Pulmonary Damage in Rats Fed by Beans *(Phaseolus vulgaris)*

The research into models of emphysema in animals has been extensive throughout the last 80 years. Many approaches have been tried, including mechanical obstruction of the respiratory passages, vagal stimulation, pulmonary lobectomies, damage to alveolar septa directly or via the lung circulation etc.[1] Interesting studies appeared recently, indicating – at least in rats – possible dietary factors resulting in pulmonary damage to the animals[2,3]. In our earlier experiments, lung lesions resembling emphysema were produced by tracheal constriction and papain given intratracheally[4], and by intratracheal injections of phytohemagglutinin both with and without tracheal constriction[5]. Here we now present results obtained in rats in which pulmonary lesions were found in connection to diet.

Male rats of the strain Wistar-Konárovice were kept in groups of 4 on a customary type of pellet diet. When their body weight averaged 110–160 g they were fed by beans of *Phaseolus vulgaris* only, with water ad libitum for a period of 12 days. A second interval of beans feeding was 1 week later and lasted 4 days. Except for a decrease of the body weight of the experimental group during and shortly after these periods, no change in growth curves was observed. At the time of the experiment, the average body weight of the beanfed animals was 95% that of the controls.

The first 2 animals of the experimental group were examined 6 weeks after the beginning of the experiment, the rest of the animals in the time between the eleventh and twelfth week, together with the control group. In urethane anesthesia the lung functional residual capacity was measured and correlated with the histological picture of the lungs. At the same time, other functional parameters were measured. There was, however, no substantial difference in the ventilatory response to 100% oxygen or to 5% carbon dioxide inhalations, in the ECG, in blood volume, hematocrit, hemoglobin concentration and in the weight of heart and liver, between the experimental and control groups.

The functional residual lung capacity was measured by the method described by KING[6]. The histological lung preparations fixed at a constant pressure of 12 cm H_2O were quantitatively evaluated by the method described by DUNNILL[7]. In short, the histological preparation was projected at an overall magnification of 200× on a screen with 25 crosses. The type of tissue underlying each of the crosses was identified and added under one of the following headings: alveolar air spaces, alveolar septa, bronchi, vessels. A total of 500 points was counted and expressed in %. The regions of large vessels and bronchi were avoided, so that these tissues averaged less than 2%.

Figure 1 shows the correlation of functional residual lung capacity expressed in ml/kg body weight to per cent of air spaces in the histological examination. A higher functional lung capacity and an increase in per cent of air spaces in the lungs of the animals fed by beans can be observed. Figure 2 presents histological pictures of lungs of one of the control rats (No. 5/11013), and of one of the experimental group (rat No. 3/10961). The emphysematous enlargements of air spaces with alveolar disruptions can be noted.

At the moment we are unable to evaluate the significance of the results presented. The mechanism of this dietary effect is obscure and further experiments are needed for its elucidation[8].

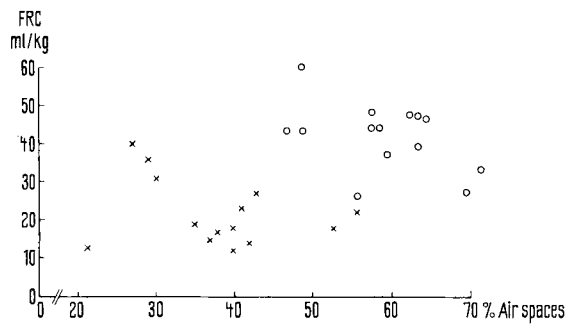

Fig. 1. Functional residual capacity (FRC) in ml/kg on ordinate and per cent of air spaces in the lung histological preparation on abscissa. Rats of the control group are marked by crosses (X), experimental animals by open circles (○).

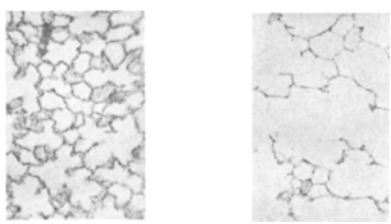

Fig. 2. Histological sections of rat lungs. (A) Lung of a control animal. (B) Lung of an experimental animal. The sections were prepared from the preparations after intratracheal fixation by Zenker's solution under the pressure of 12 cm H_2O. They are 6 μ thick, stained by haemotoxyline-eosin. The original magnification was 200 × in both cases. The longer side of the reproduction represents 700 μ of the original preparation.

Zusammenfassung. Bei Ratten, die eine besondere Diät erhielten, wurden Lungenveränderungen festgestellt. Bei Verfütterung von Bohnen (*Phaseolus vulgaris*) kam es zu emphysemähnlichen Veränderungen, welche funktionell und histologisch festgestellt wurden.

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8 Thanks are due to Mrs. BOUČKOVÁ and Mrs. ŠTĚPOVÁ for skilled technical assistance.