

Effects of Smoking on Vegetative Reactivity to Noise

P. P. Woodson, R. Buzzi, K. Baettig

Institute for Behavioral Science, Swiss Federal Institute of Technology, CH - 8092 Zuerich

Introduction

Subjective reports indicate that one of the major reinforcing effects of cigarette smoking, for smokers, is its calming or stress dampening effect (5). This subjective effect, however, is in contradiction to nicotine's pharmacological actions which result in an autonomic imbalance generally tending towards a sympathetic preponderance (5). Noise, as an environmental stressor, also induces such activational effects (2). The interactive effects of smoking and noise have been investigated (6) on a subjective level. The present study sought to extend this work (6) to a psychophysiological level as well. By manipulating both subjective state and psychopharmacological variables, a more adequate understanding of smoking's calming effect may be had.

Method

Subjects. Sixty adult females were assigned to one of five treatment groups (12/group): smoking-deprived subjects who real (DS/RS) or sham (DS/SS) smoked, nonsmokers who sham smoked (NS/SS), and smoking-nondeprived subjects who real (NDS/RS) or sham (NDS/SS) smoked. Deprived smokers had abstained since the evening before the experiment.

Apparatus. Throughout the experiment, various psychophysiological signals (electrocardiogram, photoplethysmogram for foot, ear, and hand, pulse transit time for foot and ear, and skin conductance) were continuously recorded (3,4). Environmental noise bursts were presented over loudspeakers at 95 dBA. Subjective annoyance to each noise burst was reported in deviations from that experienced for the first. Blood pressure was measured by a sphygmomanometer. Cigarette puffing profile was measured by a puff pressure and flow meter (PFM) (1). Breath carbon monoxide (CO) was measured as an index of smoke inhalation (1).

Procedure. CO and blood pressure were recorded before and after the experiment. Amnesic data had been previously obtained. The experimental recording session consisted of three phases:

- 1.) Pre-treatment, noise exposure phase. A 2 min resting baseline was followed by exposure to three 36 sec train noise bursts, each of which were separated by 2.4 min quiet intervals.
- 2.) Treatment, no-noise exposure phase. 2.4 min after the third train noise burst, the subject either real or sham smoked one cigarette of her preferred brand. Puffing style was recorded by the PFM.
- 3.) Post-treatment, noise exposure phase. 2 min after the last puff, a 2 min quiet period was followed by exposure to five 36 sec airplane noise bursts, each of which were separated by 2.4 min quiet intervals.

Results

Inspection of Figures 1-3 indicates that the interactions between noise and smoking induced sympathetic arousal differed for different recording sites. Real smoking increased heart rate thereby dampening noise induced phasic cardiac accelerations (Fig. 1). The same interaction was found for foot plethysmogram amplitude whereby the magnitude of noise induced amplitude reductions (vasoconstriction) was diminished after real smoking. Pulse transit time was decreased by real smoking while being only modestly affected by noise (Fig. 2). For finger plethysmogram amplitude, however, the vasoconstrictive effect of noise overshadowed those of real smoking (Fig. 3). The pronounced dampening effect of real smoking on subjective annoyance to noise (Fig. 4) was obtained even before the subjects were allowed to smoke, suggesting tranquilization by anticipation.

FIGURE 1: ELECTROCARDIOGRAM MEAN R-R INTERVAL

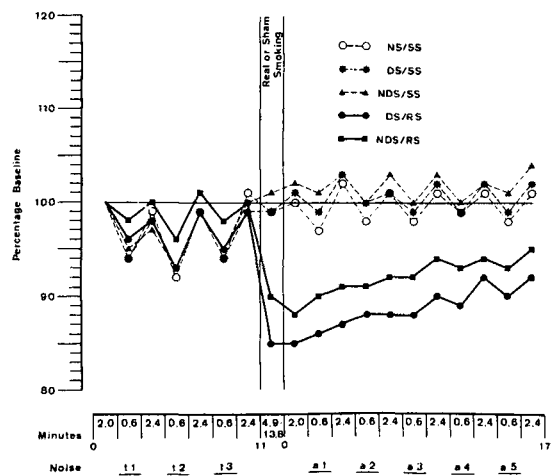


FIGURE 2: MEAN EAR PULSE TRANSIT TIME

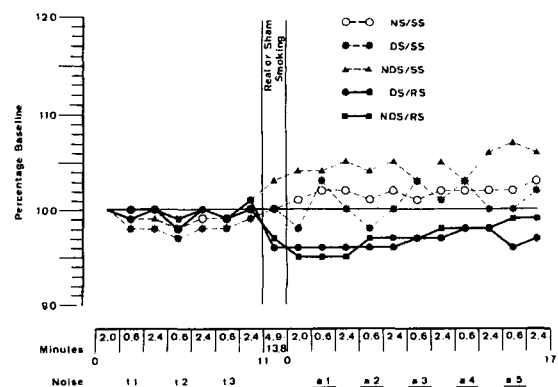


FIGURE 3: HAND PLETHYSMOGRAM MEAN AMPLITUDE

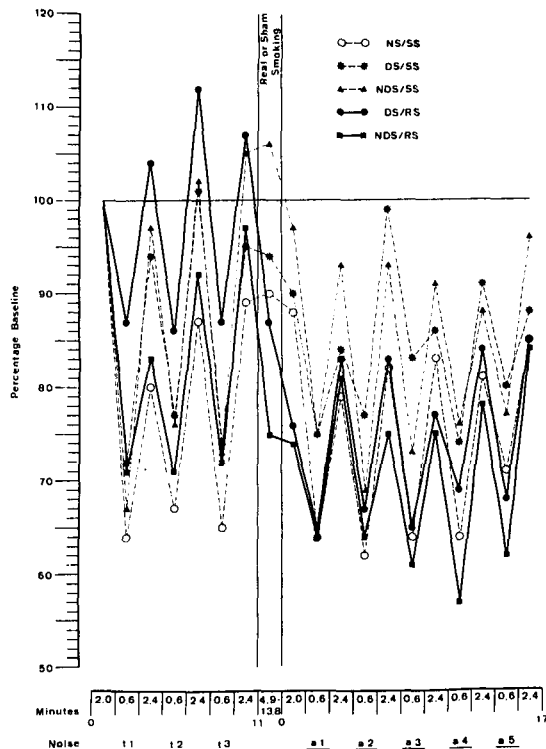
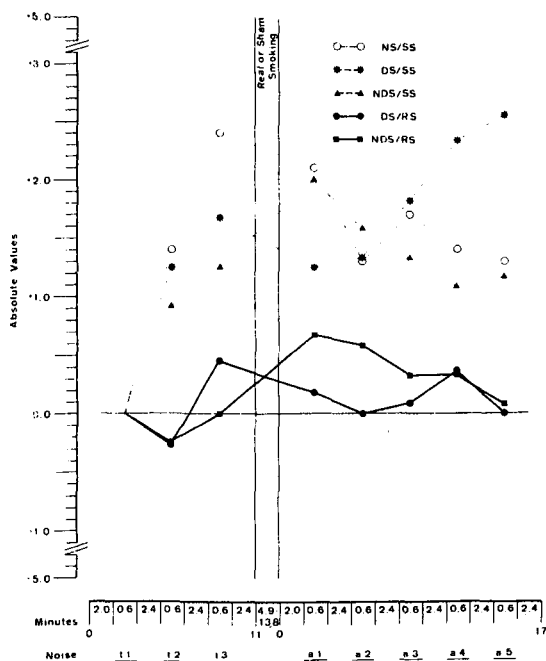


FIGURE 4: MEAN SUBJECTIVE ANNOYANCE PER NOISE BURST



Results for puffing and CO agree with previous work (1). Pre/post blood pressure was unaffected by real smoking.

Discussion

In view of the heterogeneous effects of smoking on cardiovascular responsivity to noise, the importance of cardiovascular cues in the calming effect of smoking should be questioned. The role of anticipation, as a mediating variable, should be more fully explored.

Zusammenfassung

Effekte von Rauchen auf die vegetative Lärmreaktivität

Es wurden interaktive Wirkungen von Lärmstößen und Rauchen auf verschiedene kardiovaskuläre Messgrößen und auf die subjektive Lärmbelastigung untersucht. In Bezug auf Rauchen wurde Scheinrauchen bei Nichtraucher und Rauchern sowie Echtrauchen bei Rauchern untereinander verglichen. Das Echtrauchen erzeugte je nach Variable unterschiedliche Interaktionen mit den kardiovaskulären Lärmeffekten. Damit wird die Bedeutung derartiger peripherer Effekte als Erklärung des Rauchverhaltens fragwürdig. Ferner bewirkte bereits die Antizipation des Rauchens eine subjektive Stressreduktion. Ob und inwiefern dieser antizipativen Tranquillisation eine nikotinische oder eine nicht-pharmakologische Konditionierung zu Grunde liegt, bleibt offen.

Résumé

Reaction végétative au bruit chez le fumeur

Les réactions au bruit de certaines variables cardiovasculaires ainsi que la gêne uniquement subjective ont été étudiées à la fois chez des non fumeurs et chez des fumeurs. Les fumeurs, divisés en deux groupes ont fumé, les uns une cigarette de leur marque habituelle, les autres une cigarette non allumée. Tous les non fumeurs avaient une cigarette non allumée. Chez les vrais fumeurs, la mesure des interactions dues au bruit et au fait de fumer, a montré des résultats variables pour les différentes fonctions examinées. Donc, les effets périphériques mesurés n'expliquent guère le besoin de fumer. De plus, un effet tranquillisant subjectif apparaît dès le début de l'expérience, avant que la cigarette ne soit fumée. Cette relaxation induite est-elle due à une réaction conditionnée ou à des effets pharmacologiques liés au tabac? Au vu des résultats déjà acquis, il est certain que la question mérite des recherches plus approfondies.

Littérature

- (1) Bättig, K., Buzzi, R., & Nil, R. Smoke yield of cigarettes and puffing behavior in men and women. *Psychophar.* 1982, 76, 139-148.
- (2) Bättig, K., Zeier, H., Müller, R., & Buzzi, R. A field study on vegetative effects of aircraft noise. *Arch. Envir. Health* 1980, 35, 228-235.
- (3) Buzzi, R., & Bättig, K. Computerized recording of multichannel biological functions. In press.
- (4) Buzzi, R., Wespi, J., & Zwimpfer, J. Data collection, computation and statistical analysis in psychophysiological experiments. *Act. Ner. Super.* 1982, Suppl. 3, 342-346.
- (5) Gilbert, D. G. Paradoxical tranquilizing and emotion-reducing effects of nicotine. *Psycho. Bull.* 1979, 86, 643-661.
- (6) Schachter, S. Pharmacological and psychological determinants of smoking. In R. E. Thornton (Ed.), *Smoking behaviour: Physiological and psychological influences.* Edinburgh: Churchill Livingstone, 1978.

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