Effect of Nicotine on the Mobilization of Free Fatty Acids from Adipose Tissue in vitro

It has been established in previous studies[1] that tobacco smoking in man and nicotine administration in the dog are followed by increased plasma concentrations of free fatty acids (FFA). Isotopic studies[2] have shown that the rise is due to an augmented influx of FFA into the circulation. It also has been shown that the increased sympathetic and catecholamine activity effected by nicotine have a basic role in the FFA response[3,4]. The present study was undertaken to determine whether nicotine has any direct adipokinetic effect contributing to the release of FFA.

Method of study. Sprague-Dawley rats were killed by decapitation, and epididymal fat pads were removed, sectioned, and intermixed into portions of approximately 200 mg of tissue. The adipose tissue was incubated for 2 h at 37 °C in 5 ml of Krebs-Ringer bicarbonate buffer containing 4% bovine albumin. Aliquots of medium were removed before and after incubation for FFA estimation[5]. Additions to the control medium consisted of nicotine alkaloid (1.0–8.0 μg) and L-epinephrine (7.28 and 14.56 μg).

To determine the in vivo effect of these drugs on subsequent in vitro release of FFA, rats were pretreated with saline, nicotine (0.2 mg/kg), or L-epinephrine (0.2 mg/kg), administered i.p. 15 min before sacrifice. Fat pad dissection and incubation was then done as described. Statistical significance of mean differences of paired observations was determined by Student's *t*-test.

Results. Table I shows the effect on FFA release of adding nicotine or epinephrine to the epididymal fat pad incubation. Nicotine did not significantly affect adipose tissue lipolysis compared to the control. With epinephrine there was an increase in release of FFA of 66% and 89%.

When nicotine and epinephrine were administered before sacrifice, subsequent incubation of the animals' fat pads resulted in an increased FFA release of 45% and 54%, respectively, compared to rats receiving saline (Table II).

Discussion. The initial experiments demonstrated that nicotine, in a wide range of concentrations, had no effect on rat adipose tissue lipolysis during in vitro incubation. VERDY[6], in in vitro studies with human adipose tissue, also found that nicotine had no direct lipolytic effect.

When nicotine was given before sacrifice, there was a significant increase in the release of FFA during subsequent adipose tissue incubation, comparable to that which followed epinephrine pretreatment. This suggests that pretreatment with nicotine resulted in catecholamine release and accumulation in adipose tissue, stimulating lipolytic activity during incubation.

The findings in this study indicate that nicotine has no direct lipolytic action on rat adipose tissue. They lend support to the view that the mobilization of FFA by nicotine and tobacco smoke is a result of sympathoadrenal stimulation[7].

Table I. Effect of nicotine and epinephrine on release of free fatty acids from rat adipose tissue in vitro

Additions to incubation Medium	FFA released (μEq/g tissue)	*P* (compared to control)
None	5.68 ± 0.72	
Nicotine 1 μg	5.87 ± 0.61	n.s.
Nicotine 2 μg	6.41 ± 0.58	n.s.
Nicotine 4 μg	5.21 ± 0.46	n.s.
Nicotine 6 μg	6.48 ± 0.98	n.s.
Nicotine 8 μg	4.73 ± 0.67	n.s.
Epinephrine 7.28 μg	9.45 ± 0.88	< 0.05
Epinephrine 14.56 μg	10.73 ± 1.17	< 0.01

8 animals were used in each experiment.

Table II. Effect of pretreatment with nicotine and epinephrine on in vitro release of free fatty acids from rat adipose tissue

Treatment before sacrifice	FFA released in vitro (μEq/g tissue)	*P* (compared to control)
Saline	5.71 ± 0.56	
Nicotine	8.28 ± 0.91	< 0.01
Epinephrine	8.82 ± 0.79	< 0.01

7 animals in each experiment.

Zusammenfassung. In-vitro-Versuche mit Fettgewebe von Ratten zeigten keine direkte Wirkung des Nikotins auf die Freisetzung nicht veresterter Fettsäuren. Wurde den Tieren Nikotin verabreicht, bevor sie getötet wurden, so konnte nach Inkubation des Fettgewebes ein signifikanter Anstieg der Lipolyse festgestellt werden. Diese Beobachtung stützt die Auffassung, dass die Mobilisierung freier Fettsäuren durch Nikotin über eine sympathoadrenale Stimulierung erfolgt.

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