

#####

EFFECT OF BIOFEEDBACK AND YOGIC RELAXATION EXERCISE ON THE
BLOOD PRESSURE LEVELS OF HYPERTENSIVES: A PRELIMINARY STUDY

AL Mogra and Gurmukh Singh

#####

Eight well motivated male hypertensives in the age group of 25 to 45 years - six cases of essential hypertension and two of renal hypertension - were given biofeedback of blood pressure and galvanic skin resistance (GSR) along with relaxation by the yogic posture of 'Shavasana'. Subjects were asked to increase their GSR and decrease their blood pressure by passive volition. Each session was of 30 min duration. A total of 20 such sessions was given to each subject spread over a period of 2 months. Their mean systolic blood pressure was found to decrease from 144.2 mm Hg (SD 10.5) to 119.7 mm Hg (SD 5.5) and mean diastolic blood pressure from 95.2 mm Hg (SD 3.5) to 81.2 mm Hg (SD 3.5) at the end of 20 sessions. All of them showed good ability to control and increase GSR. Their initial mean GSR of 115.1 kilo ohms (SD 33.8) increased to 175.6 kilo ohms (SD 34.5) at the end of the 20th session.

Keywords: biofeedback and hypertension; yogic exercise; galvanic skin resistance; biofeedback in aviation.

BIOFEEDBACK is the name given to a wide variety of procedures wherein some aspect of an individual's physiologic functioning is systematically monitored and moment to moment changes of it are fed back to that individual, typically in the form of an auditory or visual

signal. The individual's task then is to modify that signal in order to change that physiological function or process in some way (3).

The oldest of all the methods to develop voluntary control over various

physiological functions is 'Yoga'. Practitioners of yoga have been reported to master control over a number of involuntary physiological processes through long practice of specific mental, emotional and physical disciplines (4,5,7, 10-12). Datey et al (2) have demonstrated that yogic exercise 'Shavasana' produces complete mental and physical relaxation, reducing blood pressure significantly in hypertensive patients.

Hypertension is seen in about 15% of the population. The morbidity and mortality increase linearly with increasing levels of either systolic or diastolic blood pressure for every age group (6). Several theories have been advanced regarding the aetiology of essential hypertension. Factors incriminated as contributing to the disease include genetic predisposition as well as environmental conditions. In analysing the nature of inheritance of hypertension it has been suggested that environmental factors are more important than genetic factors in determining the degree of deviation from the norm in the population at large.

Though pharmacological control has remained the major approach to therapy in hypertension, certain nonpharmacological methods of behaviour modification, e.g., biofeedback and relaxation techniques have shown the promise of use in the management of hypertension. In this study, a combined session of yogic relaxation exercise and biofeedback of arterial blood pressure and galvanic skin resistance (GSR) has been attempted on a group of hypertensive patients and the effectivity studied in terms of changes in the blood pressure values recorded before and after completion of 20 such sessions.

Material and Method

Eight male hypertensive patients in the age group of 25 to 45 years participated in this study. Six were suffering from essential hypertension; three of them were on antihypertensive drugs and the rest not on any drugs. Two subjects were cases of renal hypertension. The duration of hypertension varied from 2 months to 6 years. The details of the subjects are given in Table I.

Medical history including duration of illness, blood pressure at the time of initial diagnosis and drugs used if any was recorded. Subjects who were on antihypertensive treatment continued the same throughout the period of biofeedback training of two months.

The subject was connected to a Relaxometer (galvanic skin resistance meter) by two lead electrodes, one on the palm and the other on the forearm. A small alternating current was passed through the skin and galvanic skin resistance in kilo ohms was read on the digital display of the Relaxometer. For the measurement and feedback of arterial blood pressure, an electronic blood pressure instrument was used and was operated by the subject or the experimenter. The subjects were first familiarised with the experimental set up. They were explained how biofeedback worked and what they were supposed to do to control physiological parameters (BP and GSR) by biofeedback training.

Each subject was given a biofeedback training session of 30 min in a day. He was asked to lie down supine in the bed in a quiet room with diffuse dim light. At the beginning of the

Table I - Details of the Subjects

No	Sub- ject	Age	Dura- tion yrs months	Diag- nosis	Drugs
1	SGN	34	12	E H	Nil
2	WSK	42	54	E H	Nil
3	SKM	45	54	E H	Nil
4	SNR	38	48	E H	Inderal 20mg BD Dytide 1 EOD
5	SSR	37	12	E H	Inderal 20mg TDS Nephрил 1 EOD
6	STW	38	72	E H	Aldomet 250mg TDS Nephрил 1 EOD
7	CTW	25	15	R H	Inderal 40mg BD Lasix 20 mg EOD
8	STH	38	2	R H	Inderal 40mg TDS Aldomet 1/2 BD Nephрил 1/2 BD

E H - Essential Hypertension
R H - Renal Hypertension

session his blood pressure and GSR were noted and their feedback was given to the individual. Then he was asked to close his eyes and breath smoothly and practise "Shavasana" relaxation exercise for 10 min by concentrating over the various parts of the body sequentially and thereby relaxing the whole body. At the end of 10 min of such practice the individual opened his eyes and noted his GSR and blood pressure reading. For the next 20 min the subject attempted passive volition method in controlling his GSR in increasing the GSR reading which was continuously feedback to him. He was also advised to repeat the autogenic phrases mentally such as "Feel more blood flowing in the limbs and they are warm and heavy". Blood pressure and GSR readings were noted at the beginning of the session and thereafter every 10 min for half an hour. A total of 20 such biofeedback training sessions were given to each subject spread over a period of two months.

Results

Blood pressure values at the time of initial diagnosis of the disease, on entering the trial and at the end of the 20th biofeedback session for the eight subjects are shown in Table II.

The mean systolic blood pressure (SBP) of 144.2 mm Hg (SD 10.5) at the beginning of the first session was found decreased to 119.7 mm Hg (SD 5.5) at the end of 20th biofeedback session, a mean decrease in SBP of 24.5 mm Hg.

Similarly the mean diastolic blood pressure (DBP) was found to decrease from 95.2 mm Hg (SD 3.5) as recorded at

Table II - Blood Pressure Values Before and After Biofeedback Training

S U B J E C T	A		B		C	
	SBP	DBP	SBP	DBP	SBP	DBP
1	150	100	130	88	114	84
2	180	100	154	92	128	80
3	160	100	158	100	124	80
4	150	100	144	96	114	74
5	160	114	130	94	118	84
6	170	110	156	100	124	84
7	154	104	136	92	122	80
8	160	104	138	96	114	84
M	160.8	104	144.2	95.2	119.7	81.2
SD	10.3	5.3	10.5	3.5	5.5	3.5

A - On initial diagnosis
 B - On entering biofeedback sessions
 C - At the end of 20 sessions

SBP - Systolic blood pressure
 DBP - Diastolic blood pressure

M - Mean
 SD - Standard Deviation

the beginning of the first session to 81.2 mm Hg (3.5) at the end of the 20th session, i.e., a mean decrease in DBP of 14.0 mm Hg.

During each session reductions were seen in both SBP and DBP following the 30 min practice of Shavasana and biofeedback, and there were gradual decrements in pre- and post-session blood pressure values as shown in Figs 1 & 2.

All the subjects showed good ability to control and increase GSR. The mean GSR of 115.1 k ohms (SD 33.8) as recorded on the first observation increased to 175.6 k ohms (SD 34.5) at the end of the 20th session. The GSR changes on biofeedback sessions are shown in Fig 3.

Associated decrease in pulse rate from the first day's pre-session mean value of 81.1 per min (SD 5.8) to 65.3 per min (SD 3.9) at the end of the biofeedback sessions is shown in Fig 4.

Discussion

It is suggested that repeated episodes of increased sympathetic discharge with concomitant hormonal release in response to emotional stimulation in daily life may constitute an intermittently acting trigger factor in the gradual development of chronic hypertension in susceptible individual (9).

In the control and management of hypertension, yogic relaxation by 'Shavasana' combined with the modern technique of biofeedback can be of great benefit. It is postulated that yogic relaxation reduces the sympathetic discharge in response to the

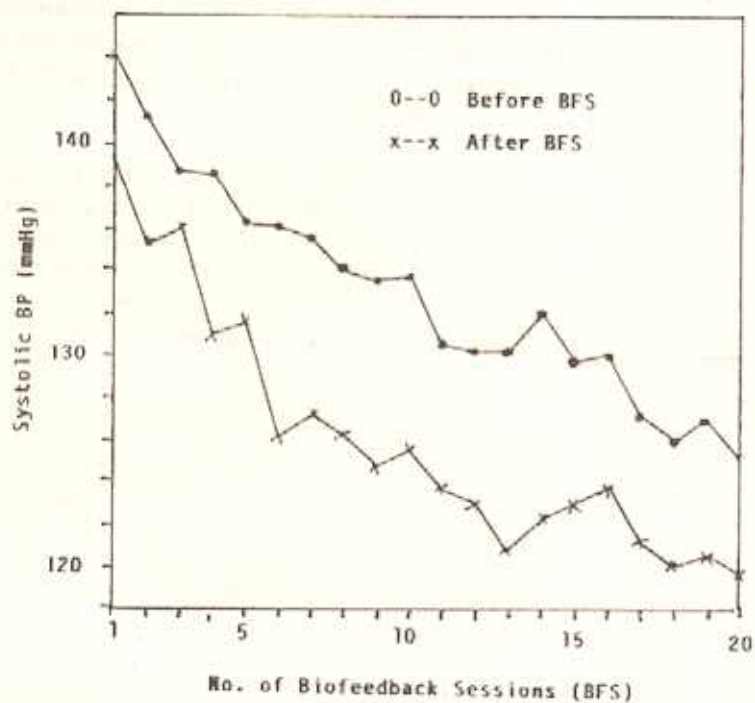


Fig 1. Changes in Systolic Blood Pressure on Biofeedback Training

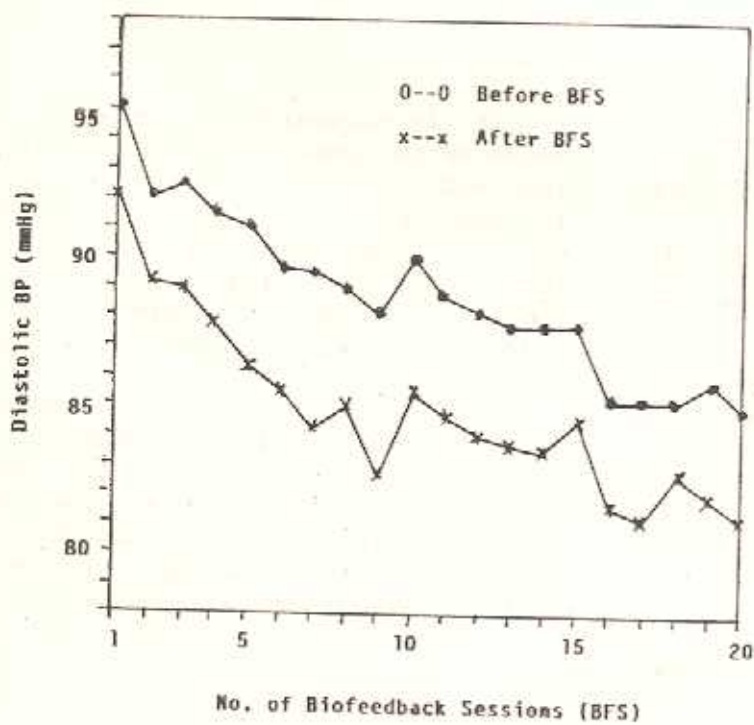


Fig 2. Changes in Diastolic Blood Pressure on Biofeedback Training

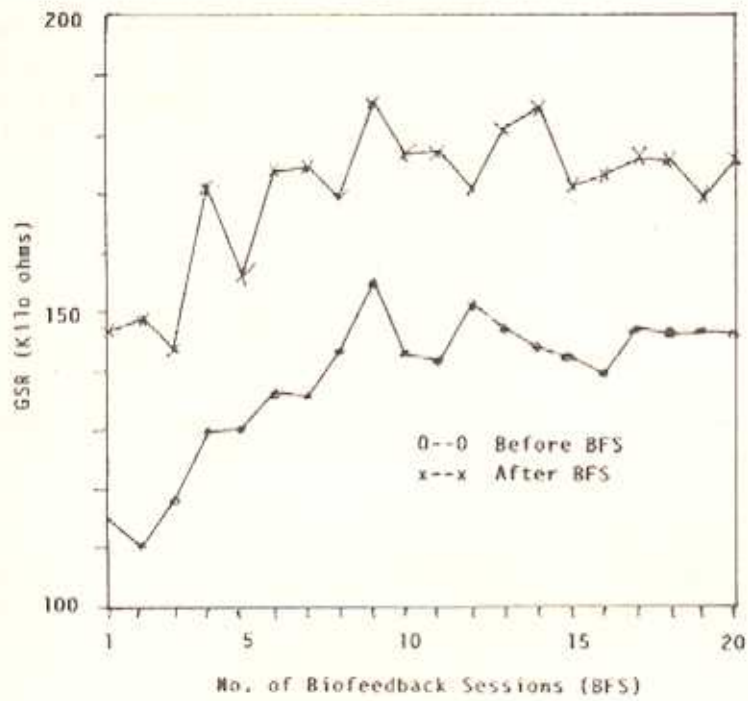


Fig 3. Changes in Galvanic Skin Response on Biofeedback Training

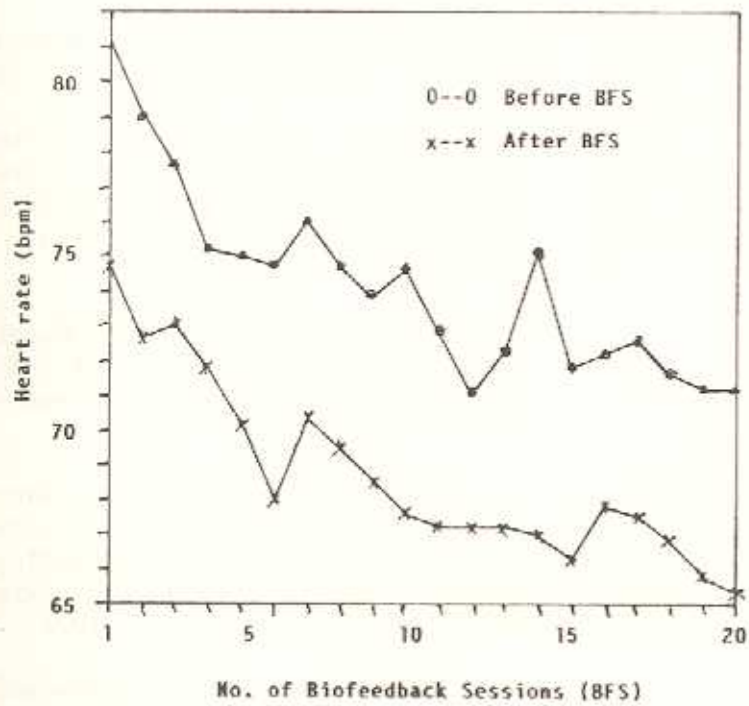


Fig 4. Changes in Heart Rate on Biofeedback Training

environmental stimuli. Mental concentration reduces the perception of the external environment and thus increases perception of one's own internal environment. Additionally helped by biofeedback, the subject becomes more aware of the smallest change in the autonomic function (in this case blood pressure) which let him make necessary change in the control of that function.

Benson et al (1) have reported a fall of 16 mm Hg in SBP in hypertensive patients following biofeedback training. Patel (9) combined yoga and biofeedback and reported a decrease in SBP by 26 mm Hg and a decrease in DBP by 16 mm Hg in hypertensive patients. Pharmacological antihypertensive therapy was stopped altogether in 5 patients and reduced by 35 to 60% in a further 7 patients out of the total 20 patients studied.

In another study, temperature control and autogenic phrases were used for treatment of hypertension (4). Out of 12 patients, 11 became normotensive at the end of training. Seven of these patients were on antihypertensive drugs and all but one could stop them. Their follow up indicated that healthier homeostatic balance was achieved and stress management maintained without need for continued daily practice of self regulation. Krist and Engel (8) suggest that intensive biofeedback training followed by monitoring and training at home might well prove to be a very useful approach.

We have used a combination of yoga relaxation exercise [Shavasana] and biofeedback of blood pressure and GSR as was done by Patel (9). Our results show similar fall in systolic as well

as diastolic blood pressure on completion of yogic relaxation exercise in combination with biofeedback trainings of 20 sessions spread over a period of 2 months.

References

1. Benson H, Shapiro D, Tursky B and Schwartz GE: Decreased systolic blood pressure through operant conditioning techniques in patients with essential hypertension. *Science* 173: 740, 1971.
2. Datey KK, Deshmukh SN, Dalvi CP and Vinekar SL: Effect of relaxation using biofeedback instruments in systemic hypertension. *Biofeedback Research Society Meeting Abstracts*, Monterey, 1975.
3. Rimm DC and Masters JC: *Behaviour Therapy - Techniques and Empirical Finding*. 2nd Ed, Academic Press Inc. New York, 1979, p448.
4. Elmer G and Alyce G: *Beyond Biofeedback*. Delacorte Press, USA, 1977.
5. Elmer G, Alyce G and Walters D: Voluntary control of internal states - psychological and physiological. *J Transpersonal Psychol*, California, 2:1, 1970.
6. Haris R, Brunner and Haralambas Gavras: *Clinical Hypertension and Hypotension*. Marcel Dekker Inc New York, 1982. p165.
7. John F, Beary BS and Benson H: A simple psychophysiological technique which elicits the hypometabolic changes of relaxation response. *Psychosomatic Medicine* 36(2): 115, 1974.

AVIATION MEDICINE, 30(2), December 1986

8. Krist DA and Engel BT: Learned control of blood pressure in patients with high blood pressure. *Circulation* 51: 370, 1975.

9. Patel CH: Yoga and biofeedback in the management of hypertension. *The Lancet*, 10:1053, 1973.

10. Vasudevan J: Yoga and aviation.

Aviation Medicine 28(2): 99, 1984.

11. Wadhawan JM, Dikshit MB, Chatterjee PC, Singh MM and Gupta JK: Yogic exercises - study of psychophysiological factors. *Aviation Med* 28:171, 1984.

12. Wallace RK: Physiologic effects of transcendental meditation. *Science* 67: 1751, 1970.