizing. Traditional sources of cooking heat use waves of infrared frequency to heat food, either directly as in grilling or broiling or indirectly, where the fire heats the pot and the pot, by direct contact, heats the food. Infrared frequency (what we normally refer to as heat) cooks the food relatively gently, actually shaking its molecules in a more or less agitated way, according to the degree of heat applied.

Microwave ovens are different. The alternating microwave electric current generated by the magnetron in every microwave oven forces the food molecules to rotate at the frequency of 1-100

billion times per second. The friction from this violent, thrashing motion tears at the food, vitamin and enzyme molecules, destroying, for instance, their cells' walls, while heating them savagely and changing their shape [3]. Besides, no indirect heating of pots or plates is possible because hard materials resist rotation of their molecules. The pot or plate is only heated from direct contact with the heated *microwaved* food. A microwave oven changes the molecular structure of the food by the process of radiation with the use of a tube called magnetron which converts electrical energy to microwave energy. Microwaving causes adverse effects in foods which include the destruction of nutrients [4]. Microwave cooking is rapid and this is achieved by passing high frequency waves from a magnetic iron through the food or liquid to be heated. Water absorbs microwave energy very well, so foods with high water content cook more rapidly. On the other hand, fat absorbs microwave energy more slowly, so foods consisting of mixture of fat and water cook unevenly. *Microwaved* foods contain deformed molecules not present in foods cooked conventionally [1]. Naturally occurring amino acids have been observed to undergo isomeric changes as well as transformation into toxic forms, under the impact of microwaves produced in ovens [5]. Ingestion of food cooked in a microwave oven causes abnormal changes in the blood and physiology of humans. These changes include a decrease in all haemoglobin and cholesterol values especially the ratio of the High-Density Lipo-protein (HDL - good cholesterol) and the Low-Density Lipo-protein (LDL – bad cholesterol) values. Lymphocytes show a more distinct short term decrease [6]. Each of these indicators points at degeneration. Since we are what we eat, the creation of abnormalities in our food creates abnormalities in us. Though the biological hazards associated with microwave cooking have been reported, no laboratory measurements have been made, to ascertain if there is a correlation between the ingestion of *microwaved* food items and haematological parameters, using albino wistar rat specimens. The present study is considered significant because knowledge of any possible correlation will help to assess how much harm modern cooking facilities such as the microwave oven has caused. The objective of this work is essentially to determine if there is a correlation between the ingestion of *microwaved* food items and haematological parameters.

2. MATERIALS AND METHODS

2.1 Experimental Design

Twenty male albino wistar rats weighing between 180-200g were obtained from the Department of Veterinary Medicine, University of Nigeria. All animals were clinically normal on arrival. They were acclimatized for two weeks, during which they were placed on standard diet (Top Feed). Subsequently, the rats were divided into 2 groups. The exposed group were fed on *microwaved* food items while the control group were fed on similar *unmicrowaved* food items. The microwave oven used in this study was the DAEWOO oven with model number KOG-6C2B; its power input was 1200W while the power output was 800W. After 3 months of feeding, the animals from each group were anaesthetised using chloroform and blood obtained by cardiac puncture for analysis.

2.2 Haematological Estimations

The blood samples collected into Ethyl Diathamine (EDTA) bottles were used for determination of haematological parameters. Total RBC and WBC counts were estimated according to the visual method of [7]. The percentage PCV was determined according to the haematocrit method of [8], the Hb concentration was estimated according to the cyanomethaemoglobin method of [8] while the differential white blood cell counts were estimated using the method of [9].

3. RESULTS AND DISCUSSION

This study is aimed at evaluating the effects of the ingestion of *microwaved* foods on haematological parameters such as RBC and WBC counts, PCV, Hb concentration and differential WBC counts. Table (1) shows the RBC Count, WBC Count, PCV and Hb Conc. of rat specimens. The significant

decrease ($P = .05$) in RBC count in the exposed group may be due to failure of erythropoietin production [10]. This could lead to anaemia. The PCV also known as haematocrit represents the percentage of RBC in blood. There is a direct relationship between RBC, PCV and Hb concentration [11]. Hence, a decrease in one parameter results in a decrease in others. The WBC count also decreased significantly ($P = .05$) in the exposed group. This may be related to the destruction of nutritive value of *microwaved* food items. Table (2) shows the Neutrophils, Lymphocytes, Basophils, Monocytes and Eosinophils counts. The significant decrease ($P = .05$) in lymphocytes, monocytes and eosinophils counts of group 2 may equally be related to the destruction of nutritive value of *microwaved* food items. However, the significant increase ($P = .05$) in neutrophils count, the most abundant of any of the white blood cells, in group 2 indicates physical stress. Besides, there is no significant decrease ($P = .05$) in basophils count in the exposed group when compared to the control group. Normal basophils levels generally vary from 0-2% of the existing white blood cells and basophils is the least common of all white blood cells.

Table 1: Haematological indices of rats

Group	RBC Count per mm^3blood ($\text{N} \times 10^4$ cells)	WBC Count per mm^3blood ($\text{N} \times 10^3$ cells)	PCV (%)	Hb Conc. (g/dl)
1 (Control)	769.0 $\pm$ 15.36	8.52 $\pm$ 1.15	45.28 $\pm$ 1.03	19.18 $\pm$ 0.37
2 (Exposed)	683.6 $\pm$ 13.41	5.98 $\pm$ 0.96	34.20 $\pm$ 1.93	15.56 $\pm$ 0.35

Table 2: Differential white blood cell count of rats

Group	Neutrophils (%)	Lymphocytes (%)	Basophils (%)	Monocytes (%)	Eosinophils (%)
1 (Control)	35.50 $\pm$ 0.85	72.75 $\pm$ 0.99	1.60 $\pm$ 0.37	6.47 $\pm$ 0.27	3.90 $\pm$ 0.20
2 (Exposed)	42.84 $\pm$ 0.68	53.70 $\pm$ 0.96	1.42 $\pm$ 0.65	5.60 $\pm$ 0.36	2.64 $\pm$ 0.47

4. CONCLUSION

The study has shown the effects of microwave radiation on food items. The *microwaved* food items ingested by albino wistar rats have adversely affected some haematological parameters. Such effects could lead to anaemia, malnutrition and excessive stress on cells.

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