# THE DEPENDENCE OF THE LIPOPEXIC FUNCTION OF THE LUNGS ON THE TEMPERATURE OF EXTERNAL ENVIRONMENT

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There is a considerable quantity of experimental data proving that the lungs retain and split fats and oxidize fatty acids [3-7 and others]. The lipopexic function of the lungs is associated with liver activity: the lungs supplement and compensate liver functions in regulating fat metabolism [8]. There is no evidence that along with active participation by the lungs in fat metabolism, they also participate even to the slighest extent in metabolism of other food substances – proteins and carbohydrates [1, 9].

No experimental work devoted to association of lipopexic function of the lungs and temperature of the external environment was found in the literature on the role of lungs in fat metabolism. Observations on seasonal fluctuations of lipids in the blood of healthy man are available. The lipid content of the blood of healthy individuals tends to become lower during the winter months [2, 10, 11]. It can be assumed that the lowering of the lipid content of blood at low temperatures of the external environment is associated with the lipopexic function of the lungs. It is possible that under such conditions fats mobilized from fat depots are transported by the blood to the lungs where their oxidation takes place.

We carried out investigations with the purpose of studying the lipid content of blood depending on the temperature of the external environment.

## EXPERIMENTAL METHOD

Experiments were carried out on warm-blooded animals during the summer months of 1955–1956, experimental animals – rats, guinea pigs and cats. All animals were divided into two groups. One group was kept at the temperature of 4-6° for 3-6 days, the other – at the temperature of 25-28°. There were 10 series in these experiments. Each series contained one group of "cold" and one group of "warm" animals. Feeding was the same in both groups. After a period during which one group of animals was kept at a high and the other group at a low temperature, the animals were sacrificed by decapitation and the lungs were removed.

The lungs of 28 "cold" and 29 "warm" rats, of 2 "cold" and 2 "warm" cats and of 2 "cold" and 2 "warm" guinea pigs were subjected to investigation. In such a manner we studied the lungs of 65 animals.

The lungs removed were placed into a drying compartment for 10 hours at a temperature of about 95°. The dried organs were pulverized and again dried to a constant weight. Following cooling in the exsiccator the dry powder from the organs was placed into packages of filter paper which was previously defatted and dried to a constant weight. The weight of the package and the package plus the powder was determined on analytical scales with an accuracy of ± 0.2 mg. The weighed packages with powder from "cold" and "warm" lungs were placed into Sokslet's apparatus and subjected to extraction with ether for eight hours. Following extraction of lipids the packages were again placed into a drying compartment for 6 hours at a temperature of about 50° to insure complete evaporation of ether. After cooling in the exsiccator the packages were again weighed with an accuracy of ± 0.2 mg. The difference in the weight of the powder before and after extraction with ether corresponded to the quantity of lipids (in mg) extracted from a given powder. This difference in weight was expressed as a percentage in relation to the initial weight (percentage of loss).

In each series of experiments the average value of the percentage of weight loss in "cold" and "warm" lungs was calculated. To obtain the average of 4 and 5 experiments the average square deviation was calculated using the formula $\sigma = \pm\sqrt{\frac{\epsilon d^2}{n-1}}$, where $\epsilon d^2$ is the sum of the squares of the differences between the average and each individual value, and n is the number of calculations.

## EXPERIMENTAL RESULTS

Data presented in the table shows that the lungs of animals kept at low temperature revealed a tendency to a somewhat higher content of lipids as compared with lungs of animals kept at a high temperature.

It may be assumed that the temperature of inhaled air influences the lipopexic function of the lungs causing its intensification in the cold.

The Influence of the Temperatures of the External Environment of the Lipid Content of the Lungs of Animals

| Series number and animal | Weight of lungs in mg and % of weight loss | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | in the cold | | | % of loss $(\frac{A-B}{A} \cdot 100)$ | in the warm | | | % of loss $(\frac{A-B}{A} \cdot 100)$ |
| | animal No. | wt. prior to extraction (B) | wt. following extraction (B) | | animal No. | wt. prior to extraction (A) | wt. following extraction (B) | |
| I (rats) | 1 | 278,0 | 246,0 | 11,5 | 6 | 210,8 | 192,8 | 8,5 |
| | 2 | 339,7 | 298,3 | 12,2 | 7 | 313,0 | 287,0 | 8,3 |
| | 3 | 502,4 | 442,8 | 11,8 | 8 | 239,5 | 212,6 | 11,2 |
| | 4 | 312,9 | 273,8 | 12,5 | 9 | 380,0 | 338,0 | 11,0 |
| | 5 | 393,5 | 341,5 | 13,2 | 10 | 312,6 | 288,0 | 7,9 |
| | Average | | | 12,2 σ=±0,66 | Average | | | 9,4 σ=±1,59 |
| II (rats) | 1 | 253,8 | 209,6 | 17,4 | 3 | 505,6 | 443,3 | 12,3 |
| | 2 | 252,2 | 214,6 | 14,9 | 4 | 392,0 | 346,9 | 11,5 |
| | | | | | 5 | 270,9 | 229,6 | 15,2 |
| | Average | | | 16,2 | Average | | | 13,0 |
| III (rats) | 1 | 246,7 | 217,8 | 11,7 | 5 | 240,0 | 215,6 | 10,2 |
| | 2 | 388,6 | 302,3 | 10,7 | 6 | 244,1 | 222,2 | 9,0 |
| | 3 | 284,1 | 204,1 | 9,9 | 7 | 291,9 | 269,6 | 7,6 |
| | 4 | 359,2 | 323,0 | 10,1 | 8 | 301,1 | 275,0 | 8,7 |
| | | | | | 9 | 274,5 | 247,5 | 9,8 |
| | Average | | | 10,6 σ=±0,81 | Average | | | 9,1 σ=±0,81 |
| IV IV (cats) | 1 | 1025,8 | 881,2 | 14,1 | 3 | 1057,2 | 934,3 | 11,6 |
| | 2 | 1064,4 | 942,0 | 11,5 | 4 | 1215,6 | 1071,1 | 11,9 |
| | Average | | | 12,8 | Average | | | 11,8 |

(continued)

| Series number and animal | Weight of lungs in mg and % of weight loss | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | in the cold | | | % of loss | in the warm | | | % of loss |
| | animal No. | wt. prior to extraction(B) | wt. following extraction (B) | $(\frac{A-B}{A} 100)$ | animal No. | wt. prior to extraction(A) | wt. following extraction (B) | $(\frac{A-B}{A} 100)$ |
| V (rats) | 1 | 181,7 | 158,3 | 12,8 | 5 | 306,0 | 269,3 | 12,0 |
| | 2 | 270,0 | 234,4 | 13,2 | 6 | 288,2 | 250,3 | 13,2 |
| | 3 | 249,3 | 214,5 | 13,9 | 7 | 282,0 | 246,3 | 12,7 |
| | 4 | 296,3 | 258,5 | 12,7 | 8 | 212,9 | 184,7 | 13,2 |
| | Average . . . | | | 13,2<br>σ=±γ0,54 | Average. . . . | | | 12,8<br>σ=±0,53 |
| VI (rats) | 1 | 215,3 | 197,2 | 8,4 | 4 | 148,3 | 137,1 | 7,6 |
| | 2 | 241,3 | 222,7 | 7,7 | 5 | 255,1 | 240,9 | 5,6 |
| | 3 | 186,8 | 175,6 | 6,0 | 6 | 169,3 | 159,8 | 5,6 |
| | Average . . . | | | 7,4 | Average . . . | | | 6,3 |
| VII (rats) | 1 | 183,0 | 168,7 | 7,8 | 4 | 122,9 | 113,8 | 7,4 |
| | 2 | 168,6 | 155,3 | 7,9 | 5 | 190,7 | 178,1 | 6,5 |
| | 3 | 204,7 | 185,8 | 9,2 | 6 | 269,1 | 256,8 | 4,6 |
| | Average . . . | | | 8,3 | Average . . . | | | 6,2 |
| VIII (rats) | 1 | 311,9 | 286,4 | 8,1 | 5 | 198,9 | 183,8 | 7,6 |
| | 2 | 227,2 | 210,8 | 7,2 | 6 | 215,7 | 198,3 | 8,1 |
| | 3 | 168,8 | 152,1 | 9,8 | 7 | 241,0 | 220,8 | 8,3 |
| | 4 | 103,6 | 91,4 | 11,7 | 8 | 328,1 | 298,2 | 9,1 |
| | Average . . . | | | 9,2<br>σ=±1,98 | Average. . . | | | 8,3<br>σ=±0,62 |
| IX (guinea pigs) | 1 | 641,5 | 560,6 | 12,6 | 3 | 1318,7 | 1203,3 | 8,8 |
| | 2 | 886,2 | 772,5 | 12,8 | 4 | 781,6 | 699,1 | 10,6 |
| | Average . . . | | | 12,7 | Average . . . | | | 9,7 |
| X (rats) | 1 | 330,9 | 293,0 | 11,5 | 4 | 260,9 | 232,7 | 10,8 |
| | 2 | 224,3 | 200,6 | 10,6 | 5 | 272,4 | 245,0 | 10,0 |
| | 3 | 265,4 | 236,9 | 10,7 | | | | |
| | Average. . . | | | 10,9 | Average . . | | | 10,4 |


## SUMMARY

The quantity of lipids was determined in the lungs of rats, cats and guinea pigs. It was demonstrated that there is a slightly increased content of lipids in the lung tissue of animals kept at low temperature.

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* In Russian.