The Effect of Electromagnetic Waves Produces by Power Plant Station of South Baghdad on the Blood Viscosity of Workers

Dr. Kassim Mahdi wadi
Basic science department, College of pharmacy
AL-Mustansiriya University

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الخلاصة:

الهدف من هذه الدراسة معرفة تأثير الأشعة الكهرومغناطيسية الناتجة عن المحطة على لزوجة دم العاملين فيها.

تضمنت الدراسة فحص دم 70 عامل من الذين يعملون في تشغيل وصيانة منظومات توليد الطاقة الكهربائية لمحطة جنوب بغداد الحرارية بأعمار وفترات زمنية تشغيلية مختلفة، ومن الأصحاء وغير المدخنين.

تم تحليل نتائج الفحوصات المختبرية التي إجربت في المختبرات المركزية العامة للصحة وهي كل من).Erythrocyte sedimentation rate (E.S.R و)hemoglobin (Hb, وكذلك packed cells volume (P. C. V) ومقارنتها مع القياسات الطبيعية المعيارية والمحددة عالمياً.

أظهرت نتائج المقارنات المعنوية فروقاً معنوية عالية عند مستوى دلالة   p<0.01   للفئات العمرية كافة في اختبار Hb في حين لم تظهر نتائج المقارنات عن فروق معنوية في اختباري   PCV و ESR عند مستوى p>0.05 . من جانب أخر, فقد سجلت نتائج المقارنات مستواً من الثقة وبما لا يقل عن 20% بوجود اختلاف ما بين النتائج المسجلة عند الفئة العمرية(- 35) سنة فأكثر والقيمة المعيارية لفحص ESR أيضاً , مما يؤشر تأثر تلك الأعمار في ضوء ذلك المتغير. كما أظهرت نتائج المقارنات المعنوية فروقاً معنوية عالية عند مستوى دلالة   p<0.01   للفئات العمرية كافة مابين نتائج المؤشرات المبحوثة بكافة الفترات الزمنية للتعرض عند مؤشري(Hb, ESR), وبمستوى دلالة P>0.05 عند مؤشر PCV.

تمت التوصية بتقليل ساعات التعرض بالاعتماد على القياسات الدولية المعتمدة من قبل منظمة الصحة الدولية, كذلك اعتماد العمر التشغيلي بالحدود المعتمدة دولياً مع إعادة الفحوصات سنويا لمتابعة مستويات الحدود المسجلة.

Abstract:

The aim of study is identifying the effect of electromagnetic waves resulted from the electric power station of south Baghdad on the blood viscosity of its workers. The study included the following:

The blood of 70 healthy and non smoker workers, working in the operation and maintenance of electrical power generating systems of South Baghdad thermal station at different operating ages and periods, was examined.

After analyzing the results obtained from laboratory tests like (Hb, ESR and PCV) done at the general central health laboratories and comparing them with the standard normal measures specified internationally.

The comparison results showed high significant difference at the level $P<0.01$ for all ages examined by Hb test, while the comparison results did not show significant differences in PCV and ESR tests at the level $P>0.05$. On the other hand, the comparison results registered a confidence level not lower than 20% in the presence of a difference among the recorded results at the age (35 and over) and the standard value of ESR test too which indicated the influence of those ages within the variable. The comparison results also showed high significant differences at the level $P>0.01$ for all ages among the researched indicators' results at all periods of exposure at both indicators (PCV and ESR) with the level $P>0.05$ at PCV indicator.

The study recommended decreasing the exposure hours basing on international measures taken by WHO and also relying on the operating age with the internationally depended limits as well as retesting annually to follow up the recorded limit levels.

Introduction:

Viscosity is the- thickness of blood and the resistance of blood to flow because of a shearing force[1]. The property of blood is related to the internal friction of adjacent fluid (laminar flow) as well as to the friction generated between the blood and the wall that condition to the resistance to flow. The viscosity of blood is depending upon hematocrit, temperature and flow rate. It is also refers to the property of a blood that determines the magnitude of dissipative forces and represent by the symbol μ and the unit of viscosity is N s m^{-2} (Newton per meter. second), the higher viscosity the greater resistance. There is a correlation between viscosity and number of red corpuscles present. Viscosity of blood decreased when the shearing stress increased the factor that is contributed by corpuscles is depend on their total volume rather than on their numbers[2]. Viscosity will affect the velocity of blood. So that the velocity near the axis of arteries is more than that far from them because of the contact with the wall of the arteries. Viscosity of the blood is usually constant but it will be reduced if large quantities of saline exist, the addition of carbon dioxide to blood caused a rise in viscosity. A reduction in the circulating red cells (anemia) has a little effect on the viscosity but it will increase for the polycythamia (high red cell count) .The plasma protein also affected the blood viscosity[3]. A low blood viscosity is associated with a low blood pressure and a high viscosity will be

associated with a high blood pressure. The viscosity has been shown to affect the absorption rate of drugs[4].

Electromagnetic radiation exhibits both wavelike and particle likes characteristics. The wave lengths extended from less than 10^{-13} m to over 10^{15}m. included in this range in order of increasing wavelength are rays, x rays, ultraviolet wave (UV) visible light, infrared (IR) light ,microwaves, radio waves and power transmission waves[5] Electromagnetic fields consist of electric (E) and magnetic (H) waves traveling together. They traveled at the speed of light and are characterized by a frequency and a wavelength. Electrical energy from generating station is distributed to high voltage transmission lines electric and magnetic fields under head and over head transmission lines may be as high as 12KV/M (kilo volt per meter)[6] and 30μT(micro tesla) respectively. Around stations and substations electric fields up to 16 KV/M (kilo volt per meter) and magnetic fields up to 270 μT (micro tesla)[7,8] workers who works in electric power station to maintain and operate transmission and distribution lines may be exposed to very large electric in excises of 25KV/M (kilo volt per meter) and magnetic fields in excises of 2MT (milli tesla)[9]. The first reports on the adverse effect of electromagnetic field on human were published the end of 1970. The field generated by electric power transmission line induced an increased in the prevalence of leukemia and cerebral tumor in children living in the vicinity of the power line [10]. Moreover increased mortality from all kinds of neoplasm's and leukemia was observed in some age group, particularly younger subject's (0-14) year's living in the vicinity of AM radio broad casting tower's[11]. Analyzing the effect that electromagnetic field my have on the biological system, which due to a free radical's genexated in these system's ,which lead to oxidation of important cell structure's, protein's, lipid's, saccharin's or even to the damage of the genetic material [12,13]. There are large numbers of research indicating biological effect's of electromagnetic radiation on experimental animals and on man exposed occupationally to electromagnetic field as well. Many recent studies to show the harmful effects of electromagnetic wave from many devices such as mobiles, phones, computers, power lines and domestic wiring. they found to include an increased risk of cancer, loss of fertility, genetic damage change in metabolism deleterious effect on brain function and un pleasant symptoms[14] Other studies have been shown that electromagnetic field remove calcium ions bounded to the membranes of living cells making them more likely to tear develop temporary pores and leakage of calcium ions in to the cytosol ,and neurons. The aim of this study was to know the effect of electromagnetic waves from the electrical power station of south Baghdad on workers blood viscosity.

Materials and Methods:

The effect of electromagnetic waves produced by electric power station of south Baghdad was studied on the blood viscosity of seventy workers working in the operation   and the maintenance. The study include sample of workers specially those in contact with the boiler, engine and turbine. The workers are no smokers, healthy their ages between 25-55 years and their period of working is between 8-35 years.

The seventy workers were a randomly sample chosen from the population send as the following tests were done to the workers with the help of central public health laboratory:

A: erythrocyte sedimentation rate (E.S.R) by waster green method.

B: hemoglobin level by cyanmehaglobin method.

C: packed cells volume (P. C. V) by microhematocrit centrifuge.

Results and discussion:

Table-1represents the original data of research including the results of examinations to (70) workers done in the central public health laboratory.

Sample N0.	Age (year)	Period of exposure (year)	PCV%	ESR mm/hr	Hb g/dl
1	40	18	37	7	13
2	24	4	44	10	13
3	32	12	45	12	12
4	24	4	43	36	13
5	35	15	37	10	12
6	37	17	48	9	13
7	27	7	44	7	12
8	27	7	42	26	13
9	30	10	45	7	13
10	25	5	39	2	13
11	27	7	43	6	13
12	25	5	45	5	13
13	20	2	42	7	12
14	20	2	44	5	13
15	24	6	43	27	13
16	35	15	45	4	13
17	40	18	49	4	16
18	33	13	44	5	13
19	42	20	50	10	16

20	20	2	50	7	16
21	42	20	42	22	13
22	32	12	43	24	13
23	31	11	37	24	12
24	29	7	45	26	13
25	25	5	50	5	13
26	22	4	46	3	15
27	24	6	46	27	10
28	38	18	46	24	10
29	31	11	48	4	13
30	19	1	47	2	12
31	28	8	51	6	12
32	55	25	41	5	13
33	35	15	50	22	11
34	30	10	49	4	15
35	20	2	39	2	13
36	40	18	37	7	13
37	24	4	44	10	13
38	32	12	45	12	12
39	24	4	43	36	13
40	35	15	37	10	12
41	37	17	48	9	13
42	27	7	44	7	12
43	27	7	42	26	13
44	30	10	45	7	13
45	25	5	39	2	13
46	27	7	43	6	13
47	25	5	45	5	13
48	20	2	42	7	12
49	20	2	44	5	13
50	24	6	43	27	13
51	35	15	45	4	13
52	40	18	49	4	16
53	33	13	44	5	13
54	42	20	50	10	11
55	20	2	50	7	16
56	42	20	42	22	13
57	32	12	43	24	13
58	31	11	37	24	12
59	29	7	45	26	13
60	25	5	50	5	13

61	22	4	46	3	15
62	24	6	46	27	12
63	38	18	46	24	10
64	31	11	48	4	13
65	19	1	47	2	12
66	28	8	51	6	12
67	55	25	41	5	13
68	35	15	50	22	12
69	30	10	49	4	15
70	20	2	39	2	13

Table-1: Result's of examination of the worker P.C.V, Hb, and E.S.R done in the central public health laboratory.

Table-2 showed the summary statistics of some principle estimations of the statistical parameters from the result of blood testing distributed according to different age groups.

Age Groups		n	Min.	Max.	Mean	Std. D.
< 25	**P.C.V.**	20	39	50	44.35	2.9
	ESR	20	2	36	12.6	12.17
	Hb	20	11	16	13.3	1.41
25 -	**P.C.V.**	30	37	51	44.63	3.72
	ESR	30	2	26	10.87	8.94
	Hb	30	12	15	12.87	0.73
35 -	**P.C.V.**	18	37	50	44.89	5
	ESR	18	4	24	12.44	7.76
	Hb	18	10	16	12.9	1.95
45 >	**P.C.V.**	2	41	41	41	0.00
	ESR	2	5	5	5	0.00
	Hb	2	13	13	13	0.00

Table-2: Summary Statistics of the studied Parameters from the results of blood testing distributed according to different age groups.

The results showed a slight increase in the PCV test among the first and second age groups (Normal Upper Limit) compared with the standard limit of healthy Interval, also the results showed a shift in the ESR test among the first and second age groups compared with the standard limit of healthy level and

finally relative decrease was recorded with Hb test which were obtained closed to (Normal Lower Limit).

The change observed in above blood parameters among the occupational worker's might be due to exposure to electric field rather than to some health problems, because these worker's all were in a very health conditions.

In addition to that, testing the statistical hypotheses was used in order to examine the impact of the deviations that were recorded between the observed mean values and with their standardized. The following table showed the testing of coincidence by using (t- test) statistics for the studied parameters results of blood testing according to different age groups.

parameter	Test Value	Age Groups	T	df	Sig. (2-tailed)	C.S. P-value
P.C.V.	45	< 25	-1.002	19	0.329	NS
		25 -	-0.54	29	0.593	NS
		35 -	-0.094	17	0.926	NS
ESR	10	< 25	0.956	19	0.351	NS
		25 -	0.531	29	0.599	NS
		35 -	1.336	17	0.199	NS
Hb	18	< 25	-13.99	19	0.000	HS
		25 -	-38.5	29	0.000	HS
		35 -	-13.732	17	0.000	HS

Table-3: Comparison Significant of the studied Parameters from the results of blood testing according to different age groups.

The testing statistical hypotheses showed a highly significant differences at $P<0.01$ were obtained along whole different age groups in the Hb indicator with increasing levels in the PCV compared with standard value, then followed by increasing levels (Abnormal Upper Limit) with the ESR criteria in the first and second age groups and followed by relatively decreasing with the Hb testing compared with normal upper standard value limit.

Table-4 showed the summary statistics of some principle estimations of the statistical parameters from the result of blood testing distributed according to different services periods of exposure groups.

Period of Working		n	Minimum	Maximum	Mean	Std. Deviation
< 5	**P.C.V.**	16	39	50	44.31	3.17
	ESR	16	2	36	9	10.88
	Hb	16	12	16	13.31	1.29
5 -	**P.C.V.**	20	39	51	44.8	3.49
	ESR	20	2	27	13.7	10.8
	Hb	20	11	16	12.85	0.93
10 -	**P.C.V.**	14	37	49	44.36	3.69
	ESR	14	4	24	11.43	8.66
	Hb	14	12	15	13	0.96
15 -	**P.C.V.**	14	37	50	44.57	5.23
	ESR	14	4	24	11.43	7.92
	Hb	14	10	16	12.44	1.8
20 >	**P.C.V.**	6	41	50	44.33	4.41
	ESR	6	5	22	12.33	7.81
	Hb	6	13	16	14	1.55

Table-4: Summary statistics of some principle estimations of the statistical parameters from the result of blood testing distributed according to different services periods of exposure groups.

The results showed an increase in the PCV value among whole different services periods of exposure groups compared with the standard limit of healthy level which were closed to (Normal Upper Limit), also the results showed a in increasing in the ESR level among first two services periods of exposure groups compared with the standard limit of healthy level and finally relative decreasing were recorded with Hb test.

In addition to that, testing the statistical hypotheses was used in order to examine the impact of the deviations that were recorded between the observed mean values and with their standardized. Table-5 showed the testing of coincidence by using (t- test) statistics for the studied parameters results of blood testing according to different services periods of exposure groups.

parameter	Test Value	Period of Working	t	df	Sig. (2-tailed)	C.S. P-value
P.C.V.	45	< 5	-0.867	15	0.400	NS
		5 -	-0.256	19	0.800	NS
		10 -	-0.652	13	0.526	NS
		15 -	-0.307	13	0.764	NS
		20 >	-0.37	5	0.726	NS
ESR	45	< 5	-0.368	15	0.718	NS
		5 -	1.532	19	0.142	NS
		10 -	0.617	13	0.548	NS
		15 -	0.675	13	0.512	NS
		20 >	0.731	5	0.497	NS
Hb	18	< 5	-14.542	15	0.000	HS
		5 -	-24.677	19	0.000	HS
		10 -	-19.472	13	0.000	HS
		15 -	-11.544	13	0.000	HS
		20 >	-6.325	5	0.001	HS

Table-5: Comparison Significant of the studied Parameters from the results of blood testing according to different services periods of exposure.

The testing statistical hypotheses showed a highly significant differences at $p<0.01$(Hb) in the whole different services periods of exposure groups in the Hb criteria compared with the standard (Normal Upper limit) of healthy level, while a non significant differences were obtained at $p>0.05$ with ESR criteria since they were compared with the standard (Normal Upper limit) of healthy level which says up to (10) in male gender.

The results showed highly grades of increasing in the PCV test along the first and second age groups (Normal Upper Limit) compared with the standard limit of healthy Interval, also the results showed a highly grades of increasing in the ESR test along the first and second age groups compared with the standard limit of healthy level and finally relative decreasing were recorded with Hb test which were obtained closed to (Normal Lower Limit).

The testing statistical hypotheses showed a highly significant differences at $P<0.01$ were obtained along whole different age groups in the Hb indicator with increasing levels in the PCV compared with standard value, then followed by increasing levels (Abnormal Upper Limit) with the ESR criteria in the first

and second age groups and followed by relatively decreasing with the Hb testing compared with normal upper standard value limit.

The results showed highly grades of increasing in the PCV test along whole different services periods of exposure groups compared with the standard limit of healthy level which were closed to (Normal Upper Limit), also the results showed a highly grades of increasing in the ESR test along first two services periods of exposure groups compared with the standard limit of healthy level and finally relative decreasing were recorded with Hb test.

The testing statistical hypotheses showed a highly significant differences at $P<0.01$ (HS) in the whole different services periods of exposure groups in the Hb criteria compared with the standard (Normal Upper limit) of healthy level, while a non significant differences were obtained at $P>0.05$ with ESR criteria since they were compared with the standard (Normal Upper limit) of healthy level which says up to (10) in male gender, so we can conclude that a highly deviation were recorded in the different services periods of exposure groups except at (< 5) years. The plasma protein which also effect the blood viscosity was not measured in this study because the study aims to show the effect of electromagnetic wave in blood viscosity (P.C.V).

There fore we believed that the changes observed in P.C.V, Hb, and E.S.R, among the occupational worker's in this study could be due to the exposure to the electromagnetic radiation field of a very low energy emitted from the power plant station for long period of time, which was sufficient to cause such adverse side effects on health and the severity of which is dependent on the duration of exposure and energy density of electromagnetic frequency.

Conclusion:

A non significant differences at $P>0.05$ which were registered with PCV criteria since they were compared with the standard (Normal Upper limit) of healthy level which says up to (45%) in both gender groups, which indicates that highly increasing were occurred with any periods of exposure groups.

Credence should be applied for working period accordance to international outline with repetition of the medical testing yearly to follow up the levels of the registration of variations in the studied parameters.

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