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Effects of Exposure to Non Ionizing Radiation on Haemoglobin (HB), Packed Cell Volume (PCV) And Red Blood Cells (RBC) With Blood Genotypes; AA,AS& SS

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Abstract: *Non ionizing radiations like microwaves(MW) have been associated with enhanced production of free radicals like,O_2, peroxides and super oxidesradicals. The effects of exposure of a non ionizing radiation [microwave] on the HB, PCV, and RBC of fifteen human blood samples of genotypes AA, SS irradiated at a power density of 60mwcm^2 have been investigated using the microwavegenerator model ER66OE (NQ 2XC21744) from Toshiba UK, while readings obtained with the aid of a haematocrit reader' The resultsobtained show that there is decrease in the HB concentration and also decrease in the 90 volume of the PCV after irradiation. Comparism of the percentage difference for pre and post irradiation of HB is 4.5. 13.5 and 4.7% for genotypes AA, AS and SS respectively. This result shows the blood genotypes AS is more fragile and most affected by MW exposure. The results indicates that MW exposure may cause adverse physiological consequences on those exposed to high levels of these radiations especially for prolonged periods.*

Keywords: *Microwave, Hemoglobin, PCV, RBC, BloodGenotype.*

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I. Introduction

Ionizing and non-ionizing radiations constitute the electromagnetic spectrum. Ionizing radiations are of very short wave lengths and have enough energy to knock off electrons from their orbital's and thus can cause permanent damage at cellular levels, like chromosomes double and triple strand breaks, free radical production genetic mutation and cancer production. Non-ionizing radiation on the other hand consists of longer wavelengths with generally less energy and cannot knock electron off theirorbital's. However some non ionizing radiations like microwaves Though ofrelatively lower energy is capable of causing a host of biological and physiological effects.

Non-ionizing radiation includes ac power, radio, infra-red and microwaves which occupy the frequency range of 300MHz to 300GHz. Microwave are widely applied in various aspects of human endeavour. For instance, food industries use MW to sterilize food containers as well as dry raw food materials such as peanuts, potato, etc. other application are in the ceramic and tobacco industries where MW is used to dry cooks, ceramic and tobacco. Microwave is also used in the field of medicine to sterilize surgical equipment as well as in physiotherapy. Most recent application of microwave is in the extraction of important volatile substance like "ergosterol" from their natural sources and also GSM phones in telecommunication. Following the ever increasing scope of application of applications of microwaves and the suspected potential health hazards associated with their exposures, keener interest and researchers are currently being focused for deeper understanding of the bio-effects of exposures to MW (Aweda et Al. 2003). Thermal and athermal are the two ways by which this radiation interact with biological systems. The thermal interactions are the best understood of the two mechanisms. They cause increased tissue temperature at a rate that is inversely proportional to the specific heat capacity C of the tissue according to the relation (Schwan Foster, 1980),

$$\frac{dT}{dt} = \frac{SAR}{C} \qquad (1)$$

where SAR is the Specific Absorption Rate, defined as the rate of energy transfer to a unit mass of the medium. It is a dosimetric quantity that is widely used in quantifying interactions of MW fields with biological systems (Fesani et. al, 1999). These interactions at the molecular level involved the conversion of electromagnetic energy to heat and it occurs through the stimulation of the excitable membranes of nerve and muscle cells. (Aweda et at 2008) these result in some observable and measurable biological and physiological effects their implications have been reported and reviewed in some literatures (Scgwan and Foster, 1980 Laogur et al 1997, Aweda et al. 2003 and Meindinyo 2006).

A large numbers of previous studies (Adachi and Asakuru, 1991: Laogun et at 1983 DDeleatic et at, 1983 Laogurn et at, 1997) have focused attention on the delectric behaviour of HB and SC whereas little information exists on the behaviour of RBC, PVC and HB on exposure to microwave radiation. The present study is therefore aimed at investigating the impact of exposure to microwave radiation on the RBC, PCV and HB of human blood genotype AA, AS and SS.

II. Materials And Method

Human blood sample were collected from 15 male subjects of ages between 20 and 40 years who were attending the Federal Medical Centre Yenagoa for genotype screening and wereconfirmed to have haemoglobin. AA, AS and SS. The relatively few number of subjects used for the study is because SS subjects were not as common as AS and AA. Hence, the study was limited by the number of SS subjects attending the laboratory at the time of study. Preparation, preservation and analysis of the blood sample for the genotype study was as reported by Laogun et al, (1997).

The source of MW used was a microwave generator model ER666E (Serial No. 2XC2 1744) of Toshiba UK Ltd. Details of the calibration of the system has been reported in the works of Aweda et al (2003) and Meindinyo et al (2017). The generator was operated at room temperature of 25+20c and 56+4% relative humidity. All except the control, samples were subjected to microwave irradiation using a central maximum power density of 60w/rn for 30 seconds.

The blood samples, both control and irradiated were analyzed by injecting the samples into a capillary tube with styride disposable plastic syringe and spun with the spinning machine while the results were obtained with the aid of the haematocrate reader. Details of the procedure for this analysis have been reported elsewhere (Adai, 2002).

III. Results And Discussion

Table 1,2 and 3 present the various results obtained in this study.

TABLE. 1: EFFECTS OF MICROWAVE RADIATION ON BLOOD GENOTYPE AA

Sample	Room Temp. (O^c)	Blood Temp. Rang O^c	Pre-Irradiation			Post Irradiation		
			Hb/gldl	RBc/c^3	PC%	HB/gldl	RBC/cm3	PC%
1	92±2	29-42	15.3	5.1	46.0	14.80	5.4	43.0
2	92±2	29-55	15.1	5.1	45.0	14.0	5.6	42.0
3	92±2	29-42	16.0	5.2	42.0	15.30	5.6	41.0
4	92±2	29-37	15.6	4.8	45.0	15.00	5.0	43.0
5	92.5± 2	29-39	15.4	5.0	48.0	14.89	5.2	46.0
Average	29.10±2.0		15.48 ± 2.10	5.04±0.80	45.20±4.60	14.78±1.00	5.36±1.00	43.00±5.00

TABLE 2: EFFECTS OF MICROWAVE RADIATION ON BLOOD GENOTYPE AS.

Sample	Room Temp. O^c	Blood Temp. Rang O^c	Pre-Irradiation			Post Irradiation		
			HB/gldl	RDC/cm^3	PCV%	HB/gldl	RBC/cm^3	PCV%
1	92±2	29-42	15.0	5.0	46.0	14.0	5.0	42.0
2	92±2	29-42	15.0	5.2	46.0	8.4	5.9	38.0
3	92±2	29-40	15.2	5.3	48.0	14.3	5.8	46.0
4	92±2	29-41	13.6	5.0	46.0	13.0	5.2	41.0
5	92±2	29-42	14.8	5.6	48.0	14.0	6.2	42.0
Average	29±2.0		14.72±1.70	5.22±1.70	46.89±4.20	12.74±2.00	5.62±1.00	4.80±4.50

TABLE 2: EFFECTS OF MICROWAVE RADIATION ON BLOOD GENOTYPE SS.

Sample	Room Temp. (O^c)	Blood Temp. Rang O^c	Pre-Irradiation			Post Irradiation		
			HB/gldl	RDC/cm^3	PCV%	HB/gldl	RBC/cm^3	PCV%
1	92±2	29-42	14.9	4.4	44.0	14.0	3.9	39.0
2	92±2	29-42	15.2	5.3	47.0	14.2	5.8	43.0
3	92±2	29-40	15.6	5.0	48.0	15.1	6.3	41.0
4	92±2	29-42	16.0	6.0	46.0	15.2	6.3	41.0

5	92±2	29-42	15.2	5.1	45.0	14.8	5.6	40.0
Average	29±2.0		15.38±0.00	5.16±0.50	46.00±4.50	14.66±1.20	5.42± 1.20	41.40±5.20

Table 1.2 and 3 present the various results obtained in this study. Table 1 shows the measured effect of microwave radiation on blood genotype AA. The mean values obtained for control (pre-irradiation) blood samples are 15.48±2 10 gidl, 5.09±0.80cm3 and 45.20±46% for HB, RBC and PCV respectively while the mean post-irradiation values are 14.76+20 gldl, 5.36±1.0cm3 and 43.00±500% for HB, RBC and PCV respectively. This result indicate that there is a slight decrease in the HB and PCV level of blood samples after irradiation while there is slight increase in the RBC levels.

Table 2 presents the result of the measured effects of MW exposure on blood genotype AS. The mean values obtained for control and irradiated samples are 14.72 ± 1.70 (12.74 ± 2.00) gldl, 5.22 ± 0.60 (5.62 ± l.00)cm3 and 46.80 ± 42 (41.80 ± 4.50)% for 1-IB, RBC and PCV respectively. This also shows a decrease in the HB and PCV status and a slight increase in RBC volume post- irradiation.

Table 3 shows the values obtained for the MW exposure on blood genotype SS. The result obtained indicate mean values for pre and post-irradiation as 15.38 ± 2.0 (14.66 ± 3.20) gldl 5.16 ± 0.50 (5.42 ±l.20)cm3 and 46.00 ± 50 (14.40 ±5.20)% for HB, RBC and PCV respectively. This implies that on irradiation, all the HB and PCV status dropped slightly below the normal (control) value obtained earlier on pre-irradiation. The RBC level on the other hand also increase against the pre-irradiation value.

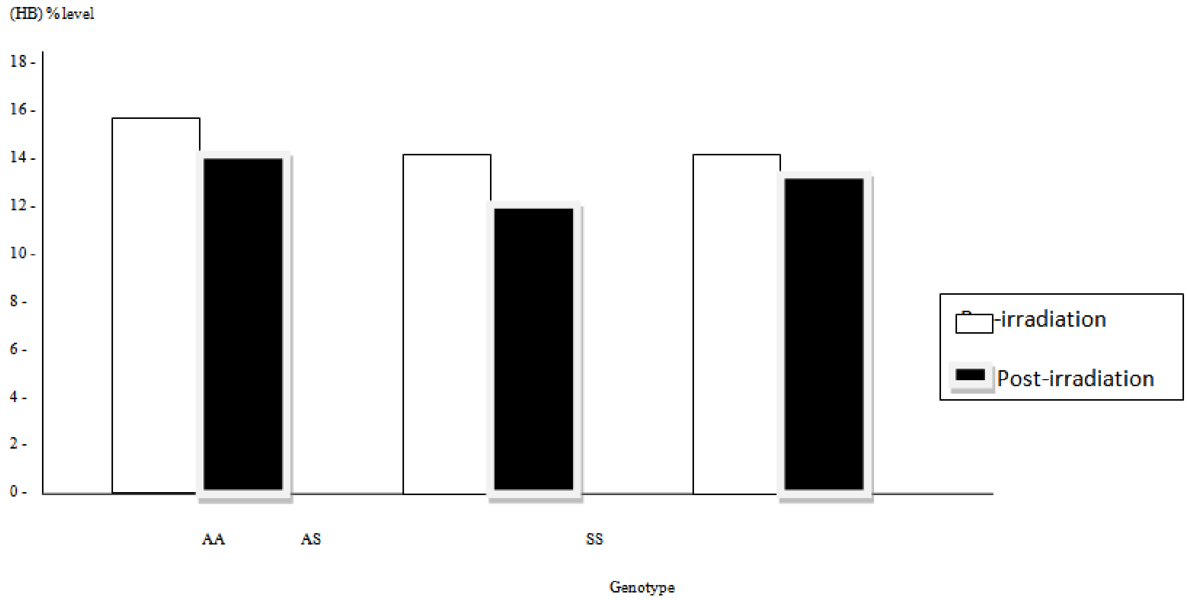

Fig. 1: Comparison of haemoglobin before and after MW Exposure of Genotype AA, AS, and SS

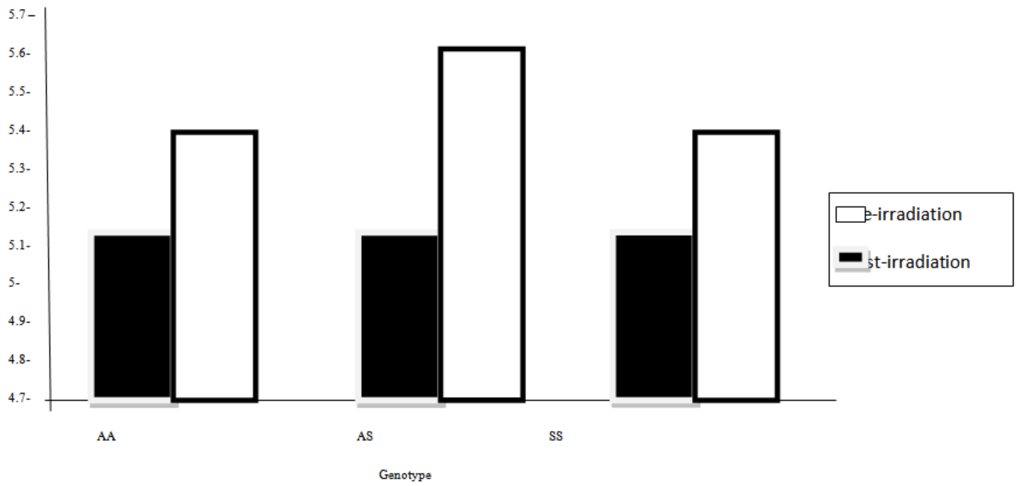

Fig. 2: Comparison of red blood cell (RBC) before and after MW Exposure of Genotype AA, AS, and SS

(PCV) % level

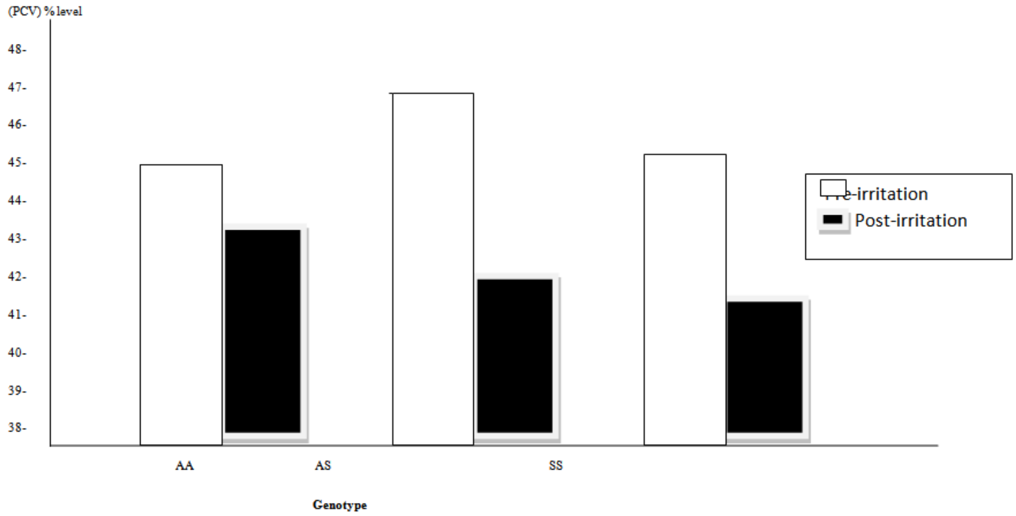

Fig. 3l: Comparison of Pack Cell Volume (PCV) before and after MW Exposure of Genotype SS

Figure 1, 2 and 3 shows the comparison of the three different subjects before and after microwave exposure of genotypes AA, AS and SS. Fig 1 shows the comparison of the subject HB for AA, AS and SS, the percentage differences are 45%. 13.5% and 4.7% for genotypes AA, AS and SS respectively. For RBC in fig 2 the percentage difference are 63% .7.7% and 5.0% for AA, AS and SS respectively.

Figure 3. Shows the percentage differences obtained for PCV subjects. They are 4.9% 10.7% and 10.0% for genotype AA, AS and SS respectively. These results revealed that the percentage variation between controlled blood samples and irradiated once is highest in AS genotype while is least in AA genotype.

The overall results show that there is general increase in the RBC volume and a general decrease in the HB concentration and PCV% of irradiated blood samples with female values lower than those of males. The study shows that exposures of human whole body (blood) to MW radiations under the experimented conditions produces or promotes free radical production in biological systems. The athermal processes of interaction of MW radiations may be responsible for the production of free radicals, free oxygen, peroxides etc. due to the reactions of phagocytic cells. This effect is most pronounced in the genotype SS and AS. Thus MW radiations effects may be more acute in SS and AS.

These shows that MW and some physiological effects on blood cells especially at this power density of $60mW/CM^2$ long term exposure to this level of MW radiation may cause cataract of the eye in man (Meindinyo, et al2017). The human bladder the intestine and stomach are also prone to thermal damage by long term exposure to this level of MW radiation. The human testes are very sensitive to temperature rise long term exposure to MW radiation of $6OmW/CM^2$ can destroy the sperm cells, which may eventually causes sterility in man.

IV. Conclusion

The effects of microwave on HB, PCV and RDC of blood genotype AA, AS and SS have been investigated. The study revealed that irradiation of the various genotype blood samples may have some adverse physiological effects. In a previous report Meindinyo and Aweda,(2017) was observe that, the fast growing MW technologies and diversification of industrial, domestic and medical applications make it indispensible for the generality of the unsuspecting public to know and be conscious of the potential health detriments of MW exposures. This is especially for those having genotype SS medical condition. as over exposure may easily precipitate crisis for such individuals. Supplemental intakes of strong anti-oxidants is recommended to considerably reduce the damaging effect of MW exposures especially for those occupationally exposed Aweda et al (2003).

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