

Selected trials of the EUROFIT test as a measure of the physical fitness of children with recurrent respiratory diseases - a preliminary report

Wybrane próby testu EUROFIT jako miara sprawności fizycznej dzieci z nawracającymi schorzeniami układu oddechowego - doniesienie wstępne

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Key words

test EUROFIT, children, physical activity

Abstract

Introduction: The study assessed the usefulness of selected trials from the European Physical Fitness Test as a tool for measuring the physical fitness of children with recurrent respiratory diseases treated in subterranean therapy conditions.

Research project: Before-after study.

Materials and methods: The assessment was conducted in the first and last day of a rehabilitation stay at the 'Wieliczka' Salt Mine Health Resort with the participation of 58 children, comprising 25 girls and 33 boys aged 5 to 10 years old, who had been performing daily breathing exercises, general rehabilitation exercises, some form of dancing and running with time measurement. To assess the physical fitness of the children, the 3 trials of the European Physical Fitness Test - EUROFIT were used, evaluating the flexibility, speed and explosive strength of the lower limbs and also the value for a standardized, standing long jump was calculated.

Results: The mean distance of the sit-and-reach test increased after the rehabilitation program to 1.78 cm for the 7-10 year-old girls ($p \leq 0.05$). The average distance of the standardized, standing long jump increased from 0.7 cm in the 5-6 year-old girls, up to 6.6 cm in the 7-10 year-old girls. In the boys group, these results were higher in the older children and amounted to 3.6 cm, than in the younger - 2.7 cm. Statistically significant differences were noted in children aged 7-10 years old (Figure 3). Analyzing the parameter which takes into account the standing long jump and body height, similar relationships was observed.

Conclusions: The proposed trials of the European Physical Fitness Test seem to be a good tool for assessing the physical fitness of children with recurrent respiratory diseases. The results are encouraging and indicate the need to engage in comprehensive rehabilitation proceedings with regard to kinetic therapy, music therapy and choreotherapy. Further research is needed to confirm the effectiveness of a rehabilitation programme carried out under subterranean therapy.

Słowa kluczowe

test EUROFIT, dzieci, sprawność fizyczna

Streszczenie

Wstęp: W pracy oceniono przydatność wybranych prób z Europejskiego Testu Sprawności Fizycznej jako narzędzia służącego do pomiaru sprawności fizycznej dzieci z nawracającymi schorzeniami układu oddechowego leczonych w warunkach subterraneanoterapii.

The individual division on this paper was as follows: A – research work project; B – data collection; C – statistical analysis; D – data interpretation; E – manuscript compilation; F – publication search

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Projekt badań: Badanie „przed i po”.

Materiał i metody: W badaniu przeprowadzonym w pierwszym i ostatnim dniu turnusu rehabilitacyjno-leczniczego w Uzdrożisku Kopalni Soli „Wieliczka” wzięło udział 58 dzieci, w tym 25 dziewcząt i 33 chłopców w wieku od 5 do 10 lat życia, które codziennie wykonywały ćwiczenia oddechowe, ogólnosprawniające, formy muzyczno-ruchowe oraz biegi z pomiarem czasu. Do oceny sprawności fizycznej dzieci zastosowano 3 próby Europejskiego Testu Sprawności Fizycznej – EUROFIT, oceniające gibkość, szybkość i siłę eksplozywną kończyn dolnych oraz obliczono wartość dla skoku w dal z miejsca unormowanego.

Wyniki: Średni dystans testu skłonu tułowia w przód w siadzie prostym uległ zwiększeniu po turnusie rehabilitacyjnym o 1,78 cm u 7-10 letnich dziewczynek ($p \leq 0.05$). Średnia odległości skoku w dal z miejsca uległa zwiększeniu od 0,7 cm u 5-6 letnich dziewczynek, aż do 6,6 cm u 7-10 letnich dziewczynek. U chłopców rezultaty te były większe u starszych i wyniosły 3,6 cm, niż u młodszych – 2,7 cm. Różnice istotne statystycznie odnotowano u dzieci w wieku 7-10 lat życia. Analizując parametr uwzględniający skok z miejsca i wysokość ciała zaobserwowano podobne zależności.

Wnioski: Zaproponowane próby z Europejskiego Testu Sprawności Fizycznej wydają się być dobrym narzędziem do oceny sprawności fizycznej dzieci z nawracającymi schorzeniami układu oddechowego. Uzyskane wyniki są zachęcające i wskazują na konieczność prowadzenia kompleksowego postępowania usprawniającego z uwzględnieniem metod kinezyterapii, muzykoterapii i choreoterapii. Niezbędne są dalsze badania potwierdzające skuteczność programu usprawniania prowadzonego w warunkach subterraneoterapii.

INTRODUCTION

‘Wieliczka’ Salt Mine Health Resort is one of the few places in the world providing treatment of respiratory diseases and certain respiratory and skin allergies under subterranean therapy conditions. The basis for this form of treatment is the therapeutic influence of underground salt chambers microclimate on the human body. Patients staying in underground salt caves are under the conditions of the unique biological, chemical and physical stimulants¹⁻³. Subterranean therapy concept has been introduced into medicine by Professor Mieczysław Skulimowski, who is also regarded as the creator of this therapeutic method⁴.

Recent clinical studies conducted in the underground salt voids microclimate in patients suffering from allergic rhinitis during an increase in severity of its symptoms indicate the reduction of symptoms immediately after the access to salt chambers⁵.

The study results presented by Obtułowicz et al.⁶ allow us to conclude that the isolation of patients with seasonal pollen rhinitis and asthma with hypersensitivity to fungal spores from sensitizers in underground salt chambers allow to reduce the symptoms. In addition, the repetition of treatment in exacerbations of disease for several years helps to reduce or stop ailments⁶. The studies of Szczeklik et al.⁷ based on an analysis of 300 patients with atopic asthma, infectious and mixed, chronic bronchitis and allergic rhinitis treated with 3-week treatment under subterranean therapy

health indicate an improvement in 2/3 of the test group. In patients with bronchial asthma under climate treatment a reduction or complete cessation of spasms of breathlessness and a reduction in the amount of taken medicines are observed⁸.

Actually, at a depth of 135 meters below the earth surface at the third level of the ‘Wieliczka’ Salt Mine, underground resort organizes therapeutic stays for children aged 4 years and over and their caregivers, enriched by comprehensive treatment with the use of various forms of kinesiotherapy. Pulmonary rehabilitation carried out in various age groups is conducted in the form of exercises and game activities and includes diaphragmatic breathing exercises, strength and flexibility increasing training of the respiratory muscles, participation in the group and supervised general rehabilitation exercise, timed running, games and activities taking into account motor control training. Endurance and speed abilities are trained by participation in a race with the measurement of the time required for running around the saline lake Wessel. Standards of pulmonary rehabilitation⁹ developed by the American Thoracic Society and European Respiratory Society indicate that physical training is the best available way to improve muscle function in chronic respiratory diseases, so it is widely recognized as the basis for this form of rehabilitation. It leads to an increase in exercise capacity, even despite the lack of changes in pulmonary function. Increasing the oxida-

tive efficiency and productivity of skeletal muscle work reduces alveolar ventilation caused by strain, which may lead to a reduction in dynamic lung hyperinflation and thus exertional dyspnoea⁹.

Races around the Lake Wessel conducted on a daily basis contribute to the increase in speed and endurance abilities. In contrast, exercises performed in closed biokinetic chains (the body supported on benches and ladders) include the elements of resistance training.

A comprehensive rehabilitation treatment conducted during the 17 days of treatment stay under the medicinal therapeutic microclimate of salt chambers-Lake Wessel (Picture 1) and the Eastern Mountains’ Stable, aims at implementing the above-mentioned recommendations regarding pulmonary physiotherapy.

AIM OF THE STUDY

The aim of the study was to verify the usefulness of selected trials from the European Physical Fitness Test as a research tool to assess the physical fitness of children with recurrent respiratory diseases treated in subterranean therapy conditions.

MATERIAL AND METHODS

The study included 58 children with recurrent respiratory disease without symptoms of exacerbation, in a stable phase of the disease, including 25 girls, representing 43.1% of the total and 33 boys, or 56.9% aged from 5 to



Photo 1
The 'Lake Wessel' Salt chamber
 (archive of 'Wieliczka' Salt Mine Health Resort)

10 years of age (mean age was 7.1 ± 1.46 years). The characteristics of the study group is illustrated in Table 1 and 2.

The examined children were divided into two age categories: 5-6 years (preschoolers) and 7-10 (the prepubertal school period) (Table 2). Young resort patients included in the study suffered from the following diseases: bronchial asthma - 29 children (50%), chronic catarrh of the upper respiratory tract - the nose, throat, sinuses -

22 children (38%), recurrent bronchitis - 3 children (5%), tonsil hypertrophy 3 - 4 children (7%).

The analysis based on BMI growth charts has found that 3 children who represent 5.17% are underweight, weight of 44 children or 75.86% was normal, 9 subjects or 15.52% were overweight and obesity was noted in 2 children, or 3.45% of the total.¹⁰

The study was conducted in a therapeutic salt chamber - Lake Wessel (Photo 1) which belongs to the 'Wieliczka' Salt Mine Health Resort. 17-day rehabilitation treatment stay included 15 meetings underground (excluding Sundays). The inclusion criteria were:

- age ≥ 5 years,
- the written consent of a parent or guardian to participate in the study,
- consent of the child to participate in the study,
- no medical contraindications to perform the exercise.

Due to the homogeneity of the group 2 children with intellectual disabilities were not qualified to the study. The first study included 67 children. Due to low attendance at motor and respiratory activities of less than 80%, 5 participants were not qualified to the second study while 4 persons did

not report on the last day of the stay for the second test.

During the treatment stay the examined children performed 30-40 minute breathing exercises every day in the form of exercise and play activities using accessories (soap bubbles, balloons, windmills, feathers, ping-pong balls, plastic tubes) (Photo 2), general rehabilitation exercises (Photo 3) with the elements of music and movement forms using accessories (mattresses, benches, ladders, rings, bags, balls, scarves, play parachute KLANZA) and timed running or steeple chase around Lake Wessel.

To assess the physical fitness of children 3 trials of the European Physical Fitness Test - EUROFIT were used: sit-and-reach test, shuttle run 10 x 5 m and standing long jump. All tests were performed according to the research procedure available in the literature, and results of sit-and-reach test and standing long jump were measured to an accuracy of 1 cm, and the running time to the nearest 0.1 s.^{11,12} In addition, the standardized value for standing long jump was assessed by dividing the jump result by a body height. Measurements were made on the first (study 1) and the last (study

Table 1

Characteristics of the study group (n=58)			
Variable	$\bar{x} \pm SD$	Minimum	Maximum
Age [years]	7.1 ± 1.46	5	10
Body weight [kg]	25.6 ± 6.65	17.0	43.0
Body height [m]	1.23 ± 0.10	1.0	1.4
BMI [kg/m^2]	17 ± 2.36	12	24

Table 2

Characteristics of the tested group of children in age categories taking into consideration sex								
Variable	5-6 years old				7-10 years old			
	Girls n=8 $\bar{x} \pm SD$	Boys n=16 $\bar{x} \pm SD$	<i>p</i>	All $\bar{x} \pm SD$	Girls n=18 $\bar{x} \pm SD$	Boys n=16 $\bar{x} \pm SD$	<i>p</i>	All $\bar{x} \pm SD$
Body weight [kg]	21.8 ± 3.59	21.6 ± 3.63	0.090	21.7 ± 3.46	27.7 ± 7.32	29.3 ± 6.63	0.530	28.4 ± 6.84
Body height [m]	1.2 ± 0.09	1.1 ± 0.05	0.475	1.2 ± 0.06	1.3 ± 0.08	1.3 ± 0.08	0.100	1.3 ± 0.08
BMI [kg/m^2]	16.1 ± 2.45	16.5 ± 2.32	0.748	16.3 ± 2.27	17.1 ± 2.62	16.9 ± 2.17	0.792	17.0 ± 2.35



Photo 2
Breathing exercises using feathers (archive of 'Wieliczka' Salt Mine Health Resort)



Photo 3
General rehabilitation exercises performed on mattresses (own archive)

2) day on the treatment stay. The study was conducted from November 2012 to February 2013 and was approved by the Bioethics Committee.

The results of this study were analyzed by statistical tests with the use of Microsoft Excel Microsoft Office (USA) and STATISTICA PL StatSoft (USA). Analysis of the results was performed separately for both sexes in two age categories: 5-6 years (preschoolers) and 7-10 years (the prepu-

berty school period). All parameters were characterized by the arithmetic mean, and the results were a measure of the dispersion of the standard deviations. The significance of differences between the corresponding parameters using the Student's *t*-test for pairs of dependent variables was also determined, and in the presented analyses the level of significance was $p = 0.05$.

RESULTS

The mean distance of the sit-and-reach test increased after the rehabilitation programme in the analyzed age groups in both girls and boys, but most of the results did not obtain the desired level of significance. The mean value for girls aged 5-6 years during the assessment at the beginning of the treatment stay was 4.69 ± 5.75 cm, and 5.63 ± 6.16 cm at the end. The boys in the same age range obtained at the beginning a mean score of 5.16 ± 6.95 cm. After the treatment stay the average value of the trunk slope was 6.13 ± 6.76 cm.

Similar changes were observed among 7-10 year olds. The average score of the first test for the girls was 4.78 ± 6.11 cm and for the second 6.56 ± 6.32 cm. In contrast, in first test the boys obtained 2.28 ± 5.25 cm, and during the second 3.59 ± 4.81 cm. Despite some changes, the statistical significant difference was observed only in girls aged 7-10 years of age (Figure 1).

Average time of 10 x 5 shuttle run on the last day was almost the same as on the first day of the treatment stay. This time was shortened from 0.1 sec. in younger girls to 0.23 sec. in older girls, while in boys aged 5-6 years by 0.87 sec., and in the age group of 7-10 year-olds by 0.27 sec. These changes were not statistically significant (Figure 2).

Average distance of the standing long jump extended after a rehabilitation stay in all analyzed groups of children. In girls aged 5-6 years the difference between the first and second study was an average of 0.7 cm, with the first test value of 87.75 ± 9.62 cm and the second 88.50 ± 8.37 . In girls aged 7-10 year the result of a standing long jump increased by up to 6.6 cm, with the first test value of 113.67 ± 17.57 cm, and the second value of 120.28 ± 17.16 cm. In boys, the differences were greater in the older group and amounted to 3.6 cm, with the result of the first test of 119.25 ± 16.29 cm, and the second 122.88 ± 18.83 cm.

In the group of young boys there was a difference between the first and second measurement of 2.7 cm. The average score for this group in the first study was 103.66 ± 23.07 cm and

106.38 ±23.25 cm in the second. Statistically significant differences were reported only in children aged 7-10 years (Figure 3). Analyzing the parameter that takes into account the standing long jump and a body height similar correlations were observed (Figure 4). In the group of younger girls the change between the two measurements was 0.01 and in the older group 0.05. In boys aged 5-6 years the difference between the first and second test reached a value of 0.02, and 0.03 in the older group. Statistical significant changes were observed in children in the age category of 7-10 years.

DISCUSSION

The literature on physical activity among children and adolescents often emphasizes the need to take exercise and physical activity as factors contributing to their proper psychophysical development^{13,14}. Many scientific reports emphasize the positive impact of physical activity on children's health, which is reflected by an increase in mineral content and bone density, increased physical fitness in terms of parameters such as strength and muscular endurance and cardio-respiratory fitness¹⁵⁻¹⁷.

Physical activity contributes to body weight reduction among obese children and helps maintain their normal body mass index (BMI), reduces symptoms of anxiety and depression and the risk of cardiovascular and metabolic diseases in adulthood¹⁵⁻¹⁷.

According to the recommendations of the World Health Organization (WHO) daily physical activity for children and adolescents aged 5-17 years of age should be at least 60 minutes¹⁷. It includes a range of activities such as various kinds of sports, games, recreation, physical education, transportation, domestic physical work and exercises which are performed with the family, at school or during organized sports and recreational activities.

Physical loading of at least moderate intensity is recommended and most of this activity should be some kind of aerobic exercise. It is suggested that children perform a higher intensity exercise at least three times a week to strengthen their muscle

and bones. It is also believed that more frequent or more intense physical activity is associated with

greater health benefits, but further studies are needed to verify this hypothesis^{16,17}

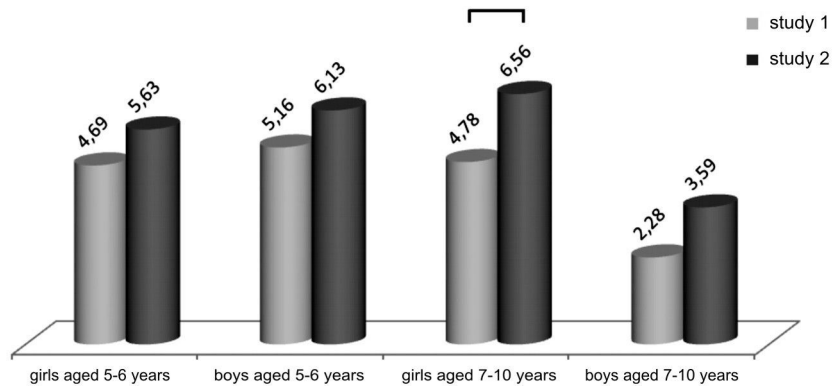


Figure 1
Average values of the sit-and-reach test [cm] (bracket indicates a statistically significant difference at $p \leq 0.05$)

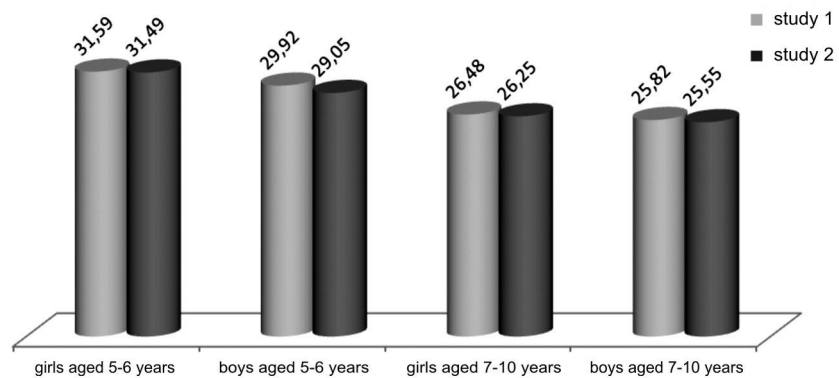


Figure 2
Mean values of the shuttle run 10 x 5 m [sec]

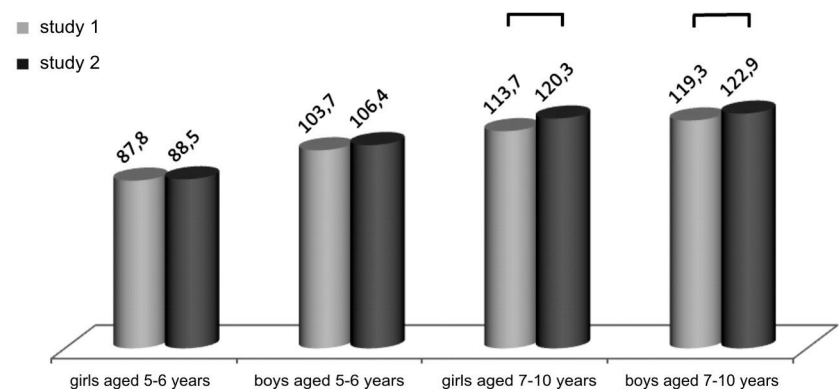


Figure 3
Mean values of the standing long jump [cm] (clasps marked the statistically significant differences at $p \leq 0.05$)

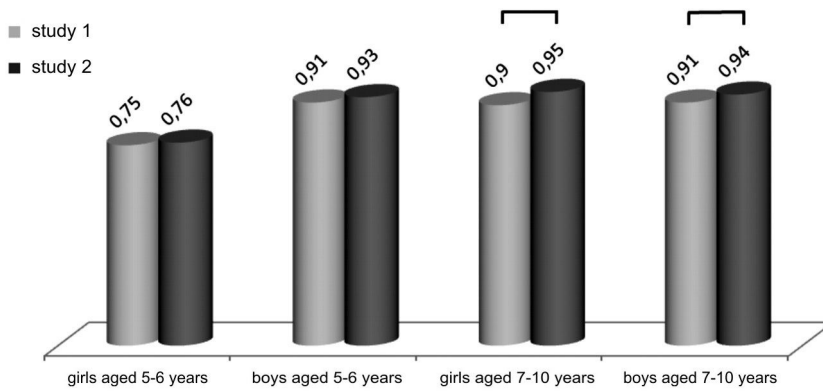


Figure 4
Mean values of the standardized standing long jump (clasps marked the statistically significant differences at $p \leq 0.05$)

Properly adapted exercise is very important especially in children with chronic and recurrent respiratory diseases. The results of the studies involving children with asthma indicate that a combination of pharmacological treatment and appropriately adapted physical training can positively affect the course of the disease, its symptoms and inhibit inflammation and transformation of the bronchus¹⁸.

It should be noted that the respiratory disease is often the cause of reduced physical activity, which can lead to various complications resulting from movement limitation. Therefore, the best conditions for training children with recurrent respiratory diseases should be provided, given the right climate and security in the form of supervision of qualified medical staff.

In addition, a proper procedure was to introduce a rehabilitation-treatment stay in the salt mining chambers - a place with a unique microclimate, preferably affecting the health of patients^{5,6,19,20}. The underground part of 'Wieliczka' Salt Mine Health Resort is characterized by high relative humidity (80-90%), constant temperature (9-12°C) and atmospheric pressure, negative ionization, a high concentration of sodium chloride and the presence of manganese, calcium and magnesium ions in air spray (saline mist). The atmosphere of underground chambers is free of contaminants, allergens, bacteria and fungi, which is confirmed by a con-

tinuous monitoring of the bacteriological and palynological purity. The mechanism of therapeutic effect of subterranean therapy has not yet been fully recognized thoroughly. A number of scientific evidence indicates, however, that the beneficial therapeutic effect in relation to diseases of the respiratory system is the result of concurrent impact of all microclimate factors^{1,3,21,22}. In these 'sterile conditions' it is possible to conduct a comprehensive therapeutic procedure without exacerbation of symptoms. In addition, the ability to raise the level of physical fitness may be an important component of the treatment of children who, often due to illness, did not participate in physical education classes, thereby limiting their physical efficiency. The 'Wieliczka' Salt Mine Health Resort can be visited by both children (who completed four years of age) and adults. The requirements for the participation of young patients (up to 14 years of age) in a daily rehabilitation-treatment stay is the supervision of a guardian or parent. According to a study conducted by the Health Resort in 2006, as many as 55% of people received treatment here together with a close or a distant family member in conditions of underground salt chambers. This enabled the conduct of motor activities involving both parents (guardians) and their children. Such participation in treatment exercises allows the children to observe behavior of their loved ones and their attitude to physical activity and enables them to de-

velop the correct behavior patterns concerning the need to move. In addition, through a common play a positive attitude towards physical activity is developed in them and it is possible to increase their self-confidence concerning their abilities. For this reason, it would be advisable to examine the satisfaction levels and changes in quality of life related to health in the future studies. It should also be noted that although the activities for children and their parents (guardians) are conducted in the same therapeutic salt chamber, at the same time are adapted individually to the needs of adults and children. The authors attempted to assess the impact of the treatment program organized in the unique underground microclimate of the Wieliczka Salt Mine on particular physical fitness parameters of children. The literature describes a number of tests and measures of fitness and physical performance, but has not been established unequivocally which research tools are the most reliable and accurate in the assessment of physical fitness of children and adolescents. In order to assess the effects of an exercise program conducted in the health resort, three tests that are part of the well-known physical fitness test EUROFIT were used: the sit-and-reach test, 10 x 5 shuttle run, standing long jump¹¹. Analysis of the results was performed separately for boys and girls in two age categories: 5-6 years (preschoolers) and 7-10 years of age (the prepubertal school period), which resulted from the differences in physical efficiency present at different stages of a child development²³.

As Puciato²⁴ noted, physical activity correlates with somatic features and the level of motor abilities of children. Although his research was done in older children, he proved that the anthropometric characteristics such as body weight and height correlates with physical activity. Therefore, this article performs the analysis according to the above mentioned age groups. The sit-and-reach test and its various modifications are commonly used to estimate the lower spine and hamstring muscles flexibility²⁵⁻²⁷. To determine the parameters such as speed and agility in children, 10 x 5

shuttle run is often used. According to the ALPHA project authors (Assessing Levels of called Physical Activity), standing long jump is a reliable, reproducible and safe test for assessing the strength of lower limbs muscle in both children and adults²⁸. Castro-Piñero et al.²⁹ demonstrated in their study that the sit-and-reach test correlates highly with other tests evaluating muscle strength in both the lower and upper parts of the body and therefore it may be used as an indicator for general muscle strength in children and adolescents. In addition, the study provides a standardized value for the standing long jump which illustrates more clearly the length of the jump among children of varying height. After the end of the treatment stay, the results of the performed tests have improved in all analyzed groups based on gender and age: the average distance of the sit-and-reach increased, the average time of 10 x 5 shuttle run between cones shortened and the distance of standing long jump improved. Despite these differences, significant changes were noted only in the group of school children concerning the parameters that indicate the strength of the extremities (for both sexes) and the flexibility of the body for girls. Most pairs of variables, though, showed no statistically significant differences. There could be many reasons responsible for this situation: too short treatment stay, which did not result in the desired changes, limited opportunities to develop speed, which could be due to safety considerations, the difficulties of carrying out the physical fitness tests in the youngest respondents because of their vigor and difficulty maintaining focus on a given task. However, this aspect requires further investigation in future studies. Undoubtedly, it would be highly beneficial to perform the physical tests in subterranean therapy conditions for a period longer than 15 days, and then carry out the measurements. Furthermore, the effects of rehabilitation proceedings under the subterranean therapy conditions should be compared with the similar therapeutic program conducted above ground or contrast the results with other therapeutic methods used in the treat-

ment of pulmonary diseases. This would allow to assess significance of the environment in which the therapy for children with recurrent respiratory diseases is conducted. However, these challenges were not feasible to evaluate in the present work. It was also difficult to refer to the literature, because no similar studies of physical fitness evaluation in subterranean therapy conditions were conducted. Baquet et al.³⁰ was the only publication found that indicated the improvement of all five physical parameters described by the EUROFIT test (including those defining the flexibility, speed and power) in children aged 8-11 years after a 7-week interval training. The training program consisted of two 30-minute sessions per week, and each of them contained intense, intermittent, short 20 - or 10-second aerobic and speed exercises which use maximum aerobic speed. An undoubted advantage of these studies was the number of respondents of 100 children divided into exercise and control groups. Another scientific experiment that analyzed the changes in children's physical performance was a study, which showed an increase in physical fitness after a 6-month training program conducted two times a week for 50 minutes. It consisted of lower extremities strengthening exercises and motor tasks including swing racing, speed racing, slalom, jumping upward, long jumping, jumping through obstacles, climbing, gymnastics and handling. The number of the children, 178 boys and 192 girls, was the main advantage of the study and they were divided into study group and control group. Eight attempts of EUROFIT test were conducted (except for hand tightening), which showed improvement in all tests apart from the endurance shuttle run³¹. Numerous reports have documented the positive effects of 'Wieliczka' Salt Mine microclimate on patients respiratory system. The results of the treatment with subterranean therapy method developed by Skulimowski often show the health improvement of patients suffering from pulmonary diseases (bronchial asthma, chronic allergic inflammation of the upper respiratory tract, chronic bronchitis and pneumonia, and others)^{5,6,7,20}. For this reason, the

underground 'Wieliczka' Salt Mine Health Resort seems to be the right place for conducting kinesiotherapy of both young and adult patients suffering from respiratory system disorders. Determining the benefits of rehabilitation in subterranean therapy conditions, however, requires for further, well-designed studies using new methods of patients assessment. Unfortunately, a number of studies is characterized by low methodological quality.

An undoubted advantage of the rehabilitation and treatment stays is the unique attractiveness of the treatment place of salt mines chambers adapted to the modern requirements of a health resort. Properly lit salt chambers, saturated with exceptionally clean microbiological and paly-nological air aerosol make an attractive place for active treatment under the supervision of a qualified rehabilitation team (doctors specializing in medical rehabilitation, nurses, physiotherapists).

CONCLUSIONS

The proposed trial of the European Physical Fitness Test seem to be a promising tool to assess the physical fitness of children with recurrent respiratory diseases treated in subterranean therapy conditions. Despite the lack of a control group the results are encouraging and indicate the need for a comprehensive rehabilitation proceedings with regard to methods of kinesiotherapy, music therapy and choreotherapy. The participation of children aged 7 to 10 years of age is particularly advisable, especially because of the improvement in lower limb explosive strength and body flexibility in girls. We remain convinced, however, that further research are needed to unambiguously confirm the effectiveness of the proposed rehabilitation program for children in subterranean therapy conditions.

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