

SHORT COMMUNICATION

AUTONOMIC CHANGES DURING "OM" MEDITATION

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**Abstract:** The autonomic and respiratory variables were studied in seven experienced meditators (with experience ranging from 5 to 20 years). Each subject was studied in two types of sessions — meditation (with a period of mental chanting of "OM") and control (with a period of non-targetted thinking). The meditators showed a statistically significant reduction in heart rate during meditation compared to the control period (paired 't' test). During both types of sessions there was a comparable increase in the cutaneous peripheral vascular resistance. Keeping in mind similar results of other authors, this was interpreted as a sign of increased mental alertness, even while being physiologically relaxed (as shown by the reduced heart rate).

**Key words:** oxygen consumption  
metabolism

yoga  
meditation

INTRODUCTION

Mentally chanting "OM" was shown to increase the efficiency with which sensory information was processed in subjects with more than 10 years of meditation experience, whereas mentally chanting "one" had the opposite effect (1). These changes occurred mainly at the mesencephalic or diencephalic level. Another study of 7 proficient subjects (3 of whom had 20 years experience of meditation), revealed that mental chanting of "OM" activated higher neural centres, i.e. the association cortices (2). Mental chanting of "OM" leads to a single thought state, and a subjective feeling of deep relaxation. Hence the present study was carried out to find out whether "OM" meditation would also cause changes in the autonomic and metabolic functions of the seven experienced meditators whose neural responses to the meditation were described above (2).

METHODS

**Subjects :** The study was carried out on 7 normal, healthy male volunteers in the age range of 29 to 55 years (mean  $\pm$  SD, 42.3  $\pm$  9.8 years). They were all committed meditators with experience ranging between 5 and 20 years. The

details of the study were explained to the subjects and their signed informed consent was taken in accord with the ethical guidelines of the Indian Council of Medical Research, New Delhi.

**Design of the study :** Each session was of 32 min duration, of which 20 min were spent in meditation, preceded and followed by two 6 min periods of sitting relaxed, with eyes closed. Subjects were also studied in control sessions which were of the same duration as the meditation sessions, and similar in design except that the 20 min period was spent sitting relaxed with eyes closed, and non-targetted thinking (instead of meditation). Meditation involved mental chanting of "OM", while sitting comfortably, with eyes closed. Both types of sessions were repeated on three separate days.

**Parameters studied :** Recordings of autonomic and respiratory variables were made on a 10 channel polygraph (Model 10, Polyrite, Recorders and Medicare systems, Chandigarh, India). EKG was recorded using the standard limb lead I configuration. Heart rate was obtained by counting the number of QRS complexes per 40 sec intervals continuously. Epochs of 40 sec were chosen to be able to correlate this data

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with that of subjects practicing other meditations (3). This has been described in the discussion. Palmar skin resistance (SR) was recorded using 2 silver chloride disc electrodes filled with electrode jelly (CSR Technocarta, Hyderabad, India), placed 4 cm apart on the palmar surface of the right hand. SR values were sampled continuously at 20 sec intervals. Skin blood flow was recorded using a photo-electric plethysmograph placed over the left thumb nail. The amplitude of six plethysmogram waveforms were calculated in each minute. Two nasal thermistors placed one at each nostril were used to record respiration. The number of breath cycles in each minute was calculated to give the respiratory rate. Oxygen consumption was recorded using the closed circuit Benedict-Roth apparatus. In this method, the subject breathed into an oxygen tank wearing a close fitting mask, and with a nose clip. The exhaled carbon dioxide does not enter the tank, as it is absorbed by soda lime. The difference between the initial and final volumes of oxygen in the tank is the amount of oxygen consumed by the subject in a given period of breathing (i.e. 5 min). The recording laboratory had a temperature of  $25 \pm 1^\circ\text{C}$ , with relative humidity about 70 percent.

The values were corrected for standard temperature and pressure.

The OC recordings were made before and after meditation, but not during meditation. Polygraphic recordings were made before, during, and after meditation.

Values of the 5 variables mentioned above were averaged for each of the 3 periods of a session viz. before, during and after meditation (or the control procedure). Statistical analysis of these averaged values was done to reveal significant differences between (a) before versus during meditation (or control) and (b) during meditation versus during control periods, using the paired 't' test.

## RESULTS

All seven meditators showed a small but statistically significant reduction in heart rate during meditation compared to the control period ( $P < 0.001$ , paired 't' test, Table I). There was a significant and comparable decrease in finger plethysmogram amplitude, during the meditation and control periods compared to the preceding periods ( $P < 0.05$ , paired 't' test, in both cases). There was also a non-significant trend of

TABLE I: Autonomic and respiratory variables recorded in 7 meditators. Values are Group mean  $\pm$  S.D.

Variables studied	Meditation session		Control session	
	Pre	During	Pre	During
Heart rate (Beats per 40 sec)	47.00 $\pm 5.00$	46.90** $\pm 4.30$	47.20 $\pm 4.90$	47.60 $\pm 4.80$
Respiratory rate (Breaths per min)	10.80 $\pm 3.60$	10.40 $\pm 3.30$	10.50 $\pm 3.40$	11.10 $\pm 3.20$
Skin resistance (Kilo ohms)	412.90 $\pm 129.90$	446.60 $\pm 107.10$	307.40 $\pm 123.40$	335.70 $\pm 113.80$
Finger plethysmogram amplitude (mm)	1.00 $\pm 0.20$	0.70* $\pm 0.20$	1.10 0.20	0.70# $\pm 0.20$

Oxygen Consumption was recorded immediately before and after the meditation period, but not during.

Oxygen consumption	Pre	Post	Pre	Post
(ml/min STPD)	454.00 $\pm 192.00$	386.20 $\pm 68.70$	480.30 $\pm 153.00$	483.80 $\pm 232.50$

\*\*  $P < 0.001$ , during meditation versus during control (paired 't' test).

#  $P < 0.05$ , before versus during period (paired 't' test).

reduction in the oxygen consumption following meditation ( $P > 0.05$ , paired 't' test). The group average values  $\pm$  SD for all 5 variables are as shown in Table I.

### DISCUSSION

The present study revealed a significant decrease in heart rate during mental chanting of "OM", which is suggestive of psychophysiological relaxation. The non-significant trend of reduction in oxygen consumption also has a similar interpretation. This change is similar to that caused by TM (4), though of smaller magnitude.

However, it is important to note that the actual pre-meditation (or control) values of oxygen consumption of the (senior) meditators of the present study were noticeably higher than those of other meditators (4), and of the general population. Since it is usually thought that yoga practitioners have lower oxygen consumption values than those who do not practise yoga, these results are difficult to explain. There is a report (5) in the literature which demonstrated an increase in the basal metabolic rate (BMR) with six weeks experience in yoga, compared to the period before learning yoga. The BMR decreased, but did not return to the initial value after continuing yoga practice for six weeks. In contrast to the present study, the subjects were not practising meditation, but were practising specific postures (yogasanas) and breath regulation (pranayama). Hence no direct correlation can be made between

the two studies, and further assessments are necessary to come to a definite conclusion.

The significant decrease in finger plethysmogram amplitude (i.e. increased peripheral vascular resistance) which occurred during both meditation and control periods is a sign of increased sympathetic tone and hence is also not expected during meditation (4).

While attempting to explain these seemingly contradictory results, it is to be noted that the same individual may simultaneously show changes in two variables indicating opposite states of arousal, e.g. a decrease in heart rate along with reduced skin resistance. While explaining similar contradictory changes in Ananda Marga meditators (6), the authors described the reduced skin resistance as an attempt to prevent intrusion of sleep during the session. Since reduced skin blood flow is known to occur when the subject is alert, as while solving arithmetic problems mentally (7), the present study might indicate that chanting "OM" mentally causes increased alertness (reduced finger plethysmogram amplitude), even though the subject was more relaxed (reduced heart rate).

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### REFERENCES

1. Telles S, Nagarathna R, Nagendra HR, Desiraju T. Alterations in auditory middle latency evoked potentials during meditation on a meaningful symbol-"OM". *Int J Neurosci* 1994; 74:87-94.
2. Telles S, Desiraju T. Recording of auditory middle latency evoked potentials during the practice of meditation with the syllable "OM". *Indian J Med Res* 1993; [B] 98:237-239.
3. Telles S, Desiraju T. Autonomic changes in Bramakumaris Raja Yoga Meditation. *Int J Psychophysiol* 1993; 1:147-152.
4. Wallace RK, Benson H, Wilson AF. A wakeful hypometabolic physiologic state. *Am J Physiol* 1971; 221:795-799.
5. Dhanaraj VH. The effects of yoga and the 5BX fitness plan on selected physiologic parameters. In : Science studies Yoga. Funderburke J (Ed), Illinois, Himalayan International Institute, 1977.
6. Corby JC, Roth WT, Zarccone VP, Kopell BS. Psychophysiological correlates of the practice of Tantric Yoga meditation. *Arch Gen Psych* 1978; 36: 571-577.
7. Delius W, Kellerova E. Reaction of arterial and venous vessels in the human forearm and hand to deep breath or mental strain. *Clin Sci* 1971; 40: 271-282.