SPECIFIC FEATURES OF PSYCHOLOGICAL REACTIVITY IN PROFESSIONAL EXPOSURE TO PULSED MICROWAVES

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OBJECTIVE AND CHARACTERISTICS OF EXPOSURE

The literature contains controversed data concerning nervous and behavioral effects of chronic human occupational exposure to pulsed microwaves. Our paper follows some psychological changes in 49 occupationally exposed subjects, technicians and engineers with 38,9±3,2 years of mean age and 15,5±5,1 years length of service in activities of maintenance of radars in the vicinity of some generators unprotected by carcass or with inadequate protection, in a relative limited space with much and generally unshielded sources. The frequencies are from 0.2 to 10 Ghz with the mean power of density from 0.1 to above 2 mW/cm^2, with peak power density exceeding thousands times the mean power density. The estimated SARs are between 0.01 and 1-2 W/Kg, greater especially for head and hands.

METHODS

Both in exposed (E) subjects and control (C) subjects (36 Ss from the same enterprise with similar profession, mean age and length of service, without exposure), were used the followings tests:

- the Pointage Test (to punctuate the middle of 100 squares with the side of 1 cm);
- the Tapping Test (the sum of points tapped with the left and right hand in six seconds);
- the Bourdon-Amfimov attention test (the barrage of O and C letters in time of 10 minutes);
- the Praga Distributive Attention Test;
- the I_2 Intelligence Test (with the subtests: analogies, number series, useless words and antonyms);
- the Cattell Anxiety Questionnaire (5 PF);
- the Subjective Symptoms Questionnaire (from the Swedish Toxicopsychological Battery);
- an original test (Gh.Bălăceanu) that involve distributive attention, quickness, manual accuracy, simple discrimination of shapes and colours (the task is to place 36 cylindrical pieces with a drawed face in triangle square or circle coloured in red, yellow, blue or green, on a table with circles containing the same figures arranged at random);
- the reaction time test (series of 10 red or blue visual stimuli for each hand).

The subjects were examined in one session with pauses between tests. The comparisons between the exposed and control group were tested by using the "z" or "chi-square" test.

RESULTS

Tests	Measured variables	Mean results				Test of significance
		Exposed Ss	SD	Control Ss	SD	
Reaction time	time in ms	341.8	73.8	310.0	54.1	z=2.23 p<0.05
Pointage	time in seconds	58.2	16.9	46.9	11.7	z=3.56 p<0.001
Tapping	sum of points tapped with both hands	70.5	10.5	74.4	7.4	z=1.96 p=0.05
Bălăceanu	time in seconds	82.6	17.2	73.3	11.9	z=2.87 p<0.01
	imprecisions number	8.2	6.8	3.0	7.2	z=2.86 p<0.01
Bourdon-Amfimov	sum of correct barraged letters	450.3	97.3	471.8	84.8	NS
Praga	solved points	67.2		75.4		z=2,59 p<0.01
I_2	solved items to:					
	- antonyms	9.3	1.2	9.7	0.5	NS
	- analogies	7.8	1.5	8.4	2.2	NS
	- number series	7.9	2.1	8.9	1.2	z=2.44 p<0.05
	- useless words	7.9	2.1	8.8	1.2	z=2.46 p<0.05
	- total score	32.1	6.5	36.0	4.7	z=3.15 p<0.01
	- time of solve (min)	13.5	2.3	9.2	3.1	z=6.9 p<0.001
Subjective symptoms Quest.	percentage of:					
	- lability	38.8		43.7		NS
	- tiredness	20.4		18.7		NS
	- extroversion	36.7		18.7		$chi^2 = 4.35$ p<0.05
	- neurosis	28.6		31.1		NS
Anxiety Ouest	percentage of:					
	- normal subjects	47.9		73.5		chi square =
	- anxious subjects	52.1		26.5		=5.3 p<0.05
	- subjects able for stress and crises	5.9		32.3		z= 3.04 p<0.01
	- subjects with increased anxiety	19.6		5.9		z=1.97 p<0.05
	- subjects with normal C (ego strength)	80.4		94.1		z=1.96 p=0.05
	- subjects with normal O (paranoiac defence)	70.6		88.2		z=2.05 p<0.05
	- Ss with anxious/ inhibited ego	9.8		0		z=2.28 p<0.05

DISCUSSIONS

As we see, the exposed subjects have a significant increase of RT, reduced motor reactivity, reduced efficiency in tasks which involve distributive attention, manual accuracy, ability to reason with number series and categories of words. The increased time of solve the á items of Intelligence Test put in evidence a reduced efficiency in cognitive tasks. The questionnaire of subjective symptoms points out the increase of extroversion symptoms, which correlated with the preference to participate to passional discussions (46.7% in exposed group vs 11.8% in control group, $z=3.26$, $p<0.001$), can indicate the increase of excitatory state which can subsequently induce inhibition and tiredness. This conclusion is supported by the increased percentage of subjects which relate frequent periods of strong tiredness (66.9% exposed subjects vs 47.1% control subjects, chi-square = 6.09 $p<0.05$) and on the other hand, as we have had seen, the reduced psychomotor reactivity and functional capacity of distributive attention. They have also more frequent troubles of recent memory (they forget what they recently think, 66.7% from exposed subjects vs 41.2% control subjects, chi-square = 7.7 $p<0.01$). The reduced percentage from exposed subjects which relate that they not dream (46.7% exposed subjects vs 75.5% control subjects, $z=2.65$, $p<0.01$) can also support the idea of increased tiredness and/or the trouble of recovery sleep. It was observed also the possibility to install an inferiority complex (55.6% exposed subjects vs 32.4% control subjects, $z=2.04$, $p<0.05$, relate that they have some difficulties to discuss about them with others).

The questionnaire of anxiety put in evidence increased percentage of anxious subjects in exposed group, more frequent increased anxiety, weakness of Ego, paranoiac defence (as compensatory factor), inhibited Ego, which can reduce the ability to cope with stress and crises and can develop neurosis or angst hysteria.

CONCLUSIONS

These findings support the idea of unfavourable influence of chronic occupational exposure to pulsed microwaves on psychological reactivity, reducing the individual resistance to stressful events, increasing the level of tiredness, reaction time, troubles of recent memory, inducing an excitatory state that subsequently can induce inhibition and tiredness. These psychological changes can have some repercussions on individual organic resistance to physical and/or psychosocial potential harmful factors on the one hand and/or on worsening of other psychoorganic affections, on the other hand.