ABOUT THE THERAPEUTIC EFFECT OF THE HAJNÓCZY-CAVE IN ÓRDORVÁR

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Introduction

The speleotherapy is an accepted method for the treatment of chronic respiratory diseases. But the beneficial effect of the caves on healthy persons has not been studied.

The aim of this study was to investigate the changes of the pulmonary functions in a new milieu with special regard to the cave-climate in healthy volunteers.

Methods

The measurements were carried out in a secondary school speleological camp on the hill Órdorvár in the mountains Bükk and in the Hajnóczy-cave near here.

29 speleologists and 8 overground campers participated in the study. The median ages in both groups were 17,5 years. The differences in body height were removed by comparisons with the standard values for normal subjects.

The pulmonary function tests were performed by instrument "Spiroscreen 21" (Medicor-Hungary) on the first and on the last days of the two-week speleological camp and 6 weeks later again, at the start of the new school-year.

Peak expiratory flow (PEF), forced expiratory volume in one second (FEV_1) and forced expiratory vitalcapacity (FVC) were measured on every occasion at the same time: between 2 and 4 p.m.

Three forced expiratory maneuvres were made by everybody. At the evaluation the best values were taken into consideration.

The speleologists spent averagely 50 hours in the cave during the camping.

Results

Our results will be presented in the following figures. On the left side of the Fig. 1. you can see the mean percentual changes and their standard deviations of the pulmonary function values.

Among the speleologists the increase in every parameters was highly significant ($p < 0,001$) at the end of the camping, the average value was 20 %. The parameters of the overground group improved during the camping too, but to a lesser degree then at the speleologists. The improvement in the PEF ($p < 0,02$) and in the FVC ($p < 0,01$) were significant, but at the FEV_1 ($p < 0,10$) it didn't reach the significant level.

These repeated measurements were performed 45 days later. The right side of the figure represents the differences between the lung function performances in September and at the start of the camping. You can see that the mean values of every measured parameters were much better in September.

Although there was a decrease in each parameters of speleologists lung function after camping, but it was not significant.

The examinations of the overground group showed that mean values of FEV_1, and FVC didn't change remarkably after the camping, moreover, the PEF was significantly smaller 6 weeks later than at the end of the camp.

The changes in the pulmonary function could be followed most sensitively by the PEF. In the Fig. 2. you can see, that the improvement in the speleologist group was higher during the camping, and the worsening was less remarkable, than in the overground group, in which the increase during the camping was smaller and the decrease after the camping was already significant ($p < 0,05$). Our observations show that the improvement in the

lung functions of the speleologists was prolonged for the next 6 weeks; in addition there was no significant difference ($p<0,10$) in the control group between the states at the beginning of the camp and in September.

Discussion

You can ask, for what reason results this marked improvement?

First of all we whould like to stress the importance of the characteristic microclimate in the Hajnóczy-cave. It has the special data, as follows (Fig. 3.):

The permanently cool air with negligible current and the high relative but small absolute humidity result the following:

- you rarely feel the cold in the cave
- the evaporation on the body surface is minimal
- at the same time a lot of water can be lost across the lung (15-17 g/hours)
- the cave-air is practically free of dust, pathogenic microorganisms or other allergens.

The high CO_2-concentration stimulates the respiratory centre, makes deeper breathing, therefore the respiratory output volume will be increased.

The alfa radiation in the cave is much higher than in the other caves used therapeutically. It results a considerable degree of negative ionization.

The most important chemical component of the speleoaerosol are the calcium ions. Their concentration in the cave-air is 30 times higher than that on the surface. The calcium acts as antiphlogistic, spasmolytic and mucolytic drug.

The most effective beta-component of the speleoaerosol derives from the dropping water in the cave. Since this has a practicle-dimension of a few micrometres and there is a high

salt content, it can effect remarkably on the mucous membrane.

The air of cave is free from ammonia. This demonstrates its pureness. Further additional factors can play a role in the improvement of the pulmonary function:

(1.) the special microclimate of the Hajnóczy-cave

(2.) the surface climate on the hill "Ördorvár"

(3.) sporting activities in the camp (on the surface and in the cave)

(4.) the considerable diminution of the injuries especially in the civilizational ones

(5.) and the enjoyment of the beauties of Nature.

The natural beauties produce a relaxing effect on the nervous system, which enables a decrease of the bronchomotor tone not only in the patients, but also in the healthy population.

FIG. 1.

MEAN PERCENTUAL CHANGES OF SPIROMETRIC VALUES

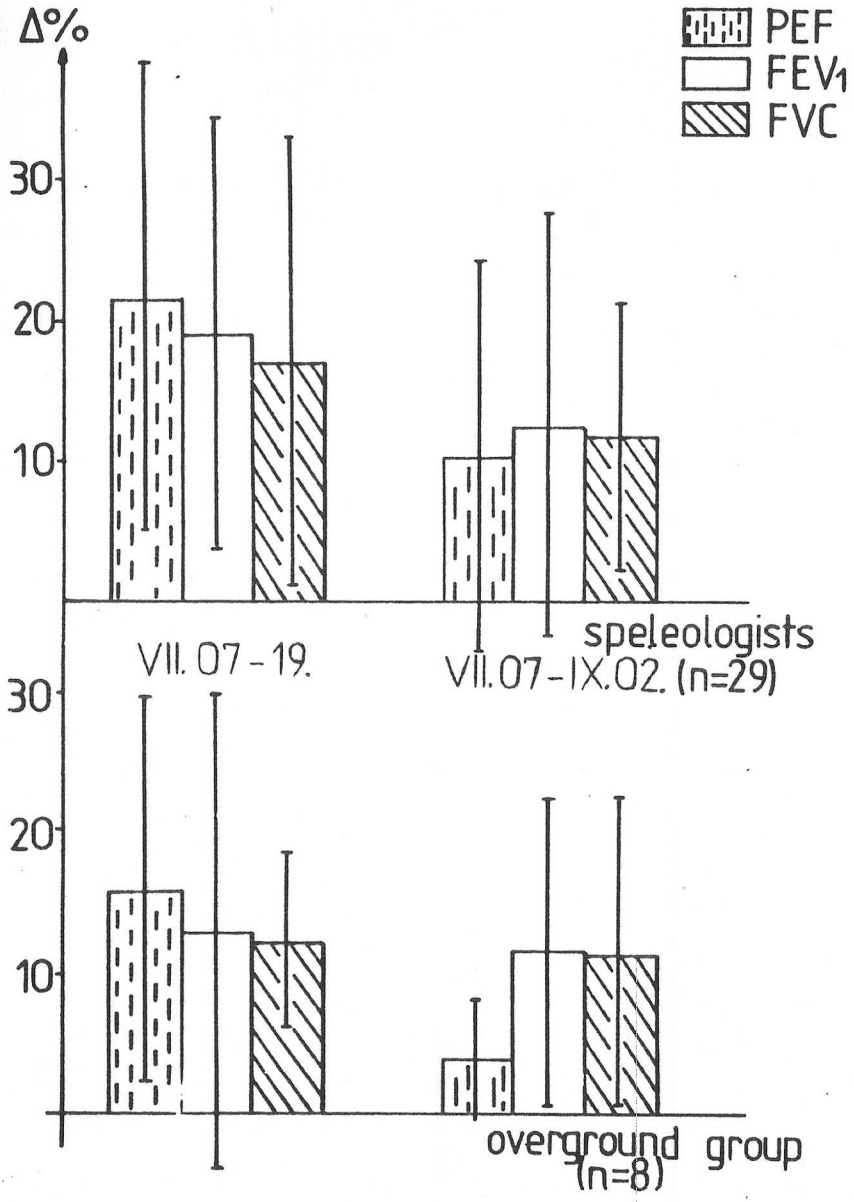

FIG. 2. THE PERCENTUAL CHANGES OF PEF IN THE SPELEOLOGICAL AND THE OVERGROUND GROUP IN 1985.

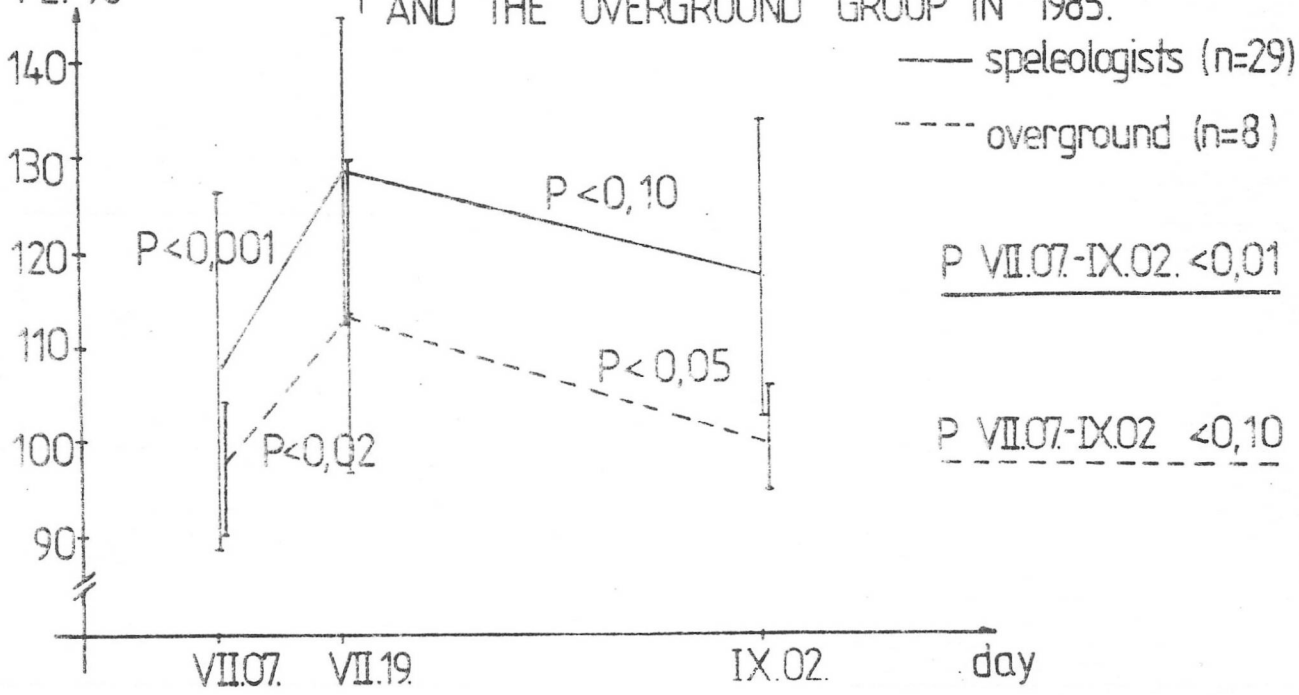

FIG. 3.

THE DATA OF MICROCLIMATE IN THE HAJNÓCZY-CAVE

Air temperature	8,5 ± 1,5 °C
Index of Bradtke	1,0
Air current	12,35 cm/s
Relative humidity of the air	95–100%
Absolute humidity of the air	9,2 g/m^3
Concentration of the grain of dust in the air	2,4-18 1/cm^3
Concentration of CO_2	0,10–1,0 vol%
Alfa radiation	8–14 kBq / m^3

Chemical components in the aerosol

- Ca^{++}	0,16–0,18 mmol/l	(6,2–7,2 mg/l)
- Mg^{++}	0,03-0,07 mmol/l	(0,8–1,6 mg/l)
- Cl^-	0,17–0,23 mmol/l	(6,0–8,0 mg/l)

Chemical components in the dropping waters

- Ca^{++}	2,10 mmol/l	(83,8 mg/l)
- Mg^{++}	1,24 mmol/l	(29,8 mg/l)
- Cl^-	0,20 mmol/l	(7,13 mg/l)
- SO_4^{--}	0,49 mmol/l	(47,4 mg/l)
- NO_3^-	0,15 mmol/l	(9,14 mg/l)
- NH_3	0,00 mmol/l	(0,00 mg/l)
pH	7,775	