

# Coronary risk factor reduction through biofeedback-aided relaxation and meditation

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**SUMMARY.** The effects of behaviour modification through education and biofeedback-aided relaxation and meditation on the levels of blood pressure, pulse rate, smoking habits as well as serum cholesterol, triglycerides, and free fatty acids were studied in 18 normotensive, 18 smoking, and 22 hypertensive patients with 18 normotensive controls.

The results showed significant reduction in blood pressure, in all the treated groups; highly significant reduction in the number of cigarettes smoked by smokers; and reduction in some of the lipids in all the treated groups, but particularly in the hypertensive group. The therapy appears to be feasible and suitable for wider application. This approach is economical, acceptable to patients, and should be explored further.

## Introduction

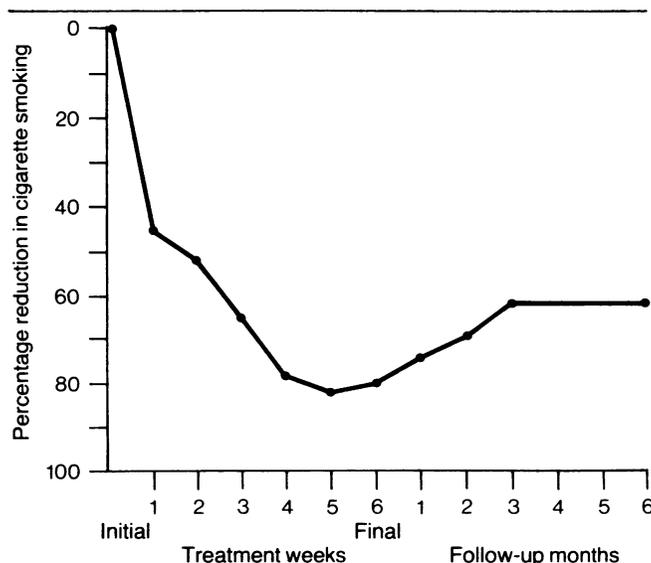
**C**ORONARY heart disease (CHD) is the main cause of death in middle-aged males in industrialized countries (Kays, 1970). About two thirds of all deaths from myocardial infarction occur outside hospitals (Armstrong *et al.*, 1972). A real impact can be made only by an effective programme of prevention. Cigarette smoking, hypertension, and hyperlipidaemia are widely recognized risk factors (Atherosclerosis Study Group, 1970). Emotional and other environmental stresses are increasingly being recognized as significant contributors to morbidity and mortality from CHD (Russek, 1967; Friedman and Rosenman, 1974).

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An increase in serum lipids in response to situational stress has been demonstrated during racing driving (Taggart and Carruthers, 1971), public speaking (Taggart *et al.*, 1973), scholastic examinations (Thomas and Murphy, 1958; Dreyfuss and Czaczkes, 1959), cyclic increase in occupational activities (Friedman *et al.*, 1958), and during emotionally stressful events of daily life (Hammersten *et al.*, 1957; Westlake *et al.*, 1958; Levi, 1969). Similarly pressor response to symbolic stimuli with threatening significance to the individuals has been demonstrated (Wolf *et al.*, 1948).

On the other hand, significant reduction in blood pressure has been observed in hypertensive patients trained in relaxation and meditation using biofeedback instruments (Patel, 1973; 1975a; 1975b; Patel and

**Figure 1.** Reduction in cigarette smoking in smokers' group.



**Table 1.** The effect of six-week relaxation training.

Group	Test	Systolic BP (mm Hg)	Diastolic BP (mm Hg)	Pulse rate per minute	Weight (kg)	Cholesterol (mmol/litre)	Triglyceride (mmol/litre)	Free fatty acids (mmol/litre)
Control n=18	Pre	115.72±11.2	74.1±6.86	71.6±7.2	64.06±10.05	6.017±0.943	1.207±0.523	0.646±0.221
	Post	118.2±13.7	73.2±6.45	70.5±6.6	64.2±9.8	6.039±1.269	1.083±0.317	0.669±0.124
Significance	P=	NS	NS	NS	NS	NS	NS	NS
Treated normo-tensive n=18	Pre	126.98±16.52	82.8±12.93	75.2±7.6	69.53±13.6	6.041±1.15	1.462±1.61	0.706±0.267
	Post	117.28±16.86	75.8±9.95	72.5±9.17	70.34±13.38	5.633±1.15	1.083±0.77	0.569±0.115
	P=	<.0025	<.005	NS	<.0005	NS	<.05	<.05
Control vs normo-tensive	P=	<.0025	<.05	NS	NS	NS	NS	<.025
Treated smokers n=18	Pre	126.9±19.29	79.87±12.36	78.0±8.72	63.74±16.24	6.289±2.317	1.202±0.259	0.575±0.253
	Post	118.66±19.09	77.94±11.84	74.3±9.8	63.91±16.13	5.944±2.056	1.085±0.304	0.522±0.180
	P=	<.01	NS	<.05	NS	<.05	NS	NS
Control vs smokers	P=	<.0025	NS	NS	NS	NS	NS	NS
Treated hyper-tensive n=22	Pre	164.5±18.14	101.1±8.73	78.6±10.43	67.34±16.64	6.26±1.044	1.85±1.411	0.638±0.267
	Post	145.9±16.6	89.9±9.16	74.6±10.8	67.5±16.65	5.764±1.146	1.486±0.737	0.575±0.156
	P=	<.0005	<.0005	<.025	NS	<.0005	<.025	NS
Control vs hyper-tensive	P=	<.0005	<.0005	NS	NS	<.05	NS	NS

Pre=before training; post=after six weeks relaxation training; NS=not significant; vs=versus.

North, 1975). In addition to blood pressure, significant reduction also occurred in serum cholesterol in hypertensive patients in a pilot study (Patel, 1976). This study was designed to observe the effects of a similar behavioural programme on several coronary risk factors.

## Method

### Patients

A notice was placed in the waiting rooms of a group suburban general practice, inviting volunteers between the ages of 25 and 60 years to participate in a heart disease research programme. The volunteers who were smoking ten cigarettes or more per day for a minimum of five years and who, on questioning, indicated a desire to give up smoking were isolated. To this group were added the smokers who had specifically asked for help in giving up smoking via the practice anti-smoking clinic (smokers' group, n=18). The remaining 36 volunteers were allocated either to the treatment or the control group (normotensive treatment and control groups). The fourth group consisted of 22 hypertensive patients of whom 12 were on a constant dose of antihypertensive medication and ten were pharmacologically untreated.

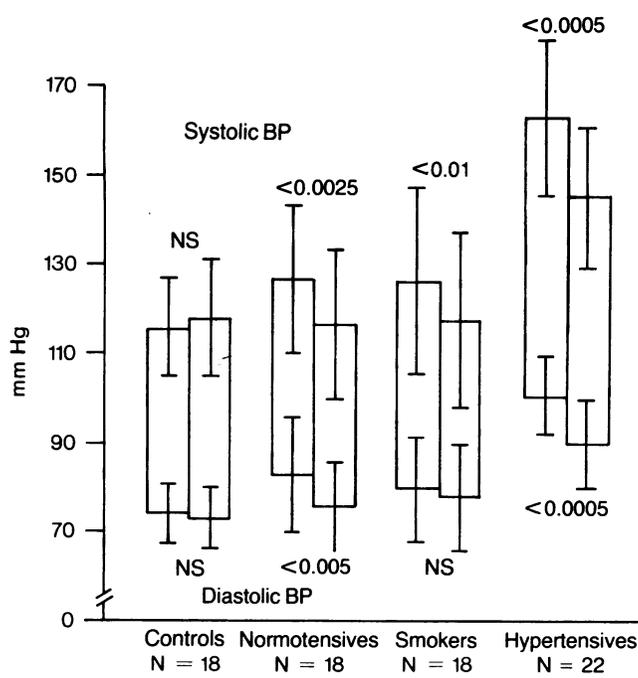
There were seven males and 11 females in the smokers' group with an average age of 40.7 years. In each of the normotensive treated and control groups,

there were six males and 12 females with average ages of 43.5 and 42.9 years respectively. The hypertensive group consisted of eight males and 14 females with an average age of 54.3 years.

### Examinations

The patients arrived after an overnight fast and sat quietly for at least ten minutes. The blood pressure was then taken in a sitting position using a random-zero sphygmomanometer (Wright and Dore, 1970) followed by withdrawal of a venous blood sample. The sample was immediately centrifuged, the plasma being separated and kept frozen until ready for transport to the laboratory. It was analyzed for cholesterol, triglyceride and free fatty acids (Levine, *et al.*, 1967; Carruthers and Young, 1973). The pulse rate, body weight, and number of cigarettes smoked daily were also recorded. Two further measurements of the blood pressure at 20-minute intervals, and one record of pulse rate were taken two to four days later. The averages of three blood pressure measurements and two pulse rates formed initial values for each patient.

The smokers, normotensive and hypertensive treatment groups, were offered treatment schedules which included educational and motivational programmes, as well as training in relaxation and meditation. The training was reinforced by galvanic skin resistance and electromyographic biofeedback instruments providing

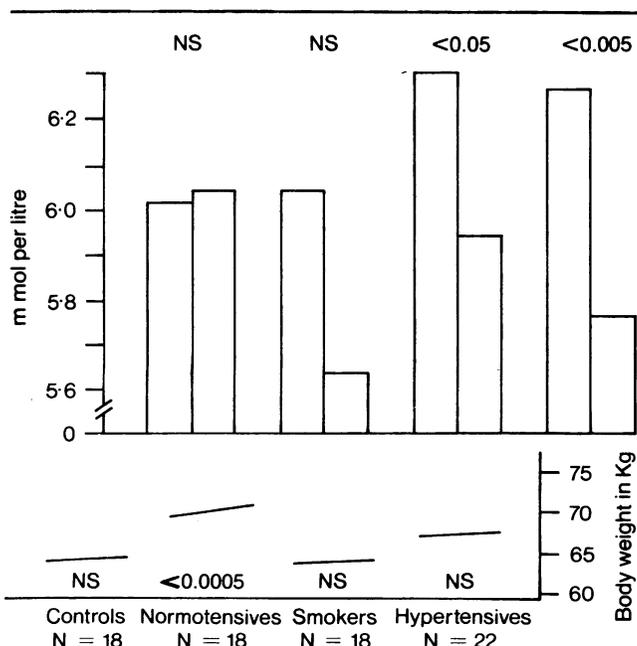


**Figure 2.** Changes in systolic and diastolic blood pressure.

continuous audiosignals to the patient.

Biofeedback instruments continuously measure and display some physiological function which the patient is learning to control by changing somatic or cognitive behaviours. The idea behind the procedure is a belief that the knowledge of results reinforces the learning. The galvanic skin resistance is related to the level of arousal while the electromyographic instrument measures muscle tension. By convention a reduction in

**Figure 3.** Changes in plasma cholesterol in relation to body weight.



the pitch of a sound or the number of clicks, represents an increase in relaxation. When the signal stops the sensitivity of the instrument is increased, the patient continues to relax more and more until the sound stops again, and so on.

The training was carried out in groups of four. Each patient lay in a supine position and was connected to a biofeedback machine by means of two finger or two surface electrodes. The signal from the machine was fed to the patient via a headphone with one earpiece. The other ear was kept open to hear the relaxation instruction given by a cassette tape. There were six half-hour sessions at the rate of one per week. The patient was also lent an instruction cassette and requested to relax with its help at least once, and if possible twice a day without biofeedback. The patient's usual diet and drugs, if any, remained unchanged.

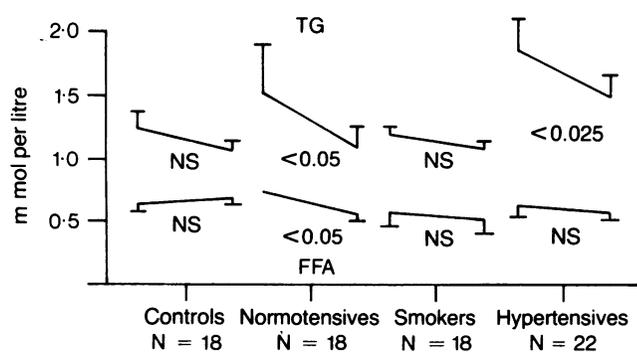
At the end of six weeks there were two evaluating sessions which were attended by the control groups, as well as all the treated groups. During one of these sessions two measurements of blood pressure, 20 minutes apart, and one measurement of pulse rate were taken. During the last session the patient attended after the overnight fast and, as before, blood pressure, pulse rate, body weight and the number of cigarettes smoked were recorded and a blood sample withdrawn. The averages of the three blood pressure measurements and the two pulse rates formed the 'final' value. The smokers were followed up monthly for three months and finally at six months, either by a letter or a telephone call.

## Results

Student's t test was applied to differences between the initial and final values of each measure for the groups and an unpaired t test was done to compare the differences in the treated group with those in the control group. The results are given in Table 1 and Figures 1 to 5.

In the control group none of the measures changed significantly. In the treated group of normotensives both systolic and diastolic blood pressure, as well as triglyceride and free fatty acid levels were reduced while body weight increased (Figures 2, 3 and 4). Treatment versus control group differences showed statistically significant reduction in both systolic and diastolic blood pressure as well as free fatty acids (Table 1).

In the smokers, the number of cigarettes smoked was reduced significantly from a total of 477 to 95 per day. However, not all the reductions were maintained. The number of cigarettes smoked at one, two, and three months follow-up was 125, 138, and 180 per day respectively. At six-month follow-up the total number of cigarettes smoked was 181 per day. Although there were some individual variations, the average number of cigarettes smoked per person was reduced from 26.5 to ten per day (60 per cent reduction, Figure 1). Two smokers in the treated normotensive group and two in



**Figure 4.** Changes in blood triglycerides and free fatty acids.

the hypertensive group, who initially did not wish to give up smoking, reduced smoking or gave up altogether. None of the smokers in the control group showed such spontaneous change, although they too were given the anti-smoking literature.

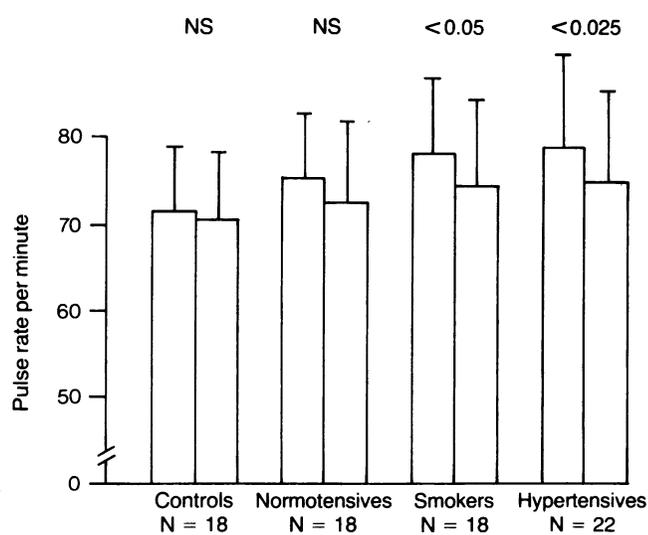
Significant reductions also occurred in systolic pressure, pulse rate, and cholesterol levels. However, control versus treated group differences showed significant reductions in systolic blood pressure only (Figures 2, 3, and 5; Table 1).

In the hypertensive group, the mean systolic pressure was reduced from 164.5 to 145.9 mm Hg and the mean diastolic pressure was reduced from 101.1 to 89.9 mm Hg. In addition significant reductions occurred in pulse rate, cholesterol and triglyceride levels without any significant reduction in body weight (Figures 2, 4, and 5). Treatment versus control group differences showed significant reductions in both systolic and diastolic blood pressure, and serum cholesterol levels (Table 1). Blood pressure, lipids, and smoking habits seemed to have changed independently of each other as there was no positive correlation between them.

## Discussion

The study showed that the behaviour modification programme involving individualistic approach of the biofeedback therapy can be successfully given in groups. Helped by a cassette tape, the time required for training per patient can be reduced to a practical level and hence the argument that it is too time-consuming a therapy to have any practical value can be reduced. The review of published anti-smoking methods suggests that most are disappointing (Schwartz, 1969). The method used in this study is at least one of the better known methods. The hypertensive group showed the best results. This group, being more at risk, may also have more to gain therapeutically. The increase in body weight in the normotensive treated group was unexpected, but could be due to reduction in the metabolic rate as a result of lowered catecholamine secretion.

A multifactorial approach in a prevention programme has been recently emphasized (Royal College of Physicians and British Cardiac Society, 1976). This



**Figure 5.** Changes in heart rate.

study shows one way in which physiological response to everyday stresses could be modified and a range of cardiovascular risk factors decreased without any change in occupational activity, work output, diet, or drugs. In view of the observed effects, a randomized controlled trial of hypertensive patients, or of a group specially at risk from coronary heart disease, would be desirable.

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**Royal College of Midwives—Royal Commission evidence**

Emphasizing the importance midwives attach to the team approach to maternity care, the College stresses how closely they must work with family practitioners.

There are two good reasons for the employment basis of the family practitioner to be brought into line with that of other members of the primary and secondary health care teams. Both are to do with the contractual payment arrangements under which family doctors work.

Item payments for part or total maternity care (at present £50 for total care) mean that doctors are sometimes loath to refer patients, and this "frequently results in duplication rather than sharing of care with the hospital services". Since the implementation of item payments for family planning services, "many family practitioners have undertaken this service without adequate training".

The College deprecates the financial ease with which family doctors may employ their own nursing staff, when district management teams have a tight budget. There has been lack of communication between the midwife employed by the family practitioner and other members of the midwifery service; and sometimes a general practitioner "instructs the practice nurse who is not a midwife to undertake duties for which she is not qualified".

**Reference**

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