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LADIES AND GENTLEMEN, FACULTY, GRADUATES AND STUDENTS OF UNIVERSITIES, READERS AND ENTHUSIASTS OF *MEDICAL SCIENCE PULSE*!

We are pleased to introduce the second issue of *Medical Science Pulse*, a quarterly journal, which publishes new research, case studies and reviews in the area of healthcare research. We would like to thank all authors, reviewers, readers, members of the Scientific Council, editors and University authorities for their involvement in the creation of the next issues of *Medical Science Pulse*. We invite any party interested in advancing the journal to contact the Editorial Board!

We are pleased to announce new members of journal's Scientific Council Dr. Q Li and Dr Y Zhong. Both are researchers from China: Dr. Li is an Associate Professor at the First Affiliated Hospital of Hainan Medical University, and vice-chairman of the Youth Committee, and Hainan Thoracic Society. Dr. Zhong is an Associate Professor at the First Affiliated Hospital of Hainan Medical University, and member of Hainan Thoracic Society. The list of scientists and research centres that are represented by members of our Scientific Council is really impressive!

The number of authors submitting articles for publication is also growing. This has been influenced by a number of factors: the open profile of the journal, thematic specialization in medical science and healthcare, quality of the work published, including precisely defined criteria for scientific evaluation of articles, automatic reporting systems and professional electronic version, as well as regularity of publishing with no delays or fees. The average waiting period for the publication of the manuscript, after acceptance, is six months from the moment of a manuscript is submitted to the editorial office. The language of publication is currently only English, and the professional proof-reading is carried out by medical specialists and native speakers of English.

We are also pleased to announce the success of Opole Medical School (PMWSZ), the publisher of *MSP* quarterly, which has been promoted to **5th place in the pres-**

tigious ranking of higher vocational schools in Poland – Perspektywy 2018. One important factor was that Opole Medical School reached the highest scientific (category A) for the Faculty of Physiotherapy in 2017. Therefore, the quarterly *Medical Science Pulse* effectively forms part of the scientific value of OMS (PMWSZ) in Opole.

We are confident that the current issue will be of interest to the broad readership of *Medical Science Pulse*. We particularly would like to draw our readers' attention to the original articles on: how far physical training could be able to minimize the differences in lung capacities in trained male and female tennis players, the need for emotional awareness and a quantitative measure based on empirical research, assessing how society perceives the usage of dietary supplements, impact of systemic cryotherapy on physical fitness, health behaviours and life satisfaction of health spa patients, examination of fundamental movement patterns and likelihood of injury in amateur runners from Opole region in Poland and relationship with peers of young school-aged children with type 1 diabetes.

We encourage you to read an interesting case study: application of IPL technology in *Acne Vulgaris* treatment and review the papers on the topic of complications in women's sex life after a surgical intervention due to a breast cancer and telomeropathies – rare disease syndromes.

We hope that all of you will continue to support the Editorial Board of the quarterly in its ongoing efforts to improve scientific quality – as the authors, reviewers, and readers. We are looking forward to your participation in the society of *Medical Science Pulse*!

We invite you to publish original manuscripts (research studies, case studies, reviews and opinions) to *Medical Science Pulse* – www.medicalsciencepulse.com – 6 points by the Ministry of Science and Higher Education!

CAN PHYSICAL TRAINING MINIMIZE THE GENDER DIFFERENCES IN LUNG CAPACITY OF TRAINED TENNIS PLAYERS AGED 14–17 YEARS OLD?

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A – study design, B – data collection, C – statistical analysis, D – interpretation of data, E – manuscript preparation, F – literature review, G – sourcing of funding

ABSTRACT

Background: This study was based on gender differences in male and female trained tennis players.

Aim of the study: The aim of this study was to determine the extent that physical training could minimize the gender differences in lung capacities in trained tennis players aged 14–17 years.

Material and methods: The participants were ten male and seven female lawn tennis players, with a mean \pm standard deviation (SD) age of 15.5 ± 1.27 and 14.43 ± 1.13 years, respectively. Physical characteristics and lung volumes were measured on the same day for each participant. Data were presented as mean \pm SD, and Student's t-test to compare the measured variables was performed.

Results: Differences between genders were insignificant in terms of age (years), weight (kg), body fat (%), lean body mass (kg) and chest circumference (cm). However, height (cm), and W/H ratio were significantly ($p < 0.05$) higher in male tennis players in comparison to female players. Insignificant differences were found for TV (L), SVC (L), FVC (L), FEV1 (L), FEV1/FVC (%), FEF25-75% (L/s), PEF (L/s) and MVV (L/min). The only significant difference ($p < 0.05$) in lung function measures between male and female trained tennis players was for PIF (L/s).

Conclusions: Male tennis players were taller than female tennis players of same age range, which might be advantageous for males while playing. Insignificant differences between male and female players in the various lung variables measured indicated that the influence of height and gender differences could be minimized by proper training during puberty. A significantly higher PIF in male players indicated stronger and more powerful inspiratory muscle activity compared with female tennis players.

KEYWORDS: tennis player, lung variables, gender differences

BACKGROUND

The lung volume of an adult male is about 10–12% higher than in an adult female with same age and height [1]. The smaller female lung volume appears to be established within the first few years of life. It is attributable to a lower rate of alveolar multiplication in girls than boys [2], although the reason for this is unknown. It is also reported that there is substantial variation in lung volume among individuals of a particular gender with the same age and stature [3]. These findings suggest that lung growth does not completely follow the longitudinal

growth pattern. Even if the stature of males and females is the same, the lower limb length differs between genders. This difference in lower limb length correlates with male and female lung size [4]. It is also reported that the smaller female lung volume could be entirely accounted for by the smaller radial rib cage axial dimension, which is determined by the position of the diaphragm in the thoracic cage [5]. All these findings suggest that thoraco-abdominal configuration is another major factor underlying the difference in lung volumes between males and females. It is also reported that differences in thoraco-

abdominal configuration impact on respiratory muscles [6]. Systemic differences in thoracic dimension and configuration between genders, including a disproportionately smaller radial rib cage dimension and shorter diaphragm are documented in females [7]. All these differences between sedentary males and females are due to their innate genetics and hormones, which also contribute to differences between athletic men and women. These include height, weight, muscle mass, body fat and aerobic capacity. The physiological differences between men and women are so great that elite male and female athletes compete with each other rarely.

Lung capacity refers to the volume of air associated with different phases of the respiratory cycle. The average total lung capacity of an adult human male is about 6 litres (L) of air. Lung capacity can be influenced by different types of physical training. Spirometry is the most commonly used pulmonary function test in the objective assessment of respiratory function. Pulmonary function is generally determined by respiratory muscle strength, compliance of the thoracic cavity, airway resistance and the elastic recoil of the lungs [8]. It is well-documented that pulmonary capacity varies with physical characteristics such as age, height, body weight and altitude [9]. Lung function tests provide qualitative and quantitative evaluation of pulmonary function and are of the highest importance in estimating respiratory fitness.

Studies on gender differences in thoracic dimension and configuration indicate that the volume of an adult female lung is typically 10–12% smaller than that of males of the same height and age [10]. Hopkins studied gender and pulmonary gas exchange during exercise and revealed that there were considerable gender-based differences in the response of the pulmonary system to exercise [11]. Specific to pulmonary gas exchange, structural and morphological differences between genders may render females more susceptible to impaired pulmonary gas exchange than males [11]. Studies have proposed respiratory muscle training as an effective means to increase inspiratory muscle strength and improve exercise performance [12]. Women have smaller airways and lung volumes, and lower resting maximal expiratory flow rates relative to men. Female athletes develop expiratory flow limitation more frequently than male athletes, and they have greater increases in end-expiratory and end-inspiratory lung volume at maximal exercise [13].

Only a few studies have investigated lung capacity in trained male and female players during adolescence (14–17 years). This age range is critical for both physiological and physical development. Physical training influences different hormonal systems and triggers the body to develop physically and physiologically. The most important requirement of athletic development is aerobic capacity. Without improvement in cardiorespiratory function, players cannot achieve a proper performance. It is also evident that male players have 8 to 10% higher performance level than female

players due to differences in genetics and hormones. If these innate between gender differences can be minimized by appropriate training, the performance level of female athletes will improve to be same or close to male athletes. Most studies have revealed that males have greater physical ability than females due to their physique, and physiological advantages. However, strategies to minimize these gender differences in athletes have not been investigated. If a gender gap can be minimized by proper and timely training then female athletes may be considered on par with male athletes. In general, differences in physique and physiology are not very prominent in males and females during childhood, and likely develop from puberty. Indeed, the 14–17 year age range is when differentiation of male and female physique is initiated. Therefore, this might be the best time to influence hormonal systems using physical training to promote development of different physiological systems as well as physique.

AIM OF THE STUDY

This study was designed to determine the gender differences in lung capacity of 14–17 year old male and female trained tennis players. The purpose was to identify the extent that physical training can minimize these gender differences.

MATERIAL AND METHODS

Study design

This study used male and female trained lawn tennis players aged 14–17 years old. In this age range, males and females have their own active hormonal systems that influence the physiology of the body. The athletic differences in male and female players including height, weight, fat content, muscle mass and aerobic capacity, gradually develop due to their own hormonal influences. The main hypothesis of this study was based on the lung capacity of male and female trained tennis players within the age range of 14–17 years when the influence of their principle hormonal systems develop actively. Moreover, lung capacity depends on respiratory muscle activity and thoraco-abdominal configuration. Thus, it can be assumed that proper training in this age range might minimize the gender gap.

This study evaluated the lung capacity of 10 male and 7 female trained tennis players aged 14–17 years. The two genders were compared in terms of selected physical and lung variables comprising height (cm), weight (kg), fat (%), lean body mass (kg), chest circumference (cm), W/H ratio, TV (L), SVC (L), FVC (L), FEV1 (L), FEV1/FVC (%), FEF25–75% (L/s), PEF (L/s), PIF (L/s) and MVV (L/min).

Setting

Tennis players were from the registered tennis club of West Bengal (India) in March 2017. The criteria for

player selection were participation in at least one district level competition and age between 14 and 17 years. The players had trained for around 2–4 hours per day for 5 days per week over at least 2 years. The Individual National Standard of Living Index and Sports Competition Anxiety Tests were performed. All anthropometric measurements and lung function tests were conducted in departmental laboratories of Serampore College. All measurements for each participant were undertaken between 10 am and 4 pm on the same day.

Participants

In this study, the mean \pm standard deviation (SD) age of the males and females were 15.5 ± 1.27 and 14.43 ± 1.13 years, respectively. The Institutional Human Ethics Committee approved the study prior to initiation. None of the participants complained of any health problems except for coughs and colds during winter. The tennis club provided written permission to involve their tennis players, with the consent of their guardians. Ambient temperature and humidity were measured by dry bulb, wet bulb and globe thermometer.

Lung function parameters

Pulmonary function tests by spirometer:

Pulmonary Function Tests were performed using automatic spirometer (Spirovit, SP 1 Model) according to American Thoracic Society guidelines. The procedures were simple, non-invasive and harmless to the participants, who were encouraged to perform them at their optimum level. The spirometer was calibrated the day prior to use and a new filter was introduced. The following variables were measured for each player after proper demonstration trials:

I. I.TV (L):

Tidal volume (TV) is the amount of air inhaled or exhaled normally at rest.

II. SVC (L):

Slow vital capacity (SVC) is the maximum volume of air that can be exhaled slowly after slow maximum inhalation.

III. FVC (L):

Forced vital capacity (FVC) is the volume of air that can forcibly be blown out after full inspiration.

IV. FEV1 (L):

Forced expiratory volume in one second (FEV1) is the volume of air that can forcibly be blown out in one second, after full inspiration.

V. FEV1/FVC (L):

FEV1/FVC (FEV1%) is the ratio of FEV₁ to FVC.

VI. FEF25-75% (L/sec):

Flow speed of the expired air by 25–75% of the vital capacity.

VII. PEF (L/sec):

Peak expiratory flow (PEF) is the maximal flow (or speed) achieved during the maximally forced expiration initiated at full inspiration.

VIII. PIF (L/sec):

Peak inspiratory flow rate (PIFR) is the fastest flow rate during the inspiratory cycle.

IX. MVV (L/min):

Maximum voluntary ventilation (MVV) is the maximum amount of air that can be inhaled and exhaled, as deeply as possible, within one minute.

Statistical analyses

The mean, standard deviation and level of significance of all measured variables were determined. The distribution of raw data was normal. The main objective of this study was to determine if the male and female differences were significant, which was assessed using Student's t-test.

RESULTS

The mean, standard deviation and level of significance of selected anthropometric variables such as age (years), height (cm), weight (kg), fat (%), lean body mass (kg), chest circumference (cm) and W/H ratio of the participants are shown in tab. 1. There were no significant differences between males and females in age, weight, fat, lean body mass or chest circumference. However, height and W/H ratio were significantly ($p < 0.05$) higher in males (tab. 1).

The mean values, standard deviation and level of significance the lung function tests, TV (L), SVC (L), FVC (L), FEV1 (L), FEV1/FVC (%), FEF25-75% (L/s), PEF(L/s), PIF(L/s) and MVV (L/min) of male and female trained tennis players are shown in tab. 2. There were

Table 1. Selected anthropometric variables

Variables	Mean \pm standard deviation		p value	Level of significance
	Male tennis players [n=10]	Female tennis players [n=7]		
1. Age (years)	15.5 \pm 1.27	14.43 \pm 1.13	0.09	not significant
2. Height (cm)	165.19 \pm 7.54	159.04 \pm 2.09	0.03	$p < 0.05$
3. Weight (kg)	55.4 \pm 10.91	56.57 \pm 10.08	0.82	not significant
4. Fat (%)	11.85 \pm 6.99	15.79 \pm 6.03	0.23	not significant
5. Lean body mass (kg)	48.32 \pm 7.46	47.16 \pm 5.56	0.72	not significant
6. Chest circumference (cm)	83.43 \pm 10.69	80.81 \pm 8.50	0.58	not significant
7. W/H ratio	0.8 \pm 0.06	0.74 \pm 0.04	0.02	$p < 0.05$

no significant differences in TV, SVC, FVC, FEV1, FEV1/FVC, FEF25-75%, PEF and MVV. However, PIF was significantly different ($p < 0.05$) between male and female trained tennis players (tab. 2).

DISCUSSION

A young body is flexible and susceptible to various stimuli. These stimuli may sometimes exceed the limit of the body's biological tolerance. Thus, it may be too much for the child's level of somatic development and motor ability, resulting in effects on growth and maturation. Somatic features are an important factor for conditioning and achievement in sports [15]. It is also an important aspect taken into consideration during the selection process for specific sports events.

In this cross-sectional study, insignificant differences were observed in weight, fat percentage, lean body mass and chest circumference between male and female lawn tennis players of similar age (tab. 1). The amount of body fat and a central pattern of fat distribution might relate to lung function via several mechanisms. These include mechanical effects on the diaphragm (impeding descent into the abdominal cavity) and on the chest wall (changes in compliance, and in the work of breathing and elastic recoil) [16]. Reduction in physical activity affects body composition parameters such as fat percentage and muscle mass. In this study, no significant difference in fat percentage was observed between male and female tennis players. This contrasts other studies that showed a higher percentage of body fat in females than males [17], although the age ranges of the study participants were different. These conflicting results might be for reasons such as age, ethnicity, body build, and the training pattern and load of the players.

Lean body mass has a definite relationship with the lung function [18] of an individual. Earlier observations indicated that reduced FEV1 may be due to reduced skeletal muscle and, consequently, respiratory muscle [19]. This study did not identify any difference in lean body mass in adolescent male and female tennis players, although the male had significantly

higher stature than the female (tab. 1). This finding might be due to a lower of percentage of body fat in the trained female players. Apparently, chest circumference is a determinant of lung function in healthy individuals. We did not identify a significant difference in chest circumference between male and female adolescent tennis players. This might be due the lack of age variation between genders, or to a more appropriate training load for the females. Further studies are needed to explain this. The ratio of waist and hip circumference has been used for calculating the WHR index, which indicates an individual's central obesity. In this study, males had a significantly higher central fat distribution than the females. As there are no reference values for trained individuals of the age range focused upon in this work, the reasons for this observation cannot be ascertained.

The lung function measures i.e. TV, SVC, FVC, FEV1, FEV1/FVC, FEF25-75%, PEF, PIF and MVV were assessed male and female trained tennis players, aged 14–17 years old (tab. 2) to ascertain whether any significant differences were present. In this study, mean values of FVC and FEV1 in male trained tennis players were 3.03 and 2.41 L, respectively. In females, the values were 2.95 and 2.10 L, respectively. FEV1/FVC was 80.29% and 76.66% in male and female tennis players, respectively. MVV in males and females was 83.33 and 79.81 L/min, respectively. All of these between gender differences were insignificant and indicated that the lung capacities were almost identical in the 14–17 year age range. This might be due to insignificant differences in body composition between the two groups, and an effective training load for the female tennis players. However, males were of a significantly taller stature than the females. So, it can be claimed from this study that differences in lung capacity in adolescent tennis players not only depends upon stature but may also depend on other factors that influence lung function. Insignificant differences in body fat percentage and lean body mass between gender groups, and effective training schedule for the females likely had an important role in minimizing the gender differences in lung capacity.

Table 2. Selected pulmonary function tests

Variables	Mean ± standard deviation		p value	Level of significance
	Male tennis players [n=10]	Female tennis players [n=7]		
1. TV (l)	0.87±0.32	0.74±0.14	0.29	not significant
2. SVC (l)	2.95±0.64	2.76±0.22	0.39	not significant
3. FVC (l)	3.03±0.92	2.95±0.40	0.81	not significant
4. FEV1 (l)	2.41±0.72	2.10±0.2	0.33	not significant
5. FEV1/SVC (%)	80.29±14.69	76.66±19.14	0.68	not significant
6. FEF25-75% (l/s)	2.37±0.85	2.04±0.67	0.39	not significant
7. PEF (l/s)	3.72±1.23	2.80±1.12	0.13	not significant
8. PIF (l/s)	3.58±1.19	1.94±0.28	0.001	$p < 0.05$
9. MVV (l/min)	83.33±27.77	79.81±9.39	0.72	not significant

This study identified that PIF was significantly higher in male than female trained tennis players (tab. 2). PIF is a reliable measure of airway resistance and inspiratory muscle strength in humans. It has already been reported that aerobic and interval training improves inspiratory muscle strength [20]. It has also been shown that increased inspiratory muscle strength does not contribute to maximal oxygen consumption in human [21]. In this study, the significantly higher PIF in male tennis players was an additional advantage over females, in terms of higher inspiratory muscle strength.

Significant differences have been found in height, W/H ratio and PIF between male and female lawn tennis players, with all values significantly higher ($P < 0.05$) in the males. The greater height found in males of a similar age is advantageous for this gender. It might result from their own growth pattern under the influence of different hormones, which were not considered in this study. The males also had more centrally located fat, which might be due to less effective physical training in male adolescents. Greater central fat distribution may hinder lung capacity by influencing the abdominal cavity. Higher peak inspiratory flow in the male trained tennis player indicated that inspiratory muscles are more powerful in males of this particular age range.

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CONCLUSIONS

The insignificant differences in body composition between the two gender groups and the effective training load for female tennis players though stature of male players are significantly higher than female tennis players. Therefore, it can be concluded from this study that gender differences in lung capacity can be minimized with a proper training load in females, at least in the 14–17 year age range. This study also suggests that stature is not the only decisive factor for lung capacity in adolescent male and female trained tennis players. Body composition, central fat distribution, active inspiratory muscles and proper physical training have definite role in improving lung capacity of young male and female trained tennis players.

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THE NEED FOR EMOTIONAL AWARENESS AND A QUANTITATIVE MEASURE BASED ON EMPIRICAL RESEARCH

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A – study design, B – data collection, C – statistical analysis, D – interpretation of data, E – manuscript preparation, F – literature review, G – sourcing of funding

ABSTRACT

Background: The scope of emotional competence and the definition of individual differences therein is still a matter of scientific debate. So, too, is the inclusion of emotional awareness as an important feature of emotional competence.

Aim of the study: To explore levels of emotional awareness in relation to a *predefined* six factors model. This study will also examine the ability to measure emotional competence with empirical research.

Material and methods: For this study, a self-report questionnaire (EAQ30) is used to assesses emotional awareness in children. Here, emotional awareness is described as the “ability of people to differentiate, express, analyze and pay attention to their own emotions and those of others” emotions and those of others”. Participants were recruited as a representative group of N = 27 11-year-old children.

Results: We found that scores in two dimensions – ‘acting out emotions’ and ‘bodily awareness’, were lower in comparison to the other four dimensions from the emotional awareness measure.

Conclusions: Individual differences in emotional awareness have shown to have a significant impact on important life outcomes for children and adolescents, including mental and physical health, successful academic behavior and achievement, and social relationships. It is important to proceed with attempts to measure emotional awareness in young people with valid empirical investigations, and to develop new models for emotional training that are capable of enhancing emotional functioning.

KEYWORDS: emotional awareness, children, adolescents, self-report questionnaire

BACKGROUND

Why do we need to teach children about emotions?

With their brains growing at a rapid rate, children constantly notice, react, adapt, and develop their ideas based on their emotional experiences. This is why we need to equip them with an emotional education that can improve their quality of life. Teaching children how to recognize their feelings, understand where they come from, and learn how to deal with them is considered to be an essential skill for success in life.

People respond in a variety of ways to the experiences they encounter. Some people immerse themselves in the situation they experience, others attempt to do so, whilst others don't seem to be able to do so at all [1]. Based on these observations, it seems that emotional awareness is required before coping responses can be applied to a given situation. Moreover, a precise and elaborate awareness – i.e. an analysis of the exact nature of the emotion, the eliciting antecedents, and possible consequences – enhances the like-

lihood of finding a more adaptive approach to a given situation [2].

Emotional awareness consists of individual differences in the way that people differentiate, express, analyze, and pay attention to their own emotions and the emotions of others [3]. Emotional awareness is an important feature of emotional competence. The term ‘emotional competence’ is used to capture all of the different aspects of emotional functioning, such as identification of emotions, regulation of emotions, emotion expression, and empathy.

Emotional competence can be defined as the ability to purposefully and fully express a variety of emotions, understand the emotions of self and others, and regulate emotional expressiveness and experiences when necessary [4]. Emotional competence undergoes dramatic changes within the first five years of life, which coincides with increased ability to express more sophisticated, nuanced, and regulated emotions. There is also an age-related increase in the ability to understand, identify, and empathize with others' emotions.

Although there are some debates in the literature, many studies have associated higher emotional competence with physical and mental health [5,6]. The first studies examining the role of emotional competence in children and adolescents adapting to their environment revealed that self-reported emotional competence was associated with positive social behaviors [7], as well as with physical and psychological health [8].

Given the individual differences in emotional competence across the lifespan, it is critical to have a valid and reliable instrument for measuring variability in emotional competence, particularly for child and adolescent populations. Although some questionnaires on trait emotional intelligence have been adapted for children, we assert that the most appropriate tool for examining emotional awareness as part of emotional competence to date is the Emotion Awareness Questionnaire for children – EAQ30 [9]. The EAQ30 is specifically designed to identify emotional awareness, which refers to an attentional process, for e.g., ability to monitor and differentiate emotions. The EAQ30 also examines attitudes towards emotions, for e.g., how are emotions and their corresponding expressions valued [9]. The EAQ30 shows good psychometric properties and good criterion validity with a related measure of emotional self-efficacy, the TEIQue. Additionally, the EAQ30 shows good concurrent validity with respect to common internalizing problems experienced by children and adolescents, including somatic complaints, social anxiety, depression, and a tendency for non-productive thinking (e.g., worry, rumination). In addition, a cross-cultural study demonstrated that the EAQ30 accurately captures the structure of children's emotional dispositions, regardless of cultural differences [3].

Emotional awareness is closely related with the construct of emotional intelligence. Although there are ongoing debates about the scope and the status of emotional intelligence, the most predominant thesis refers it emotional intelligence as individual differences in the perception, processing, regulation, and utilization of emotional information [10].

In accordance with the debate on the status of emotional intelligence as an ability or trait, a tripartite model of emotional intelligence has been developed [11]. This model posits that there are three levels of emotional intelligence: knowledge, abilities, and traits. The knowledge level refers to the complexity and width of emotional knowledge, where the focus is on what people know about emotions and how to deal with emotion-laden situations. The ability level refers to the ability to apply emotion knowledge in an emotional situation, and to implement a given strategy. The trait level refers to emotion-related dispositions, namely the propensity to behave in a certain way in emotional situations.

The same tripartite model can be seen in the structure of EAQ30, where the questions in the six scales attempt to estimate a child's ability to differentiate between various emotions, their knowledge and tendency to analyze their feelings and talk about them, their

attention to bodily symptoms of an emotional arousal, their attention to others' feelings, and their propensity to behave in particular ways in emotional situations.

AIM OF THE STUDY

The aim of the study is to explore levels of emotional awareness in relation to a predefined six factors model. This study also examines the ability to measure emotional competence with empirical research

MATERIAL AND METHODS

A representative group of N = 27 11-year-old children participated in this study. Prior to participating in the study, parental permission was obtained.

The EAQ30 is a self-report questionnaire developed specifically for children and adolescents, and aims to identify what children feel and think about their own emotions and the emotions of others. It was developed in correspondence with the Toronto Alexithymia Scale [12], the Children's Depression Inventory [13], the Worry Questionnaire [14] and the Somatic Complaint List [15]. The EAQ30 was designed with a six-factor structure that represents various aspects of emotional functioning and consists of a total of 30 items. Some of the items are negatively formulated and thus subsequently reverse-scored. Respondents are asked to rate the degree to which each item is true about him or herself on a three-point scale (1 = not true, 2 = sometimes true, 3 = often true). The questionnaire is composed of six dimensions:

1. *Differentiating Emotions* is the ability to differentiate discrete emotions and locate their antecedents;
2. *Bodily Awareness* is the cluster of physical sensations of emotions;
3. *Analyses of Emotions* and
4. *Attending to Others' Emotions* identify children's interest in facing their own and others' emotions, respectively;
5. *Not Hiding Emotions* refers to the tendency to not attempt to conceal personal feelings
6. *Verbal Sharing* of emotions refers to verbal aspects of communication.

RESULTS

Group results can be found in tab. 1. Overall, scores on dimensions of 'hiding emotions' and 'bodily awareness' were lower in comparison than scores on the other four dimensions, as shown in fig. 1.

DISCUSSION

We compared our results with a representative study, with participants from the Netherlands (N = 665), Spain (N = 464) and Belgium (N = 707) used for cross-validation of the EAQ30 [3] (see fig. 2). Results show that the factor 'not hiding emotions' has the lowest score compared to

Table 1. Results from the conducted study

Participants number	Dimensions of emotional awareness						
	Differentiating emotions	Verbal sharing	Not hiding emotions	Bodily awareness	Attending to others' emotions	Analyses of emotions	Emotional awareness
Average score	2.11	2.14	1.85	1.86	2.69	2.19	2.14
1	2.43	2.67	2.20	2.40	2.40	2.80	2.48
2	2.43	1.67	2.00	2.60	2.60	1.80	2.18
3	1.86	2.00	2.00	1.40	3.00	2.80	2.18
4	2.57	2.00	2.40	1.40	2.80	2.80	2.33
5	2.14	2.00	2.40	1.60	3.00	1.60	2.12
6	1.57	1.33	1.40	1.40	2.80	2.00	1.75
7	2.00	2.33	1.60	1.60	2.60	1.20	1.89
8	2.43	2.67	1.80	3.00	2.40	2.40	2.45
9	1.57	2.33	1.20	2.40	3.00	2.60	2.18
10	2.29	2.00	2.20	2.20	2.60	2.60	2.31
11	1.71	2.00	2.00	1.80	3.00	1.80	2.05
12	2.71	1.33	2.20	2.00	2.20	1.00	1.91
13	2.43	2.67	1.80	2.00	3.00	2.00	2.32
14	1.71	2.33	1.80	1.60	2.80	1.60	1.97
15	2.29	1.67	1.60	2.20	2.60	1.80	2.03
16	2.00	2.33	1.40	1.60	2.60	1.80	1.96
17	2.29	2.33	1.20	1.20	2.80	2.00	1.97
18	1.71	2.67	1.80	1.40	2.80	2.80	2.20
19	2.43	2.67	2.20	3.00	2.40	2.60	2.55
20	2.00	2.67	2.20	2.20	1.80	2.20	2.18
21	2.29	2.33	1.60	2.60	2.40	1.80	2.17
22	2.29	2.00	2.20	1.60	3.00	2.20	2.21
23	1.00	1.67	1.60	1.00	2.60	3.00	1.81
24	2.57	2.33	1.60	2.00	2.80	2.00	2.22
25	1.57	1.67	2.40	1.20	3.00	3.00	2.14
26	2.43	2.00	1.80	1.40	2.80	2.40	2.14
27	2.14	2.00	1.40	1.40	2.80	2.60	2.06

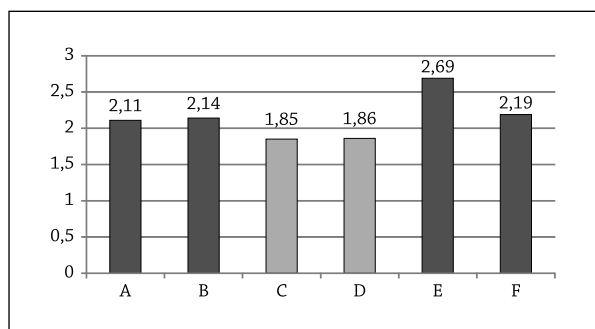


Figure 1. Over scores on dimensions of emotional awareness
 A – Differentiating Emotions; B – Bodily Awareness; C – Analyses of Emotions; D – Attending to Others' Emotions; E – Not Hiding Emotions; F – Verbal Sharing

the other four factors in the Netherlands sample, and 'bodily awareness' has the lowest score compared with the other four factors in the Spain and Belgium samples.

It can be seen, that the factor 'not hiding emotions' has the lowest score in comparison with the other four factors in Netherlands sample and the factor 'bodily awareness' has the lowest score in comparison with the other four factors in the sample of Spain and Belgium.

These results prompt some questions:

1. Will the factors 'not hiding emotions' and 'bodily awareness' always show the lowest scores when compared to scores on the other four factors of emotional awareness?

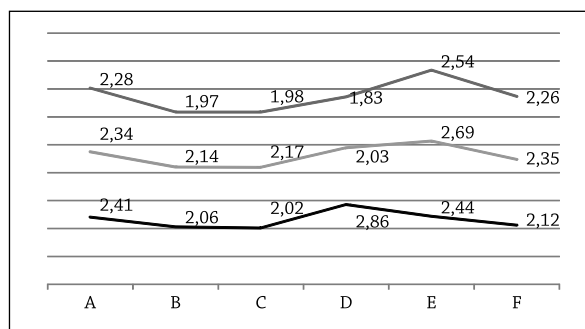


Figure 2. EAQ30 scores in samples from the Netherlands (top line), Spain (middle line), and Belgium (bottom line).

A – Differentiating Emotions; B – Bodily Awareness; C – Analyses of Emotions; D – Attending to Others' Emotions; E – Not Hiding Emotions; F – Verbal Sharing

2. Can specific efforts be made in the direction of developing some strategies to increase scores on the two aforementioned factors – 'not hiding emotions' and 'bodily awareness'? If there is growth in scores for these factors, will higher scores on these factors correlate with higher on the other four factors, and with overall scores of emotional awareness?

Nonetheless, a goal should be to create and implement assessments, such as emotional training programs, to improve on children and adolescents' skills and abilities or other appropriate measures. It is also

important to identify survey measures that are appropriate for approximating social and emotional development of young children and adolescents.

CONCLUSIONS

Despite the ongoing debate regarding the nature and scope of emotional intelligence, it is clear that supporting the emotional development of young children is crucial for their success in school as well as in other

settings, and for their life into adulthood. Healthy emotional development is also associated with later ability to function in family, school, peer situations and other contexts, and is often connected with good physical health. For these reasons, it is important to create and develop training methods and good practices that aim to enhance children and adolescents' emotion-related dispositions. Moreover, it is clear that emotional intelligence is an active and essential ingredient of life success and happiness.

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ARE DIETARY SUPPLEMENTS DANGEROUS? ASSESSING HOW SOCIETY PERCEIVES THE USAGE OF DIETARY SUPPLEMENTS – RESULTS OF THE PRELIMINARY ANALYSIS OF NATIONWIDE SURVEY DATA

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ABSTRACT

Background: Dietary supplements (DSs) are concentrated sources of nutrients and/or other substances, whose purpose is to supplement the normal diet. Their consumption in Poland has been on the rise, leading to numerous concerns. However, current legislation does not provide any background for a relevant pharmacovigilance system. Therefore, little is known about their adverse effects (AEs) or patterns of use in Poland. To shed some light on this, we conducted a nationwide survey.

Aim of the study: To assess the prevalence of, and the reasons for, the use of dietary supplements in Poland via national survey with a collection and an analyse of supposed adverse effects of dietary supplements.

Material and methods: The study was conducted using an online survey based on the original questionnaire. In this report, we present the results of the analysis of the first 200 responses.

Results: As many as 55.5% (111) of respondents were 'definitely sure' or 'rather sure' about DSs safety. However, 70.5% (141) believed that they could have negative effects. Over 3/4 (153) of respondents used DSs themselves, and 61.0% (122) used them within last 12 months. Of those using DSs, 11.1% (17) reported diverse AEs, with GI tract irritation and mental disturbances being the most common (experienced by 35.3% (6), and 17.6% (3) of those reporting AEs, respectively).

Conclusions: Respondents had mixed feelings about DS safety. Despite that, they used these products frequently. Of a note is high incidence of adverse effects experienced by DS users. This undoubtedly points to the need for a relevant pharmacovigilance system.

KEYWORDS: dietary supplements, safety, adverse effects

BACKGROUND

According to the European Food Safety Authority, dietary supplements (DSs) are concentrated sources of nutrients or other substances with a nutritional or physiological effect, whose purpose is to supplement the normal diet (including vitamins, minerals, herbs or other botanicals, amino acids, and other substances) or their constituents [1].

Many people seem to believe that a special diet based on the intake of certain nutrients may increase their overall capacity to perform diverse activities [2]. Indeed, many studies have reported that continued usage of supplements on a daily basis is beneficial for primary and secondary prevention of some diseases and improves quality of life [3,4]. The use of dietary supplements varies by age, sex, and race/ethnicity. Use is also

common in patients with chronic or recurrent illnesses, who also receive care from health professionals [5,6].

Despite the overwhelming use of dietary supplements across different populations, an overall pattern of negative effects related to their use has not been well-studied [7]. Moreover, because there are no trustworthy sources of information on the use and real safety of dietary supplements, the general population may share unrealistic beliefs about the impact of those supplements on physical and mental performance, and overall health [8].

At present, the popularity of dietary supplements across different social groups are on the rise in Poland. People increasingly want to buy “a pill for everything,” often without contact and consultation with their doctor. Many ads on TV, in newspapers, and on the Internet encourage them to buy these products. Analyses of the International Euromonitor have demonstrated a rising consumption of vitamins and dietary supplements in Poland, driven mainly by health and wellness, convenience, and increasingly hectic lifestyles [9]. In many cases, DSs are too often used beyond objective indications, without objective need.

Unfortunately, current legislation does not establish nor support any effective system of dietary supplement pharmacovigilance. Thus, the true prevalence of adverse effects related to the use of dietary supplements in Poland is completely unknown.

AIM OF THE STUDY

The aim of this study was to assess the prevalence of, and the reasons for, the use of dietary supplements in Poland via national survey. We especially wanted to collect and analyse information of supposed adverse effects of dietary supplements. As the study is still ongoing, in this paper we present the results of the analysis of the first 200 responses.

MATERIAL AND METHODS

Based on the literature review and the experience of the members of the project team, the first draft of the survey questionnaire was designed. The major dimensions we wanted to assess with the questionnaire were: the level of knowledge users possessed about dietary supplements, reasons for taking dietary supplements by different user groups, details on the practice of dietary supplement use, and experience with adverse effects of dietary supplements.

To allow for content validation, feedback of the study group was analysed, and relevant changes to the draft were introduced. The second, modified version of the questionnaire was drafted, and was made available online on the surveying platform. This version was piloted in about 20 volunteers (not involved in the questionnaire preparation) to prove its readability and further fine-tune the tool. Volunteers of different age/gender were invited to the pilot through

direct contacts. Their feedback was analysed and the final version of the survey tool was prepared accordingly. It contained approximately 30 questions (mainly closed-ended), including questions related to respondents' demographics.

This version of the questionnaire was used in the final study. A nationwide online survey was opened on the SurveyMonkey platform on June 9th, 2017, and the invitations were sent to the open public by different channels. The survey will be continued until we obtain the target number of 1,000 responses.

Data collected so far from the first 200 respondents has been analysed and presented in a form of descriptive statistics.

RESULTS

Among 200 respondents whose responses we have analysed in this publication, more than half (54.5% – 109) constitute women. The average age of respondents was 26.8 ± 7.5 years. Similar percentages of respondents had secondary and higher education (41.0% (82) and 42.5% (85), respectively); over a half of them (51.0% – 102) lived in cities with populations of over 100,000.

Respondents expressed mixed feelings regarding DS safety. On one hand, 55.5% (111) of them were ‘definitely sure’ or ‘rather sure’ about DSs safety (fig. 1).

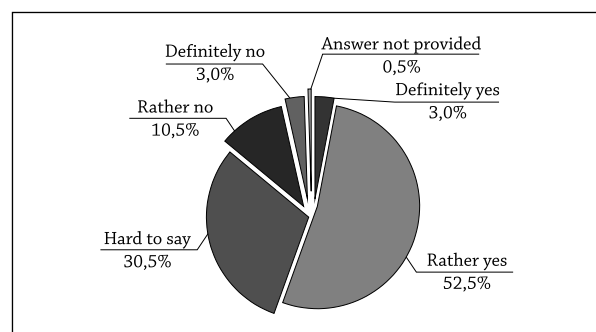


Figure 1. Respondents' beliefs regarding dietary supplement safety (answers to the question ‘Are the dietary supplements safe?’ n=200).

At the same time, in most cases they knew that DSs were not undergoing any safety tests prior to entering the market (as many as 51.0% (102) of respondents answered ‘rather not’ or ‘definitely not’ to the question asking whether DSs undergo any safety testing prior to launch at the market). Moreover, as many as 70.5% (141) of them believed that they could have negative effects.

Despite these mixed feelings, over 3/4 of respondents (76.5% – 153) used DSs themselves, and 61.0% (122) used them within last 12 months. The types of DSs used most often were those containing vitamins and minerals, non-saturated fatty acids, and probiotic bacteria, being used by 65.5% (131), 31.5% (63), and 28.0% (56) of respondents, respectively.

As far as the main reasons for DS usage, most of the respondents claimed it was an easier way to replenish nutritional deficiencies compared to diet change,

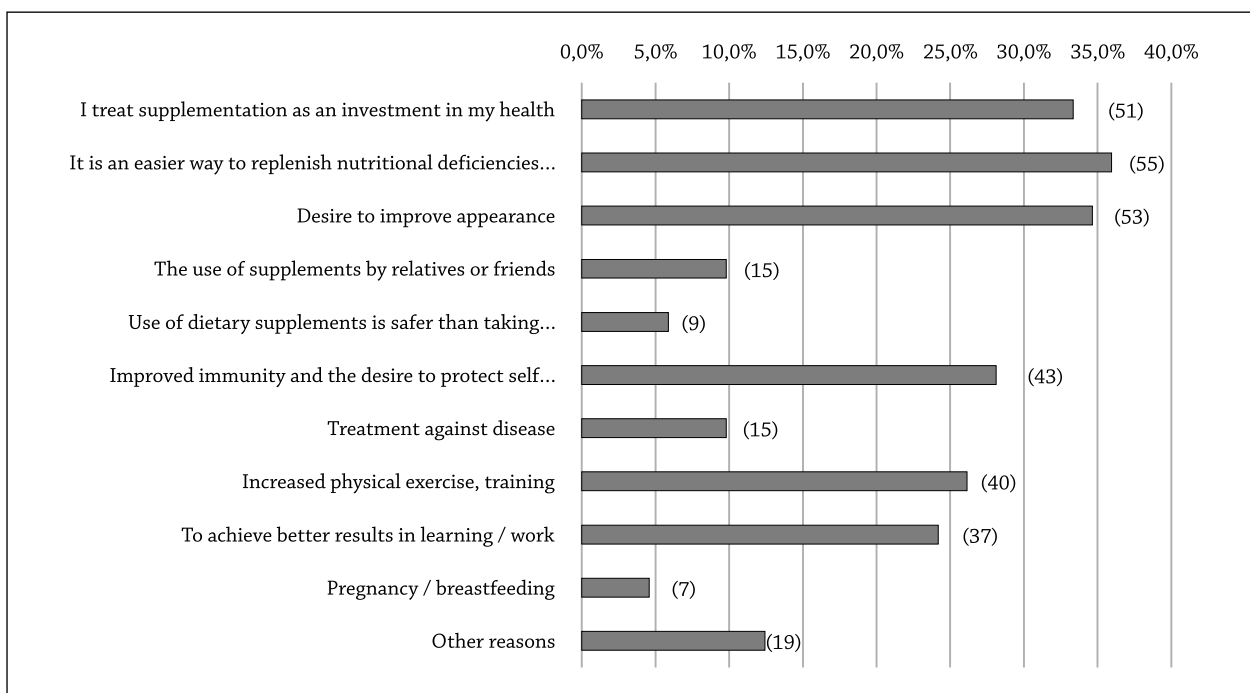


Figure 2. Main reasons why respondents used DS. (Respondents could provide multiple answers; percentages are calculated for those respondents who admit to using dietary supplements; n=153).

desire to improve one's appearance, or treated supplementation as an investment in one's health (35.9% – 55, 34.6% – 53 and 33.3% – 51 respectively). Nearly 1/4 of them took dietary supplements due to increased physical exercise/training (26.1% – 40) or to achieve better results in learning or at work (24.2% – 37). For details of the answers see fig. 2.

Of those using DSs, 11.1% (17) reported diverse AEs, with GI tract irritation and mental disturbances being the most common (experienced by 35.3% (6), and 17.6% (3) of those reporting AEs, respectively, see fig. 3).

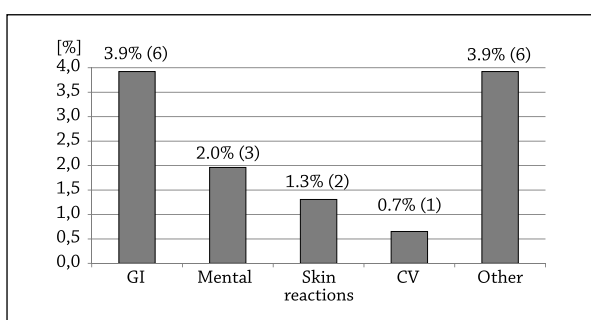


Figure 3. Adverse effects of dietary supplements reported by their users, by classes (Respondents could provide multiple answers; percentages are calculated for those respondents who admit to using dietary supplements; n=153). Legend: GI – gastro-intestinal tract disturbances, Mental – mental problems/disturbances, CV – cardiovascular problems

DISCUSSION

Currently, in Polish legislation, there is a gap which enables nearly unlimited marketing of dietary supplements. This may create a false image of remedies that are very effective, and completely free of any adverse

effects. Consequently, the sale of the DSs is rising every year. According to the estimates from the Supreme Chamber of Control (NIK), the dietary supplement market in Poland will reach 4 billion PLN in 2017. This market continues to grow even though, at present, dietary supplements are remedies of uncertain quality [13]. As reported most recently by the Guardian [14] and NIK [15], they may even contain illegal ingredients and thus could be dangerous for one's health.

Being aware that dietary supplements are not tested for their safety before introduction to the market, and could be even dangerous, well-educated respondents to our survey were still generally happy to use them.

Undoubtedly, an excessive consumption of dietary supplements is not effect-neutral to their users. It can lead to the substance accumulating within the body with possible negative health consequences [10].

Several studies performed so far have shown different levels of knowledge of lay people when it comes to dietary supplements – especially on the legal aspects of their introduction to the market [11]. In Poland, this knowledge is particularly low [12]. Most users are not aware of what the dietary supplements are, or what they contain. This could create conditions for DS overuse, with a wide variety of consequences. Often, customers are also happy to take more than one supplement at the same time, exposing them to interactions between supplements. Another important interaction risk comes with the use of dietary supplements in tandem with their over-the-counter (OTC) medications and/or prescription medications.

A recent report by the Supreme Audit Office (*Najwyższa Izba Kontroli*) revealed that the control of dietary supplements in Poland was lacking at all steps

prior to reaching the market. First, to introduce a new DS to the market, the manufacturer is only required to notify the General Sanitary Inspectorate, and without further testing a product can be advertised and sold in the stores. Moreover, advertisements of the dietary supplements were often misleading, thus making it impossible to properly assess whether a product was in fact an OTC drug or a DS. Further points were made on the quality control of DSs. The General Sanitary Inspectorate had insufficient control on dietary supplements which, for example, allowed products containing hazardous health ingredients such as *E. faecium* or psychoactive substances (e.g. amphetamine-like) to be introduced to the market [13].

The pathway that dietary supplements currently follow when being introduced to the Polish market is very similar to introduction in the United States. Manufacturing of dietary supplements is regulated by the Dietary Supplement Health and Education Act of 1994 and companies are required to produce them in a quality manner without contaminants or impurities, according

to Good Manufacturing Practice and labelling regulations. On the other hand, the Food and Drug Administration (FDA) must be notified if the DS contains a new ingredient or if adverse events occur [16–18].

CONCLUSIONS

Our study shares all the limitations typical of online surveys. Still, it is a comprehensive response to the growing trend of dietary supplement consumption in Polish society, examining the level of general knowledge about dietary supplements, as well as the prevalence and reasons for their use. The major strength of this study rests on this: for the first time, using a structured survey, we demonstrated the presence of adverse effects related to dietary supplements, and we showed the extent of those effects in Polish consumers. This may allow for expanded research over the use of dietary supplements in Poland. Moreover, this could trigger changes in national legislation, and support the creation of functional pharmacovigilance system.

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IMPACT OF SYSTEMIC CRYOTHERAPY ON PHYSICAL FITNESS

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ABSTRACT

Background: Systemic cryotherapy has broad effects on the human body. These include improved immunity, accelerated tissue regeneration, activation of thermoregulatory mechanisms, analgesic effects, and reduced muscle tension and spasticity without compromising strength.

Aim of the study: To evaluate the effect of systemic cryotherapy on physical fitness.

Material and methods: The 43 participants (42 – 53 years of age) underwent 10 daily treatments in a nitrogen cryochamber over two consecutive weeks. Each cryochamber treatment lasted for 3 minutes at -130°C . Physical fitness was tested before and after the cryochamber treatment course using elements of three physical testing methods (a functional movement screen, a TKKF physical fitness test and a general fitness test).

Results: After cryotherapy, there was a visible improvement in the first four exercises of the fitness test with fewer participants feeling pain during movement, and more able to perform the exercises correctly or perfectly. For the remaining three exercises, the changes occurred in fewer subjects and to a lesser extent.

Conclusions: Systemic cryotherapy was associated with improved physical fitness. It can be used to help increase overall physical fitness as a complementary and supportive process.

KEYWORDS: systemic cryotherapy, cryochamber, physical fitness

BACKGROUND

One of the most dynamically developing fields of modern medicine is physical medicine based on natural treatment methods. An interdisciplinary approach has resulted in various forms of energy being used for both therapeutic and preventive purposes. Among these treatment fields is thermotherapy, which includes cryotherapy. Cryotherapy has been used in therapeutics for over thirty years [1–3], while the practice of cold therapy extends back to ancient times. In the 5th century BC, Hippocrates is reported to have surmised that low temperatures, even leading to hypothermia, effectively reduced swelling and bleeding as well as having an anesthetic (analgesic) effect [3,4].

In the first half of the 20th century, scientific research on the influence of low temperatures on organism life (cryobiology) developed rapidly. Studies investigating the application of extremely low temperatures to human tissue were undertaken, with the first of these

describing cold as treatment for benign and malignant skin lesions. This gave rise to the treatment strategy of local cryotherapy [5–8].

Systemic cryotherapy is currently used for therapeutic and preventive purposes, and to restore appropriate bodily functions if they have been disturbed. In the human body, it activates generalized physiological and defense reactions, as well as thermoregulatory mechanisms. Extremely low temperatures have analgesic effects, and reduce muscle tension and spasticity without compromising strength [9]. Endocrine effects include altered concentrations of various hormones including adrenocorticotrophic hormone, cortisol, catecholamines (noradrenaline and adrenaline), testosterone, thyrotropin and thyroid hormones [10–12]. Cryogenic temperatures potentiate immunity and can precipitate biochemical cellular reactions including release of growth factors such as epidermal growth factor and growth hormone-releasing peptide 6 [13].

Cryotherapy is widely used in sports as it has a positive effect on the general health and physical fitness of athletes through regenerative processes and biological renewal. It also assists with readiness to undertake further physical exertion [7,10,14,15].

Studies to illustrate and confirm the physiological effects of low temperatures are undertaken regularly. This has promoted systemic cryotherapy as a useful tool for biological renewal for inclusion in cosmetic procedures as well as in physiotherapy when working with patients [11,16–17]. The aim of this study was to evaluate the impact of systemic cryotherapy on physical fitness.

AIM OF THE STUDY

This study aimed to evaluate the effect of systemic cryotherapy on physical fitness.

MATERIAL AND METHODS

There were 43 participants (25 men, 18 women) who were 42 – 53 years of age. Inclusion criteria were 40 – 55 years of age and sedentary lifestyle, which was defined as lack of involvement in any form of physical activity or recreation, with daily life limited to professional tasks and family obligations. Exclusion criteria were contraindications to cryochamber treatment (cardiovascular or respiratory diseases, skin changes), and presence of pain in the back, or hip or shoulder joint.

Immediately prior to entering the cryochamber, the blood pressure and heart rate of each participant was measured to confirm a lack of contraindications.

All participants underwent ten daily systemic cryotherapy treatments on Mondays through to Fridays for two consecutive weeks. Each treatment lasted 3 minutes at -130°C.

Before cryochamber treatment, participants performed a test to assess their physical fitness level. This consisted of selected elements of the Functional Movement Screen by Cook et al., TKKF physical fitness for adults by Pilicz and Żmudzki, as well as a general fitness test for junior football players by Talaga. The type and order of the seven exercises in the test was as follows: squat depth, walking over hurdles, lunges, mobility of the shoulder girdle, straightening and bending arms in a front support position, planking supported on fore-arms and straight-leg sit-ups.

The selection criteria for the exercises to verify physical fitness level prioritized safety and physical abilities. The selected exercises were appropriate for the age and lifestyle (no physical activity) of the participants. However, they were also sufficient to evaluate physical fitness level and to obtain knowledge about the general physical condition of the participants. A therapist assessed participant ability to perform each of the first four exercises according to the following: 0 points – participant reported pain on attempting to make a movement, 1 point – participant could not do an exercise, 2 points – participant completed an exercise, but used compensation patterns, and 3 points – participant did the exercise perfectly without compensation patterns.

The subsequent exercises were different, and included the number of repetitions of bending and straightening upper limbs in a front support position within 30 seconds along with the duration of planking on fore-arms and the number of straight-leg sit-ups.

During the two weeks of cryochamber therapy participants maintained their previous lifestyle and did not undertake any physical training or other form of physical activity.

RESULTS

Tab. 1 shows the comparative results for four kinds of exercises from the general physical fitness test, before and after cryotherapy.

With cryotherapy, there was a decrease in the number of participants (two people) who experienced pain during movement with each exercise test. There was also an increase in the number of participants who could complete an exercise with a compensation pattern, and who could complete an exercise perfectly (shoulder mobility was an exception). Further, the number of participants unable to perform an exercise decreased after cryotherapy.

For the exercise involving straightening and bending of arms in a front support position, the number of participants who did up to 14 repetitions increased from 6 to 13 after cryotherapy. The number of participants who did only ten repetitions decreased from 16 to 10, while the number of participants with the maximum number of repetitions (15) did not change (two people).

For the planking on fore-arms exercise, three participants recorded a time of 21 seconds after cryo-

Table 1. Results of first four exercises of the fitness test, before and after therapy

Exercise/ performance level	Squat depth		Hurdle		Lunge		Shoulder mobility	
	before	after	before	after	before	after	before	after
Pain during movement	5	2	6	4	4	3	2	2
Unable to do the exercise	18	16	7	4	7	1	28	21
Movement with a compensation pattern	14	18	25	28	23	28	13	20
Perfectly done movement	6	7	5	7	9	11	0	0

therapy. This was the longest time recorded, with no participants attaining this good a result prior to cryotherapy. A further three participants maintained the position for up to 19 seconds after cryotherapy. Two individuals from the weakest group improved their result from 11 to 15 seconds.

During the straight-leg sit-up exercise four more people completed eight repetitions after cryotherapy, in comparison to the situation before the therapy. A further seven people did seven repetitions. After cryotherapy, the smallest number of repetitions in this exercise increased from three to five.

DISCUSSION

Systemic cryotherapy is one of the treatment methods used for various locomotor system diseases such as degenerative changes of the spine, Ankylosing Spondylitis, painful shoulder syndrome, osteoporosis and psoriatic arthritis [14,16,18]. It has an analgesic effect, reduces muscle tension, improves tissue nourishment and increases joint mobility. Obtaining these therapeutic results positively affects patient wellbeing, increasing willingness to undertake recommendations in the field of kinesiotherapy [14,16–18]. Cryochamber treatments contribute to biological renewal for athletes across a range of sporting disciplines. Application of low temperatures shortens the period for muscle regeneration, delays onset of muscle soreness, reduces athlete fatigue, accelerates repair processes and improves effort tolerance [6,7,11,15,18]. These scientific reports that confirm the multifaceted nature and effectiveness of systemic cryotherapy motivate its broader application. We evaluated the impact of cryochamber treatments on general physical fitness in healthy sedentary people, and determined that physical fitness improved as assessed by our study methods. Overall, an increase in the number of repetitions and an improvement in exercise quality were observed. The participants did certain movements better and more precisely, and were able to maintain specific positions for a longer time demonstrating durability. However, substantial changes

were observed only in the case of simple exercises, which utilized movements similar to those undertaken daily e.g. shoulder functioning or a squat. The more difficult exercises done in a front support position or using abdominal muscles had considerably poorer results.

Our results confirm that systemic cryotherapy positively affects general physical fitness and therefore functioning of the human body. However, it cannot replace or equal routine physical activity. During training aimed at increasing general fitness, cryotherapy can be used adjunctively to support the process, but should not be a dominating method. This confirms that the basis of fitness is physical activity and when planning a training session for sedentary adults, it is recommended to include exercises that strengthen the abdominal muscles to correct and stabilize proper posture, and to increase the range of shoulder and hip girdle mobility. We were unable to compare our results to other studies, as there appeared to be no published literature of a similar nature. Most often, general fitness tests are used in young and healthy people who are involved in a physical activity recreationally. In such a context, they constitute a tool to determine current fitness level and as a basis to plan a training session to increase fitness. Fitness tests are also used during entrance examinations at sports universities to select candidates for particular Physical Education courses or physiotherapy [19]. Application of these tests to people of various ages who are not involved in sports or are not physically active allows for illustrative presentation of the participants' physical fitness level. Improved self-awareness enables actions to be undertaken to change and improve general fitness and mobility.

CONCLUSIONS

The conducted study suggests that systemic cryotherapy benefits physical fitness, but is insufficient to be used as the only method of increasing general fitness. Therefore, cryotherapy should be considered a supplementary method to support physical fitness.

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HEALTH BEHAVIORS AND LIFE SATISFACTION OF HEALTH SPA PATIENTS

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A – study design, B – data collection, C – statistical analysis, D – interpretation of data, E – manuscript preparation, F – literature review, G – sourcing of funding

ABSTRACT

Background: Determining the relationship between health behaviors and life satisfaction in patients who use health spas as an accurate measure of well-being (subjective well-being reflecting health condition) can be the basis for implementing preventive activities, setting trends for behavior modification, and monitoring changes in health-promoting practices.

Aim of the study: To determine an empirical verification of the relationship between health behaviors and life satisfaction.

Material and methods: The study included 123 women and men aged 32–80 years – all of whom were health spa patients. The Health Behavior Inventory (HBI) by Juczyński, and the Polish adaptation of the Satisfaction With Life Scale (SWLS) by Diener, Emmons, Larsen, and Griffin were used to measure health behavior and life satisfaction, respectively.

Results: There was a significant positive correlation between health behavior indicators and the level of life satisfaction in patients, as well as an increase in the practice of health behaviors with age. Gender appears to differentiate the frequency of the performance of health behaviors in the subjects. A higher overall rate of health behaviors was observed in females compared with males. For instance, females attached greater importance to healthy eating habits compared with males. However, a higher level of life satisfaction is associated with more intensified preventive behaviors in males.

Conclusions: A health education program should take into account both the age and gender of health spa patients. It should also aim to not only develop health awareness, but also to include psychological factors, such as a sense of life satisfaction, which can strengthen patients' beliefs in the importance of health-promoting activities.

KEYWORDS: health behaviors, life satisfaction, health spa, health psychology, health education, health and diseases correlates

BACKGROUND

Health education within a health spa context is an important part of a country's health policy – a tool to reduce disease risk and prevent premature mortality. Its advantage is its low costs and relatively high efficiency [1–5].

Lectures on health education fundamentally alter the purpose of staying in a health spa. It is therefore not limited to treatment and rehabilitation, but is also supplemented with new content, initiating the process of lifestyle reconstruction and the practice of pro-health behaviors [6].

Health behaviors play a key role in maintaining and strengthening an individual's health and are important factors in shaping well-being. Many diseases that currently constitute the greatest threats to life and health (including cancer and cardiovascular disease) are ones for which the occurrence is significantly contributed to by a patient's life choices [7–10].

The prevalence of health behaviors and life satisfaction in health spa patients as an accurate measure of well-being (subjective well-being reflecting health condition) can be the basis for programming preventive

activities, setting trends for behavior modification, and monitoring changes in health-promoting practices [7].

Health behaviors

For the purpose of this study, the definition of Gochman's health behaviors [11] was adopted. He believes that health behaviors are subjective and dependent on psychological variables. According to the author, health behavior includes "such personal attributes as convictions, expectations, motives, insights, and other cognitive elements, personality characteristics, including emotional states and traits, patterns of explicit behaviors, actions and habits that are associated with maintaining, recovering, and improving health" [7]. It is a broad approach, consistent with modern knowledge, and has been examined by health psychology experts.

In the realm of health-oriented human activity, one can distinguish between habitual health behaviors and purposeful health activities. Health habits are related to everyday hygiene, nutrition, physical activity, and leisure. They are the result of socialization processes and cultural influences. They include promotional and prophylactic activities to both strengthen and protect health (i.e. preventing diseases and contributing to their early detection). On the other hand, intentional health activities are initiated in specific situations. They include human behavior in a situation of developmental change (e.g. preparation for the birth of a child, aging, or illness). They consist of seeking help and acting as an ill person and as a patient [7,12].

Making changes in health behaviors depends on many factors. Contemporary theoretical approaches propose different explanations of the mechanisms responsible for changes in health behaviors [8,9,13]. Particularly noteworthy is Schwarzer's processual approach to health activities [14]. The author, referring to the socio-cognitive theory of personality, assumes that the acquisition and consolidation of health activities takes place in two phases: 1) motivational, in which the individual formulates an intention, 2) an action phase, aiming to fulfill a plan and consolidate new behaviors. Changes in health behaviors in the motivational phase depend on the individual's sense of self-efficacy. In the volitional phase, an important predictor of change is the goal, along with its related gratification [7,12].

The results of numerous empirical studies on health practices show that individuals who prefer healthy lifestyles are more extroverted, optimistic, have a greater sense of value, and attribute less importance to leaving their health to chance. Women, in contrast to men, are more likely to undertake health-promoting activities. There is also a tendency towards a greater degree of engaging in health behaviors in those with ill health, the elderly, and those residing in urban environments [7,15,16].

Life satisfaction

Well-being is an important element of health. In turn, an important component of subjective well-being

is life satisfaction – a sense of fulfillment relating to one's own achievements and living conditions – which promotes being active and coping with difficult situations. Life satisfaction is the result of comparing one's own life situation with one's own set standards. If the result of the comparison is satisfactory, the individual experiences satisfaction. Life satisfaction may be related to a broadly understood life goal, the fulfillment or the process of realization of which gives rise to satisfaction. It is a conscious, cognitive process of a holistic assessment of life. It involves the evaluation of life as a holistic and comprehensive project spread over time [17–19].

A relationship between life satisfaction and some personality traits was found. For instance, life satisfaction positively correlates with self-esteem and negatively correlates with the level of neuroticism and emotionality. Lower levels of life satisfaction also manifested in people who were physically ill. However, researchers note the lack of a relationship between life satisfaction and the degree of social approval. There were no statistically significant differences between genders and their environments [7,17,20].

Ambiguous research results regarding the relationship between life satisfaction and health behaviors was one of the reasons this subject was chosen [21,22].

AIM OF THE STUDY

The aim of the study is to examine health behaviors and life satisfaction, and to determine the relationship between these variables in health spa patients.

The following hypotheses were formulated:

- H1. There is a relationship between the patient's adoption of health behaviors and their sense of life satisfaction. It was predicted that individuals with a higher health behavior indicator experienced greater life satisfaction.
- H2. With age, the practice of health behaviors increases and life satisfaction decreases.
- H3. There are differences in the extent of adopting health behaviors between males and females. The assumption was that female patients would undertake health-promoting activities to a greater extent than male patients.

MATERIAL AND METHODS

Subject characteristics

The study focused on 123 people, ranging in age from 32.00–80.33 (59.54 ± 9.92) and included 63 women (60.60 ± 8.90) and 60 men (58.75 ± 10.79). These were all *Samodzielny Publiczny Zakład Opieki Zdrowotnej* (SPZOZ) patients of the Health Spa of the Ministry of the Interior in Krynica-Zdrój undergoing spa treatment or rehabilitation [1,2].

The vast majority of subjects (76%) resided in urban areas (mainly from medium-sized populations, i.e.

100-200,000). The remaining 24% lived in rural areas. Almost half of the subjects (47%) had completed higher education, 37% mid-school, 9% vocational and 7% primary school. 59% of the subjects were retired disability pensioners, while 41% were employed in a variety of vocations. Most subjects were married (72%), with 13% widowed, and 12% divorced. In 68% of subjects, monthly income per family member exceeded PLN 1,500. In 19% PLN was up to 1,000 and in 13% PLN was between 1,000 and 1,500. The subjective assessment of each individual's health (on a scale of 1-5) showed that 52.9% rated their health as satisfactory (3 points), 30.1% as good (4 points), and 1.6% as very good (5 points). Only 14.6% rated their health as unsatisfactory (2 points) and 0.8% as bad (1 point).

Research methodology and research tools

The research was carried out during 2016 and 2017 and was conducted on an individual basis. The Health Behavior Inventory (HBI), created by Juczyński, and the Polish Adaptation of the Satisfaction With Life Scale (SWLS), created by Diener, Emmons, Larsen, and Griffin, were used.

The Health Behavior Inventory contains 24 descriptors of health-related behaviors. Using a five-point scale, the subject measures how often they perform activities conducive to good health (from 1 – almost never to 5 – almost always). The numerical values were totaled to obtain an indicator of the intensity of an individual's practice of health behaviors. Its value ranged between 24-120 points. The higher the overall index, the greater the intensity of health behaviors reported. HBI allows calculation of results in four subscales related to four categories of health behaviors:

1. Healthy eating habits – considers the quality of food consumed (e.g. including whole wheat bread, vegetables and fruits, avoiding the consumption of salt, animal fats, sugar, and food with additives)
2. Preventive behaviors – refers to compliance with health recommendations, such as regular visits to doctors and obtaining information about health and illness
3. Positive psychological attitude – considers the presence of strong emotions, stress, tension, and depressive events
4. Health practices – includes daily habits like smoking, sleeping, recreation, and physical activity

For each scale (containing 6 statements), the subject received 6-30 points. Interpretation also included an indicator of the average number of points in a given category (i.e. the sum of points divided by 6).

The psychometric tool has satisfactory accuracy and reliability. The Cronbach α index for the whole test is 0.88, and for the subscales, it is within the range of 0.6-0.65 [7].

The Satisfaction With Life Scale (SWLS), created by Diener, Emmons, Larsen, and Griffin, contains 5 statements: 1) In many ways my life is close to ideal. 2) The

conditions of my life are perfect. 3) I am happy with my life. 4) In my life, I have achieved the most important things that I wanted. 5) If I could live my life again, I would not want to change anything.

On the basis of a 7-grade scale, the subject assesses the extent to which each statement relates to their current life and gives points based on the extent to which they agree with each statement (from 1 – I completely disagree to 7 – I completely agree). The result of the measurements is a general indicator of a sense of life satisfaction, ranging from 5-35 points. The higher its value, the greater the sense of life satisfaction.

The Polish adaptation of SWLS is characterized by psychometric properties: reliability and accuracy. The Cronbach α internal consistency ratio is 0.8 [7].

Statistical analysis was performed using the Statistica 12.0 PL program. Significance of differences between groups was verified using the Mann-Whitney U test. To determine the relationship between variables, Spearman's rank correlation was performed. For analysis, an admissible type I error $\alpha=0.05$; $p \leq 0.05$ was considered statistically significant.

RESULTS

Tab. I presents the results collected using the Health Behavior Inventory (HBI) and the Satisfaction With Life Scale (SWLS).

The general rate of health behaviors in the subjects was 88.10 ± 12.33 and was higher than that observed in the standard group of 30-50-year-olds (81.82 ± 14.16) and patients undergoing dialysis (83.45 ± 14.76) [7]. This shows a greater intensity of health behaviors reported in health spa patients, which is typical for ill and elderly people [23,24].

In the HBI subscales, the highest scores were obtained in the category of positive psychological attitude (3.77 ± 0.62) and the lowest scores in the health practices subscale (3.55 ± 0.60). However, these results are higher than those of the standardization group (3.52 ± 0.66 ; 3.32 ± 0.85). In their health behaviors, subjects focus most on avoiding stressful and depressing situations, and least on observing normal everyday habits like smoking, sleeping, recreation, and physical activity.

The overall rate of life satisfaction in health spa patients is 23.15 ± 5.54 , which is higher than the standardized group of 20-55-year-olds (20.37 ± 5.32).

In order to verify Hypothesis 1 (the relationship between the intensity of health behaviors of health spa patients and their sense of life satisfaction), Spearman's rank correlation analysis was carried out (tab. 2).

A significant positive correlation was found between the general indicators of health behaviors and the results from the Satisfaction With Life Scale (SWLS) ($r_s=0.401$; $p \leq 0.001$). Health spa patients with higher rates of health behaviors showed a greater sense of life satisfaction. This trend applies to all HBI subscales, with the overall SWLS score most strongly correlat-

Table 1. Research results collected using the Health Behavior Inventory (HBI) and the Satisfaction With Life Scale (SWLS)

		M	SD	Z	p
Women (n = 63)	Health behaviors–general indicator	90.49	10.88		
	Proper eating habits	3.87	0.66		
	Preventive behaviors	3.77	0.68		
	Positive mental attitude	3.85	0.55		
	Health practices	3.59	0.49		
	Life satisfaction	22.73	5.70		
Men (n = 60)	Health behaviors–general indicator	85.58	13.32		
	Proper eating habits	3.43	0.71		
	Preventive behaviors	3.61	0.67		
	Positive mental attitude	3.68	0.67		
	Health practices	3.51	0.69		
	Life satisfaction	23.58	5.38		
Total (n = 123)	Health behaviors–general indicator	88.10	12.33	1.914	0.056
	Proper eating habits	3.65	0.72	3.359***	0.001
	Preventive behaviors	3.69	0.68	1.595	0.111
	Positive mental attitude	3.77	0.62	1.222	0.222
	Health practices	3.55	0.60	0.495	0.620
	Life satisfaction	23.15	5.54	-0.596	0.551

n – sample size; M – arithmetic mean; SD – standard deviation; Z – value of Mann-Whitney U test statistic; p – level of significance
*** p ≤ 0.001

Table 2. Health behaviors and life satisfaction

	Life satisfaction					
	Total (n = 123)		Women (n = 63)		Men (n = 60)	
	r_s	p	r_s	p	r_s	p
Health behaviors–general indicator	0.401***	0.000	0.420***	0.001	0.432***	0.001
Proper eating habits	0.197*	0.029	0.246	0.052	0.220	0.091
Preventive behaviors	0.278**	0.002	0.195	0.125	0.419***	0.001
Positive mental attitude	0.450***	0.000	0.481***	0.000	0.454***	0.000
Health practices	0.294***	0.001	0.273*	0.031	0.348**	0.006

n – sample size; r_s – Spearman's rank correlation coefficient; p – level of significance
* p ≤ 0.05; ** p ≤ 0.01; *** p ≤ 0.001

ing with a positive mental attitude ($r_s = 0.450$; $p \leq 0.001$) and health practices ($r = 0.294$; $p \leq 0.001$). Individuals who are most satisfied with their lives are those with a positive attitude and a higher rate of habitual health behaviors concerning smoking, sleep, recreation, and physical activity.

Hypothesis 2, which measured the dependence between the variables studied (i.e. intensity of health behaviors and the level of life satisfaction) and the age of health spa patients is reflected in tab. 3I. The correlation coefficient $r_s = 0.204$; $p \leq 0.05$ indicates that the frequency of health behaviors increases with age. This applies mainly to health-promoting practices ($r_s = 0.318$; $p \leq 0.001$) and preventive behaviors ($r_s = 0.258$; $p \leq 0.01$). With age, patients attached greater importance to everyday habits like sleep, recreation, and physical activity. They also limited smoking, controlled their body weight, followed health recommendations and had more

frequent regular medical appointments, and acquired medical information from various sources.

However, no significant negative correlation between age and life satisfaction was found and therefore, it may be concluded that age is not a predictor of life satisfaction. On the other hand, research showed that the patient's sense of satisfaction positively correlated with their subjective assessment of health ($r_s = 0.324$; $p \leq 0.001$). The higher the subjective assessment of their health, the greater their life satisfaction.

Interesting data are provided by the comparison of the female group with the male group (verification of Hypothesis 3). The analysis of data collected using the Inventory of Health Behaviors (HBI) (tab. 1), indicates women obtained a higher HBI (90.49 ± 10.88) compared with men (85.58 ± 13.32). The value of the Mann-Whitney U test, although statistically insignificant ($Z = 1.914$; $p = 0.056$), seems noteworthy. There

Table 3. Health behaviors and life satisfaction of health spa patients

	Life satisfaction					
	Total (n = 123)		Women (n = 63)		Men (n = 60)	
	r_s	p	r_s	p	r_s	p
Health behaviors-general indicator	0.204*	0.023	0.025	0.844	0.355**	0.005
Proper eating habits	0.039	0.672	-0.177	0.166	0.231	0.075
Preventive behaviors	0.258**	0.004	0.149	0.243	0.378**	0.003
Positive mental attitude	0.067	0.461	-0.057	0.660	0.165	0.208
Health practices	0.318***	0.000	0.219	0.085	0.377**	0.003
Life satisfaction	0.099	0.275	-0.013	0.921	0.228	0.080

n – sample size; r_s – Spearman's rank correlation coefficient; p – level of significance
* $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$

is a tendency toward greater health-oriented activity in women. The results indicate a significant difference in the range of healthy eating habits ($Z = 3.359$; $p \leq 0.001$). Females achieved a higher result (3.87 ± 0.66) than males (3.43 ± 0.71). Male representatives paid less attention to the type of food consumed.

The increase in health behaviors with age (tab. 3) applies mainly to males ($r_s = 355$; $p \leq 0.01$). With age the frequency of preventive behaviors ($r_s = 378$; $p \leq 0.01$) and health practices ($r = 377$; $p \leq 0.01$) in males increases.

In males, an interesting relationship not found in women was also observed between the level of life satisfaction and the intensity of preventive behaviors (tab. 2). Spearman's rank correlation coefficient $r_s = 0.419$ was significant at $p \leq 0.001$. Patients with a greater sense of life satisfaction followed health recommendations more often, attended regular medical appointments, and searched for information related to health and illness.

In summary, Hypothesis 3, regarding the differences in the prevalence of health behaviors between males and females, has been positively verified.

DISCUSSION

The results in HBI subscales correspond with studies by Zadworna-Cieślak and Ogińska-Bulik [23] conducted in an elderly population. The subjects, both those who were healthy and those with ill health, according to the Health Behavior Inventory, obtained the highest scores in the positive psychological attitude subscale. This dimension positively correlated with mental optimism which is a feature recognized by the authors as being conducive to "healthy/positive aging."

Our results, confirming Hypothesis 1, concur with those from the study by Młynarska. The author showed that an important predictor of health behaviors in people over 65 is their level of life satisfaction. It was observed that the higher the life satisfaction ratio of SWLS, the higher the level of health behaviors of the HBI declared by subjects [22].

Similarly, Grant et al. [25] conducted research among students aged 17–30 from 21 European and Asian coun-

tries and found a positive two-way relationship between life satisfaction and health behaviors such as physical exercise, not smoking, use of sun protection, increased fruit intake, and limited fat intake.

The observed relationships between higher levels of health behaviors and health spa patients' ages are consistent with previous research in this area [7,15,26].

The research results are confirmation of the conclusions formulated by the authors of the Satisfaction With Life Scale test: In general, age and gender have no relationship with the SWLS index, but a sense of life satisfaction has a significant correlation with physical health [7,17].

Timoszyk-Tomczak and Bugajska [27], who researched individuals in late adulthood, came to similar conclusions. They found no connection between life satisfaction and age. The comparative analysis carried out among 60-, 70-, and 80-year-olds, both men and women, did not reveal any significant differences between the groups.

The differences in the prevalence of health behaviors of women and men was indicated by Zadworna-Cieślak and Ogińska-Bulik. They stated that gender is associated with the intensity of the practice of health behaviors in the elderly population. Females obtained higher results in the Health Behavior Inventory compared with men, especially relating to eating habits and preventive behaviors [23].

Arendt et al. [28] examined males aged between 40 and 82 years and found they achieved a lower overall HBI rate compared to the standardized group. The highest results were found in the scale of positive mental attitudes, and the lowest in eating habits.

Szkup et al. [24] found that the results from tests carried out on patients who qualified for cardiovascular surgery showed that healthy eating habits in the female group were greater than in the male group.

Thus, it may be concluded that men, regardless of their age and health, look after their health less than women. This may be related to socially-functioning gender stereotypes requiring women to be more health-oriented, while riskier behaviors are attributed to men. Due to the lower average life expectancy in males, it

seems advisable to carry out preventive interventions adapted to gender, by intensifying health awareness in men [23,29].

When examining health behaviors of health spa patients and their satisfaction with life as an accurate measure of well-being (subjective well-being reflecting health), it should be noted with optimism that health spa patients have a greater frequency of health behaviors and a higher level of satisfaction with life in comparison to the control groups. Particularly noteworthy is the positive correlation between the variables studied. Health spa patients with higher rates of health behaviors have a greater sense of life satisfaction.

Something positive to note is also the increasing frequency of health behaviors with age, mainly health practices and preventive behaviors, which require a lot of effort on the part of patients (mental change, regularity, persistence, self-discipline, etc.). They are some of the most desirable effects of health education playing a key role in maintaining and strengthening individuals' health.

The research presented here has some limitations. The selection of the respondents was not random, but purposeful. The data collection involved self-reported techniques which may be subjective and based on the measurement of stated behaviors, rather than direct observations. The statistical analyses carried out do not explicitly verify the conclusion that cause and effect relationships exist. Nevertheless, this research may be

a useful contribution to the study of behavioral determinants of health and illness.

CONCLUSIONS

This study shows that life satisfaction is not related to age, but to health-oriented activity and additionally to the subjective assessment of health. Therefore, sources of satisfaction in older people's lives can be both health-promoting activities and a positive assessment of their health condition.

However, differences between men and women regarding the frequency of health behaviors require attention and in-depth reflection. The lower overall rate of health behaviors and lower scores with respect to healthy eating habits in male patients are worrying in the context of the lower average lifespans of men.

Our research results can be used to design health education programs in health spas. A health education program should aim to not only develop health awareness, but also to develop positive psychological factors, such as a sense of life satisfaction, which may strengthen patients' beliefs in pro-health activities. Program content should take into account both the age and sex of patients, emphasize the importance of health practices and preventive behavior in younger patients, and motivate male patients to intensify their practice of healthy behaviors, with particular emphasis on the principles of proper nutrition.

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EXAMINATION OF FUNDAMENTAL MOVEMENT PATTERNS AND LIKELIHOOD OF INJURY IN AMATEUR RUNNERS FROM OPOLE REGION IN POLAND

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ABSTRACT

Background: The most common risk factors for running-related injuries are mistakes, such as insufficient warm-up and stretching exercises, during training. Good preparation and proper training reduces the risk of sport-related injuries.

Aim of the study: To examine fundamental movement patterns and likelihood of injury in amateur runners.

Material and methods: Twenty-four amateur long-distance runners from Opole region (Poland) were divided into two groups. The first group comprised 12 runners from the club “Kotwica Brzeg”, who did a proper warm-up before training and stretching exercises after training. The second group comprised 12 runners from other clubs who did not undertake any warm-up or stretching exercises (control group). Fundamental movement patterns were tested by the Functional Movement Screen test (FMS).

Results: The mean FMS test score was higher in “Kotwica Brzeg” runners (17.08 points) than in the control group (15.50 points), but this was not statistically significant. The “Kotwica Brzeg” runners performed better in five of the FMS tests, but this was only significant for the rotational stability test.

Conclusions: Runners who did a proper warm-up and stretching exercises achieved better results in the FMS test, which may reduce the risk of running-related injuries.

KEYWORDS: FMS test, runners, risk of injury, prevention

BACKGROUND

Regular running is a form of exercise that supports mental and physical health. Many amateur runners are not aware of the need to prepare physically for sports. Insufficient adaptation to physical exertion may result in injuries [1,2]. Available literature shows a high percentage of injuries among long-distance runners [3,4]

Training mistakes are the most common precipitant of running-associated injuries. The errors include incomplete warm-up activity, inadequate training duration, incorrect intensity and frequency, along with too rapid advancement to the next stage of training. Anatomic and biomechanical factors also contribute to injuries in runners. These include physique irregularities, improper running shoes, age, the ground on

which most training sessions occur and athlete experience [1,5,6]. Other precipitants of injury are previous injuries, their course and treatment [1,3]. Women are at greater injury risk than men [7,8].

Warming up, that is, preparing the whole body for a given physical activity is a broad concept. However, it is often understood that warming up is only to prepare the muscles involved in the ensuing activity. A proper warm-up enables a runner to engage fully in the run from the start, while assisting with psychomotor readiness, which allows the runner to get into the right running rhythm. A well-conducted warm-up also increases the effectiveness of training or competition. Insufficient or absent warm-up may lead the athlete to make many technical mistakes and be more vulnerable to injuries [9,10].

An important element of training is stretching, which facilitates proper joint mobility by maintaining appropriate muscle length. It also helps prevent muscle stiffening, which can happen, for example, after endurance training. If used regularly, stretching can reduce the risk of injury. Stretching should be performed after training, while active dynamic stretching exercises should be part of the warm-up [11].

Contemporary sports medicine puts considerable emphasis on injury prevention. An important element of prevention is a comprehensive assessment of fundamental movement patterns. Nowadays, running is fashionable with many people practicing medium- and long-distance recreational activities. Therefore, it is important to evaluate comprehensive functional assessment and the merit of well-conducted training sessions for health endurance athletes.

AIM OF THE STUDY

To examine fundamental movement patterns and likelihood of injury in amateur runners.

MATERIAL AND METHODS

This is a pilot study undertaken as a component of a master's thesis.

PARTICIPANTS

Twenty-four long-distance runners (5, 10, ~20 and ~40 km) from Opole region (Poland) were divided into two groups. The first group included 12 runners (7 men and 5 women) from a specific running club (Kotwic Brzeg) who performed warm-up exercises before training and stretching after training. The second (control) group comprised 12 runners (6 men and 6 women) from other clubs who did not perform exercises before or after training.

Each runner's height and weight were measured, and body mass index (BMI) calculated. There were no significant differences in the mean of age, BMI, number of running sessions per week and years of running between the two groups. Mean BMI was normal in both groups (tab. 1).

RESEARCH TOOLS

The Functional Movement Screen (FMS) test was used to assess subject functional status. The FMS test

provides a simple, accessible and measurable way to evaluate the quality of movement patterns and allows possible limitations or asymmetries to be identified.

The following are descriptions of the seven specific tests used in the FMS [12–14]:

1. Deep squat assesses bilateral, symmetrical and functional mobility of the hips, knees, and ankles. The dowel held overhead assesses bilateral and symmetrical shoulder and thoracic spine mobility.
2. Hurdle step assesses bilateral and functional mobility and stability of the hips, knees, and ankles. This movement requires proper coordination and stability between the hips and torso during the stepping motion as well as single leg stance stability.
3. In-line lunge evaluates hip and ankle mobility and stability, quadriceps flexibility and knee stability
4. Shoulder mobility screen assesses bilateral and reciprocal shoulder motion range, combining internal rotation with adduction of one shoulder and external rotation with abduction of the other.
5. Active straight leg raise tests ability to disassociate the lower extremity from the trunk while maintaining torso stability.
6. Trunk stability push-up evaluates trunk stability in the sagittal plane while a symmetrical upper extremity push-up motion is performed.
7. Rotary stability test assesses multi-planar trunk stability during a combined upper and lower extremity motion.

Each of the above tests was evaluated on a 4-level scale of 0 to 3 points. A score of 3 points was awarded for correct execution of the locomotor pattern with no apparent compensation. A score of 2 points was given when motion was performed with a compensation element, and 1 point was indicative of inability to complete the task. If pain was felt during the test, 0 points were given. If there was a difference in results between the left and right side in an asymmetry test, the lower result was used for the final score [15,16].

A total score of 18 to 21 points meant that the body had correct movement patterns and the risk of injury was low. A score of 15 to 17 points indicated that compensation and asymmetries occurred, with the probability of injury increasing to 25–35%. A result below 14 points was associated with an increased risk of injury of more than 50% [17].

Table 1. Descriptive statistics of "Kotwica Brzeg" and control groups

Variable	„Kotwica Brzeg” group		Control group		Student's t-test	
	\bar{x}	s	\bar{x}	s	t	p
Age, years	36.50	10.87	40.17	7.28	-0.97	0.34
Body Mass Index (BMI), kg/m ²	22.75	3.30	21.62	1.95	1.02	0.32
Number of running sessions per week	2.91	1.51	2.67	1.41	0.42	0.68
Number of years of running	2.63	2.76	4.75	3.56	1.62	0.12

STATISTICAL METHODS

Descriptive statistics, which include the mean (\bar{x}) and standard deviation (s), were calculated using Statistica 12.0. Student's t-test for independent groups was used because the means did not differ significantly between groups, and their distributions were not significantly different from the normal distribution. Significance was defined as $P = 0.05$.

RESULTS

The mean FMS test result was higher in the "Kotwica Brzeg" group (17.08 points) than the control group (15.50 points), but this was not a significant difference. The "Kotwica Brzeg" runners achieved better results in five of the FMS tests – hurdle step, in-line lunge, shoulder mobility, trunk stability push-up and rotational stability – although, only the rotational stability test was a significant difference. The control group obtained higher results in the remaining two tests, but the differences were not significant (tab. 2).

Tab. 3 shows the number of runners in each point range of the FMS test. In the "Kotwica Brzeg" group, five people attained the highest point category indicating lowest injury risk, five people were in the middle category (15–17 points) with an increase in injury risk of 25–35%, and two were in the lowest point category (below 14 points) and had an increase in injury risk exceeding 50%. For the control group, two people were in the highest level (lowest injury risk), six were in the middle, and four were in the lowest point category (highest risk).

DISCUSSION

The FMS test is a valuable screening tool because it allows evaluation of functional status and the risk

of injuries. This test enables assessment of the individual in a global way as it is the function of the whole body that is examined, not just the individual muscles or joints.

Both the "Kotwica Brzeg" and the control groups achieved a mean FMS test score above 14 points at 17.08 and 15.50, respectively. The arithmetic means were within the range of 15–18 points proving asymmetry and compensation among the tested runners, along with disturbed motor patterns and an increase in injury risk of 25–35% [14]. The most frequent injuries and dysfunctions in long-distance runners are hamstring injuries, plantar fasciitis, iliotibial band syndrome, stress fractures and lower back pain [1,3,18].

Siedlaczek et al. used the FMS test in volleyball players of the II-league team, who obtained an average test result of 14.73 points. The authors indicated that such a result may cause compensation and asymmetry, and increase the risk of injury and stress pains [19]. Sulowska et al. used the FMS test for risk assessment and prevention of injuries among floorball players (17.48 points). Their results were similar to ours runners from "Kotwica Brzeg" (17.08). These authors observed asymmetries between the right and left body sides in more than half of the participants, with results correlating with the injury history of the tested athletes [20].

The effectiveness of calculating the probability of injury using the FMS test was demonstrated by Kiesel et al. Professional football players were examined before the season and obtained a mean test result of 16.9. The individuals who suffered subsequent injuries obtained a mean result of 14.3. After analysis, the authors showed an increased probability of injuries in footballers who received a pre-season test score of 14 points or less [17].

Table 2. FMS test results for the two groups, presented as mean (\bar{x}) and standard deviation (s)

Test	„Kotwica Brzeg” group		Control group		Student's t-test	
	\bar{x}	s	\bar{x}	s	t	p-value
FMS test	17.08	1.97	15.50	2.07	1.92	0.06
DS – deep squat	2.42	0.51	2.50	0.52	-0.39	0.69
HS – hurdle step	2.25	0.45	2.00	0.60	1.15	0.27
ILL – in-line lunge	2.66	0.49	2.42	0.51	1.22	0.24
SM – shoulder mobility	2.75	0.45	2.25	0.87	1.77	0.09
ASRL – active straight leg raise	2.25	0.62	2.33	0.65	-0.32	0.75
TSP – trunk stability push-up	2.41	0.67	2.08	0.79	1.11	0.28
RS – rotational stability	2.33	0.49	1.92	0.29	2.53	0.02*

* $p < 0.05$

Table 3. Number of people in each FMS test score category

Total FMS score	„Kotwica Brzeg” group	Control group
18 – 21 points	5	2
15 – 17 points	5	6
≤ 14 points	2	4

Little research on FMS testing has been undertaken in endurance athletes. Loundon et al. studied long-distance runners who had a mean test score of 15.0 points. A statistically significant difference was seen between younger (< 40 years) and older (> 40 years) runners in favor of the younger players [21].

Agresta et al. conducted a study of amateur long-distance runners and observed a mean FMS test score of 13.13, which was in the lowest point range putting the injury risk increase to over 50%. There were no significant differences between beginners and advanced runners, and trainees with and without injuries [4].

Hotter et al. showed that deep squat and active elevation of the lower limb were effective methods of assessing injury risk amongst runners aged 18–24 years [22].

In our work, only the rotational stability test was statistically significant. This test assessed multi-planar trunk stability during a combined upper and lower extremity motion. Central stabilization depends on the deep trunk muscles, which have the main task of controlling the position and movement of the trunk over the pelvis [23,24].

The runners from “Kotwica Brzeg” conducted a proper pre-run warm-up, and general and stretching exercises after training. Perhaps these factors contributed to a higher level of rotational stability. Runners from “Kotwica Brzeg” achieved higher results in the rotational stability test (2.33) compared to the control group (1.92). These findings were also higher than observed by other authors. For example, the mean rotational stability results for weightlifters was 1.98, while for volleyball players and other runners it was 1.86 and 1.6, respectively [16,19,22]. A low rotational stability test result may contribute to lower back pain as weaker deep trunk muscles predispose the lumbosacral region of the back to dysfunction [16].

There were five women among the runners from “Kotwica Brzeg” and six women in the control group. It is possible that the difference in gender ratios in

the groups contributed to the rotational stability test findings. However, studies by other authors do not support an effect of gender on rotational stability test results. Gołąsta et al. and Loundon et al. found no significant differences between women and men in the total test score or in the individual rotational stability test results [4,21].

Many publications have confirmed the role of central stabilization in rehabilitation, while fewer have studied the effectiveness of central stabilization training among athletes [23]. Mandacho et al. studied handball players and showed that improving stabilization of the pelvis and lumbar spine helped improve the kinematic chain of the throwing movement, and thus to the speed of ball throwing [25]. Dello Iacono et al. showed that training trunk stability affected the reduction in asymmetry of lower limb muscles in soccer players [26]. However, the studies by Okada et al. do not confirm the importance of trunk stability in functional movement [27].

CONCLUSIONS

1. The FMS test results indicated occurrence of asymmetry and compensation among the tested runners, as well as disturbed movement patterns and an increase risk of injury.
2. The better rotational stability and FMS test results in runners who used a proper warm-up prior to exercise and stretching after training, may indicate improved preparation for sports competitions and lower risk of running-related injuries.
3. The principal limitation of this work was the small number of research participants. Therefore, the presented results should be treated as indicative. Further research, using larger subject numbers, will allow a more accurate assessment of the functional status and risk of injury to runners.

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RELATIONSHIP WITH PEERS OF YOUNG SCHOOL-AGED CHILDREN WITH TYPE 1 DIABETES

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ABSTRACT

Background: Functioning in a peer group plays an important role in child development. Building self-esteem of children depends on many factors such as physical health, self-evaluation of their physical performance, academic achievement, social support, family relationships, as well as relationships with peers and teachers. Importance of contacts with peers increases during school-age. At this time children are not able to reject the opinion of other people and subject their behaviour completely to the expectations of their peers. When the need for emotional contact is not satisfied, the complex of being different appears. Isolation within group causes a sense of inferiority, the child becomes passive and resigned. Children, who are chronically ill, rejected or isolated often follow negative emotions in their actions, they become aggressive towards other children or do not want to continue learning. Often the decision about an individual teaching plan results in further isolation of the child. The child's position in the peer group affects the developing personality, self-confidence and self-esteem.

Aim of the study: The aim of the study was to determine the interpersonal relationships of young school-aged children with type 1 diabetes in their peer groups.

Material and methods: The study was conducted on children with type 1 diabetes and their parents, who are supervised by Clinic of Diabetes, Regional Medical Center in Opole. The research tool used in both groups was a questionnaire consisting of open and closed questions elaborated by the authors of this study.

Results: 73% (41) of evaluated children declared that diabetes does not hinder their performance at school. 93% (55) children claimed that they do not hide their condition from their peers. In addition, 61% (34) talk about their illness with their peers and 69% (38) of them can count on their peers' help in self-control of diabetes. 71.9% (46) of parents of children with type 1 diabetes allow their children to participate in school trips and 68.8% (44) to participate in school competitions.

Conclusions: In most children, diabetes does not affect children's performance at school. They participate in classes, are accepted and liked in their peer group. Chronically ill children should be able to participate in all types of activities as much as their healthy peers. It seems necessary to continue studies on performance of young school-aged children with type 1 diabetes in their peer group.

KEYWORDS: diabetes, child, school, parent

BACKGROUND

In chronically ill children, being an active part of a group of peers, positive thinking and self-confidence are shaped and strengthened as children grow older and play an important role in their lives. Self-esteem in the eyes of children depends on and is based on: physical health, self-evaluation of their physical performance, academic achievement, social support, solving social problems, relationships at home and school with peers, and teachers. Chronic illness affects every one of these

areas of the child's life, hindering its performance in the peer group [1–3].

In the last decade it is possible to notice an increase in prevalence of type 1 diabetes among the population of children already suffering from this disease. In studies conducted in the Pomeranian Voivodeship, Mysliwiec et al. observed that between 1998 and 2006 the incidence of type 1 diabetes in children aged 15 and under increased almost twice. In 1998 the morbidity amounted to 10.4%, whereas in 2006 to 20.5% [4].

Diabetes is not noticeable to others, but awareness of the difference may cause isolation of children [5]. Due to the illness children are rejected by their peers. These children have difficulty dealing with new situations such as living with the disease and limitations that this disease causes at school. Diabetes requires a lot of self-control, respecting dietary restrictions and exercise, which is often incomprehensible to their peers.

The need for contact, acceptance and development of early-childhood emotional bounds is very strong in children and becomes dominant in their behavior. When the need for emotional contact is not satisfied, the complex of being different appears [2,3]. When the child becomes aware that it is not accepted in the peer group, it feels inferior which presents with passiveness, resignation, and a sense of somatic disease. Chronically ill children, who are not accepted by their peers, become aggressive and act out. In these pupils the fear of being punished or ridiculed often dominates. Children who are rejected or isolated by peer group everyday face negative emotions such as aggression towards other children and aversion to learning. At this point parents decide to teach the child individually, which results in further isolation. The child's position in the peer group affects the developing personality, self-confidence, self-esteem and emotional comfort in social relations [7].

Functioning in a peer group includes also a constant search for self-esteem and positive self-evaluation. It can affect the child's general emotional condition, determining the motivation to take actions typical for young school children. Chronic illness, meaning permanent loss of health, often leads to lower quality of life in children [2,3].

In Poland, there are currently only few studies examining the specific aspects of functioning of diabetic children in the society. Therefore, it is difficult to use previous conclusions for planning the study. Research conducted in this field may explore the area that is interesting from both a scientific point of view and practical one, as limitations resulting from a chronic disease shape relationships among peers. Similar studies were conducted in 2010/2011 by Małkowska-Szcutnik et al, but these studies focused on adolescents. They have shown that the self-esteem of adolescents with diabetes may be primarily reflect the ability to cope with the limitations resulting from the disease [1].

AIM OF THE STUDY

The aim of the study was to determine the interpersonal relationships of children with type 1 diabetes in the peer group in the early school age.

MATERIAL AND METHODS

The study was conducted in the Provincial Diabetes Outpatient Clinic, Regional Medical Center in

Opole. The study lasted 3 months, from October to December 2013.

The study group consisted of 59 children with type 1 diabetes, and 64 parents who were legal guardians of these children. In five cases, both parents participated in the study. In the study a diagnostic survey based on a questionnaire was used. The questionnaire was formulated by the authors. The questionnaire for children included questions about their functioning in the peer group, the practical aspects of life with disease and limitations caused by it. The questionnaire for parents included questions about the strategies adopted for raising an ill child, its functioning at school, and concerns of parents related to child's condition.

Children filled out questionnaires by themselves, after written parental consent.

Children in the largest group included in the study have been sick for 4–6 years (37%). 22% of children have been sick for 6–10 years, and the fewest children have been sick for less than a year. Children's age varied. Most of the evaluated children were 10 years old (67.8% (40)). Children aging 9 years 11.9% (7), 8 years 8.5% (5) and 7 years 10.2% (6) constituted a similar percentage. One evaluated child was 6 years old (1.7%). Girls accounted for the majority of the study population – 57.6% (40).

An MS Excel spreadsheet was used to compile the results.

RESULTS

The opinions of children with type 1 diabetes on their functioning in the peer group.

On the question of whether diabetes make their functioning at school more difficult, the vast majority of children (73% 43) responded that they do not feel limited by the disease. Only 20% (11) of the children declared to have such difficulties.

The most frequent answers to the questions about the situations when diabetes interferes with daily functioning at school included: the need to control blood glucose levels in classroom as it is a distraction; visiting a nurse during class; and breaks that are too short, as children have to measure glucose levels and eat a sandwich, which lasts the entire break. Children were also concerned about the injection or insulin pump falling out, need to take the pump out during physical education classes, as well as blood glucose tests and insulin injections during the class, when peers are around.

The answers to the questions "Did this happen to you that you couldn't do the following activities because of diabetes in last 6 months?" presented below aimed at evaluation of the scale of the problem caused by diabetes 1 in functioning in the peer group. The answers to this question were presented on the fig. 1.

93% (55) of children do not hide their condition from their peers. In addition, 61% (34) talk about their illness with their peers and 69% (38) of them can count on their peer's help in self-control of diabetes. Nearly

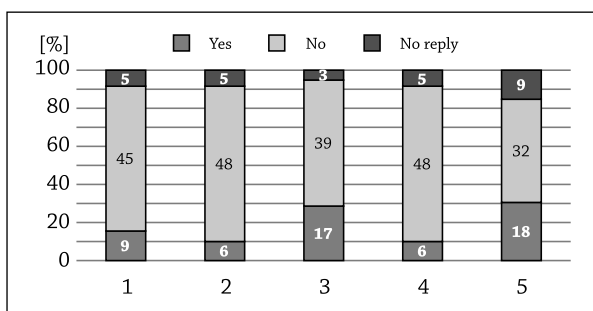


Figure 1. Limitations in children's functioning among peers. Did it happen to you that you couldn't do the following activities because of diabetes in last 6 months? 1 – Play soccer or other sport game 2-Go to your friend's birthday party, 3 – sleep at friend's house, 4 – play with friends, 5 – participate in the physical education class.

all children with diabetes report that they have a lot of friends – 93% (55). The question of whether they have a best friend with whom the child can talk about the disease and whom they may turn to when they feel worst, 86% (50) of surveyed children replied „yes”.

89% (52) of children answered that they feel most comfortable among people they know, and 91% (53) that they like making new friends. 80% of surveyed children (47) claimed that they go to school trips. 75% of children participate in extracurricular activities (44) and the majority of them take part in school celebrations, as co-organizers or participants – 66% (39).

Parent's opinion on performance of children with type 1 diabetes in the peer group.

The following analysis was conducted based on parent's answers to the question about their feelings, when they learned about their child's illness (tab. 1).

The table shows that fear was one of the parent's primary feelings when they learned about their child's disease. This was confirmed by 84.4% (54) of parents. As many as 95.3% (61) declared that they were not prepared for such information. 56.3% (36) of parents indicated that they also felt uncertainty. On the other hand 85.9% (55) declared determination.

Children right after diagnosis are hospitalized and connected to the pumps that administer insulin along with glucose to normalize blood sugar. It is not until the second day that insulin is administered subcutaneously with an insulin pen, and the child and parents are trained about type 1 diabetes. As many as 70% (45) of parents declared that their child had a break at school caused by a diagnosis of type 1 diabetes. Tab. 2 presents the school absence of children because of diabetes.

Another question included in the questionnaire focused about allowing a diabetic child to participate in certain events / situations. The answers to this question were presented in tab. 3. The analysis of the parent's answers indicated how often their children sleep over, go to school trips, participate in sport competitions, go to mountain trips and go to their friend's birthdays by themselves.

When asked about the child's participation in various events out of home, most parents responded that they agreed to such participation. Considering sleep-

Table 1. Parents' reactions to the information about disease of their child

Categories of questions	Categories of answers	No	%
Fear	No	10	15.6
	Yes	54	84.4
Uncertainty	No	36	56.3
	Yes	28	43.8
Decisiveness	No	61	95.3
	Yes	3	4.7
Sadness	No	26	40.6
	Yes	38	59.4
Determination	No	55	85.9
	Yes	9	14.1
Surrender to fate	No	60	93.8
	Yes	4	6.3
Other	No	64	100.0
	Yes	0	0

Table 2. The duration of school absence after diagnosing diabetes

No	Break in weeks	L	%
1	1	9	14.1
2	2	25	39.1
3	3	3	4.7
4	4	5	7.8
5	6	1	1.6
6	8	1	1.6
7	No answer	20	31.3
Total		64	100.0

Table 3. Would you allow:

No	Categories of questions	Categories of answers	No	%
1.	A sleepover at a friend's house?	No	28	43.8
		Yes	36	56.3
2.	Child's participation in a school trip	No	18	28.1
		Yes	46	71.9
3.	Your child's participation in sports competition	No	20	31.3
		Yes	44	68.8
4.	Child's participation in a trip to the mountains	No	23	35.9
		Yes	41	64.1
5.	Your child to go to their friend's birthday party	No	16	25.0
		Yes	48	75.0

ing over in a friend's house, 56.3% (36) of parents said that they would allow their children to stay over. As many as 68.8% (44) allow their children to participate in sport competitions and 64.1% of parents (41) to participate in a school trip to the mountains. 75% (48) of surveyed parents allow their children to attend birthday parties. When asked about the increased supervision during child's participation in events in peer group, 81% (51) of parents said „yes”. Only 8% (5) of respondents said that the child does not need to be supervised by an adult.

The most frequently encountered answers to the question regarding child's contact with peers included: the child is liked and accepted, the illness does not affect child's relationships with peers, the child is treated like any healthy kid, the relationships are as they were before the disease was diagnosed.

The last question addressed to parents of children with diabetes was: "How did the head teacher and other school teachers respond to information about the child's illness?"

As many as 3 out of 4 parents declared that teachers of their child reacted with fear to their child's diabetes. In addition, 95% (61) of the surveyed parents responded that the teachers did not seem puzzled by their child's illness.

DISCUSSION

The results show that most children with diabetes do not feel limited by their condition at school. Bogumiła Pecyna claims that children with diabetes have an ambivalent attitude between anxiety, haste and the need for being left in peace and security with loss of autonomy and increased dependency [8]. A high percentage of positive answers to the question about acceptance and peer help suggest that there is no ambivalence among school children.

The answers regarding the procedures the pupil must do in order to control diabetes well suggest that the breaks between classes are too short to precisely perform blood glucose test, insulin infusion and eat the meal. Children also note that the pump that they carry with them 24 hours a day creates discomfort in physical education classes, which is not only caused by wearing it, but also the possibility of ripping the infusion needle out. These children also reported that insufficient self-control of type 1 diabetes during classes affects how they feel, which is reflected in their educational performance. The emotional state of a child caused by chronic disease determines the motivation to undertake actions that are characteristic of this child [1–3].

By issuing educational brochures, the Ministry of Health emphasizes: "An independent excursion of the child with diabetes mellitus requires cooperation between the head teacher, parents and child [9]". The results of the study indicate that children with type 1 diabetes are going on school trips and are eager to take part in organized extracurricular activities, which demonstrates their sense of security and good co-operation between parents, their children and head teachers.

Cytowska describes: "For some children sport games and plays with peers become unavailable". A chronically ill child may not be able to attend kindergarten or school and therefore, may feel isolated and different from its peers [10]. The surveyed parents did not write a single sentence in the questionnaire about any lack of acceptance in the peer groups of their children. Summing up the above answers, it can be stated that children with

chronic diseases, such as diabetes, have no problem in relationships with peers.

The same author also emphasizes that chronic illness, due to absences at school and low physical and mental capacity usually, is the cause of problems in compulsory education [10]. In the presented study, it was found that most of the children at the initial stage of the disease actually have a break, which results from e.g. a need to stay in the hospital and visit the clinic frequently. However parents cooperate well with the school and there are no educational problems in the studied population.

Parents are mostly responsible for supporting a child with diabetes in education and health care professionals and the school staff plays a secondary role. The standard care in children with diabetes involves teaching the child and parents about self-care and self-control (glucose measurement, subcutaneous insulin injection, estimation of energy demand and management of acute complications of diabetes, such as hypoglycemia and hyperglycemia) [9]. Unfortunately, there are no regulations on those elements of childcare that are intended to keep the child healthy. It is assumed that the actions taken by the child's guardian at school should be analogous to those undertaken in urgent situations by the parents [9]. A different interpretation that a child's guardian at school would not be able to perform any of the activities ordered by a physician would put the child at risk of a loss of health or life, and encumber the guardian with a charge of poor childcare. The school should make it possible for diabetic children to participate in all kinds of activities on the same bases as their healthy peers, so they can feel good and function in full physical and intellectual capacity [11]. The ability to cope with illness in school and at home will have a tremendous impact on the treatment effect, health and quality of life of the child in the future.

Chronic illness is not a mystery for most parents, which is a very good thing especially when a child openly talks openly about its illness without making a secret of it. Such behavior allows the student to feel comfortable among his / her peers. The child does not have to hide the activities that involve self-control of type 1 diabetes, including control of sugar levels and insulin injections. The feeling of uncertainty related to child's illness can be explained by the parent's initial ignorance of the illness itself, the determination results from a feeling of responsibility for the sick child. The teachers did not seem to be puzzled regarding the child's disease, which is normal for a person, who wants to help a sick child in to function during class normally. The teacher, who spends several hours per day with a child, is the second most important guardian of the child.

The education of ill children, their peers, parents and teachers is an important element for functioning of a child with type 1 diabetes at school. Sochocka emphasizes the importance of communicating the knowledge

of chronic illness among pupils, their parents and the school staff [12].

The results of this study are not fully representative due to the small number of respondents and therefore, should not be generalized. However, they can be used to formulate many conclusions. Studies on performance of young school-aged children with type I diabetes in their peer group should be continued, because still there are very few publications focusing on this subject. The knowledge of interpersonal relationships of children with type I diabetes in peers group should help to improve their psychosocial functioning, thereby improving health and the quality of life of both children and their parents.

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APPLICATION OF IPL TECHNOLOGY IN ACNE VULGARIS TREATMENT: A CASE REPORT

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A – study design, B – data collection, C – statistical analysis, D – interpretation of data, E – manuscript preparation, F – literature review, G – sourcing of funding

ABSTRACT

Background: Intense pulsed light (IPL) technology has been used by cosmetic and medical practitioner since 1990. Initially it was only used to remove unnecessary hair, but over time, it began to be used for anti-aging treatments, removing erythema, acne lesions, and acne scars.

Aim of the study: The aim of this study is to investigate how the use of IPL technology has affected acne lesions and to determine whether the condition of the patient's skin has improved.

Material and methods: A young woman who was struggling with ordinary acne underwent a series of treatments using IPL technology to reduce skin eruptions.

Results: The study subject was a 22-year-old patient who had been suffering from acne vulgaris for several years. The skin on her face exhibited changes in the form of pustules, blackheads, and lumps. The entire treatment series was 10 weeks. Prior to the procedure, a very thorough interview was conducted, during which all contraindications were excluded. The Hellgren-Vincent scale, which is used to determine the severity of acne lesions, accurately determines the amount of skin lesions in the form of lumps, pustules, and blackheads.

Conclusions: As demonstrated by this study, IPL technology has been beneficial for the condition of the patient's skin. Pictures from before and after unambiguously indicate the positive effect of intense pulsed light. There has been great improvement in the skin's overall condition, with reduced acne lesions (lumps, pustules, blackheads).

KEYWORDS: IPL technology, acne vulgaris, cosmetology

BACKGROUND

IPL technology is nothing more than intense pulsed light therapy, the usage of which has been applied since 1990 [1]. Initially it was used for removing unnecessary hair [2]. IPL technology devices operate by emitting a beam of radiation in the wavelength range of 560 nm–1200 nm. They significantly differ from lasers as their characteristic feature is unstable wavelength, as well as a non-parallel beam of radiation, and a polychromatic emission beam. There is no risk of skin burns as a result [3].

Acne vulgaris is a problem which affects not only people in puberty but also people over 30 or 40 years old [4]. It is a difficult disease because the changes are observed on the face and they cannot be entirely covered. The cause of acne changes is very complex and in each case has a different course [5]. The most frequent cause is a disturbed production of sebum and the formation of calluses in the hair follicles, as well as the presence of the bacteria *Propionibacterium acnes* [7].

The first signs of the acne's formation are the blackheads. From this moment on, one should pay attention to skin care. The usage of proper cosmetics is indeed the most important factor in the fight against this disease [6,12].

The treatment of acne vulgaris with IPL technology involves the destruction of the bacteria responsible for the disease [8,11]. The proper device for the treatment of acne vulgaris uses waves from 500 nm–1200 nm. However, the best spectrum is a wavelength in the 530 nm–700 nm range [9]. Reduction of the amount of acne pellets has been observed during treatment with the green, yellow, and violet lights. The best effects, however, are visible during simultaneous treatment with green light and violet light [10].

AIM OF THE STUDY

The aim of the paper is to present the application of IPL technology within the treatment of acne vulgaris

on the basis of a description of the case study. Additionally, the paper describes the operation of devices emitting intense pulsed light, the etiopathogenesis of the acne vulgaris, as well as the role of proper care of acne-affected skin.

MATERIAL AND METHODS

Within the presented paper, the author used an IPL device—specifically, the GSD sPTF model with the MA no. 2 lamp. The analysis of the skin involved a special piece of equipment from the Beauty of Science company, called the Nati skin analyzer. The initial analysis of the patient's skin utilized the Hellgren-Vincent scale which helps to define the stage of advancement of acne changes in grades according to degree of severity.

Table 1. The Hellgren-Vincent scale

The Hellgren-Vincent scale	
I°	erythema, blackheads, 1 – 5 pustules or papules
II°	erythema, blackheads, 6 – 10 pustules or papules
III°	erythema, blackheads, 11 – 20 pustules or papules
IV°	erythema, blackheads, 21 – 30 pustules or papules
V°	erythema, blackheads, over 30 pustules or papules

The treatment used a lamp designed to fight against acne changes (AC), a wavelength of 400–1200 nm and emitted energy from 13–14 J. There were 5 flashes per single lamp position with a maximum of 100 flashes on the total face area.

CASE STUDY

The research was based on a case study featuring a 22-year-old patient who had struggled with acne vulgaris for several years. The acne changes were located across the entire area of the skin on her face. Pustules, papules, and blackheads were observed.

The research was carried out at Public Higher Medical Professional School in Opole after gaining permission from the Bioethical Commission. The entire series of treatments lasted for ten days. The first examination was carried out in December 2016. Each subsequent treatment was made in one-week intervals.

In order to participate in all of the examinations and treatments, the patient needed to give written permission. She was informed about all possible sensations that could occur during treatment, as well as during at-home care. All contraindications were ruled out, including pregnancy, breastfeeding, cancers and tumors of unknown origin, suntan, application of antibiotic ointments, application of photosensitizing herbs, psoriasis, herpes in the active phase, active infections on the treatment area, epilepsy, and taking isotretinoin.

The first examination included a careful analysis of the skin and it was made using the Nati skin analyzer. The analysis looked at the level of epidermal exfoliation,

the greasiness of the skin, and the hydration level of the skin in the T and U zones. Data from the pre-treatment examination were saved for later comparison following the series of treatments. The IPL treatment was conducted after the skin analysis. The level of greasiness of the patient's skin before the treatments was unusually high at 58.31% (typically, it should be about 15%-20%). The level of skin exfoliation was in the normal range, falling at 14.59% (the norm is 14%). Before the series of treatments, hydration in the T zone was alarming. The value of hydration was 12%. Hydration in the U zone was also non-typical at 35%. The correct value for skin hydration in the T and U zones should fall in the 41%–65% range.

The first treatment was carried out with the lowest level of intense pulsed light (level 5-3J), in order to see how the skin reacted to the radiation. During the treatment, the patient was asked how she was feeling. The patient said that the treatment was not painful or uncomfortable, and that she only felt warmth. The most sensitive area was around the mouth. Ultrasound gel was used in order to make it easy for the light to penetrate the skin. The light's power level was increased during each subsequent treatment. The last 5 treatments were carried out using a power level of 1 / 14 J. After the treatment the patient did not apply makeup up for 24 hours, only using a specified nourishing cream in order to encourage the skin to regenerate quickly. At home, she obeyed all care recommendations.

The second examination using the Nati skin analyzer was carried out after the tenth treatment. It was found that the level of greasiness improved after the series of treatments. During the second evaluation, the value of greasiness was 24.62%. The value of exfoliation was 16.72%. After the series of treatments, the level of hydration in the T zone was still alarming, however, it had improved, now equaling 24%. The level of hydration in the U zone was still far from where it should have been. After the series of the treatments it deteriorated, now equaling 28%.

DISCUSSION

After a precise analysis of the results of the Nati skin analyzer examinations, it was proven that the application of IPL technology to treat acne vulgaris did have the anticipated effects. The pustules or papules had largely subsided and the inflammation of the patient's skin had also decreased. Other parameters of the skin had likewise undergone a change. Greasiness decreased from about 58% to about 24% (tab. 2). Hydration of the skin in the T and U zones changed slightly. The initial values were 12% (T zone) and 35% (U zone). However, after the series of treatments, the values were 24% (T zone) and 28% (U zone) (tab. 4). Exfoliation changed the least, increasing from about 14% to 16% (tab. 3). The structure of the patient's skin had not changed. Erythema reduced from level IV to level III according to the Hellgren-Vincent scale (tab. 1).

Wang B, Wu Y, Luo Y.J., Xu X.G. authored the article *Combination of intense pulsed light and fractional CO₂ laser treatments for patients with acne with inflammatory and scarring lesions* where, they described the treatment of acne by applying the IPL device and CO₂ fractional laser. The treatment involved 2 patients suffering from inflammatory acne and wounds. The research predominantly included patients from China. They made 4–6 IPL treatments followed by 2 treatments using the CO₂ fractional laser. The IPL treatment significantly decreased the amount of acne changes and lowered the level of pain in those areas. The subsequent treatments using the CO₂ fractional laser additionally reduced the number of wounds. Approximately 90% of the patients experienced significant or moderate improvement.

In their article, Monika Patidar, Ashish Ramchandra Deshmukh, and Maruti Yadav Khedkar described very interesting and positive effects of the IPL method of acne vulgaris treatment, as well. They worked out a method of treating acne vulgaris using two different power levels of the IPL device. They conducted their research on 45 people suffering from facial acne vulgaris. The people participating in the research ranged in age from 16–28 years. The right side of the face underwent light radiation at an intensity of 35J/cm², while the left side underwent treatment at an intensity of 20J/cm². Each person with acne vulgaris underwent 4 treatments using the IPL device at two-week intervals. The results of the efficiency of using IPL in the treatment of acne were analyzed using the Mann-Whitney U test. On the right side, they achieved a perfect result. That means IPL conclusively worked in the treatment of acne vulgaris for 10 people (22%), with good results for 22 people (49%), and with moderate results for 13 people (29%). On the left side, they achieved a perfect result for 7 people (15%), a good outcome for 19 people (42%), and moderate results for 16 people (43%).

CONCLUSIONS

Due to the series of treatments that were carried out using IPL technology and the presentation of the researchers' results, one may draw the following conclusions:

1. Application of IPL technology reduced the amount of acne efflorescence on the patient's face.

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Table 2. The range of values for the level of greasiness of the skin.

Measurement	Unit	Range		Description
		From	To	
Greasiness	%	0	10	Dry skin
Greasiness	%	11	14	Skin with a tendency for drying
Greasiness	%	15	20	Proper greasiness of the skin
Greasiness	%	21	25	Skin with a tendency for becoming greasy
Greasiness	%	26	100	Oily skin

Table 3. The range of exfoliation measurement values

Measurement	Unit	Range		Description
		From	To	
Exfoliation	%	0	14	Within normal range
Exfoliation	%	15	20	Above normal
Exfoliation	%	21	100	Excessive

Table 4. Range of values of hydration

Measurement	Unit	Range		Description
		From	To	
T zone hydration	%	0	24	Alarming
T zone hydration	%	25	40	Below normal
T zone hydration	%	41	65	Within normal range

2. The series of treatments using intense pulsed light produced great improvement in the appearance of the patient's skin.
3. Hydration of the T and U zones, exfoliation of dead epidermal cells, and skin greasiness levels improved due to the series of 10 IPL device treatments.
4. The patient may continue to maintain the effects of the treatment by following proper at-home skin care recommendations.
5. Such research encourages patients suffering from acne to take advantage of the latest technological improvements as well as to use services of beauty salons to improve their condition.

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COMPLICATIONS IN THE SEXUAL ACTIVITY OF WOMEN AFTER A SURGICAL INTERVENTION FOR BREAST CANCER

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ABSTRACT

Breast cancer is one of the most common types of cancer among women. The most common form of treatment of this illness is a surgical intervention consisting of a partial or radical mastectomy.

This article describes the psychological impacts of this experience on the frequency and occurrence of complications in the sexual activity of women and to determine the role that medical staff can play in helping patients cope with these challenges.

The loss of a breast can have negative effects on a woman's emotional state, specifically in terms of feeling feminine and the relationship with her partner. This is often reflected in a reduced quality of life.

The care extended to post-mastectomy patients should routinely include an assessment of possible sexual dysfunctions and monitoring of how such dysfunctions are coped with. The PLISSIT model makes it possible to indicate how post-mastectomy patients may be effectively supported by medical staff. It serves to define a group of patients requiring specialist help. It also aims to initiate a conversation about the difficulties of functioning in this sphere, to provide general information and change existing perceptions, to give specific advice on making referrals to a specialist, and to consider these types of existing problems. The described intervention model is applicable to individual work, as well as to work with couples and groups. This method depends on the type of intervention desired and on the current psychophysical state of the patient and her readiness to start a conversation concerning sexual activity.

KEYWORDS: breast cancer, mastectomy, sexuality, PLISSIT model

BACKGROUND

According to statistics from the Polish National Cancer Registry, women's malignant breast cancer accounts for 22% of cases. Over 17,000 women were given this diagnosis in 2013, which was almost 2,000 more than three years earlier. The number of patients is expected to increase as the upward trend continues. However, the number of deaths caused by this type of cancer in Poland is decreasing and, in 2013, it was almost 20% below the average of other European Union countries [1]. For this reason, there have also been increases in the number of women who have undergone partial or radical mastectomies and then returned to daily activities like professional work and family life. This reintegration process brings with it completely new challenges, including the necessity to rebuild poten-

tially disturbed relationships with friends and family or to change current relationships, adapting them to the new experiences and feelings. The experience of having cancer often leads to radical changes in one's value system and perception of the world and requires building one's reality anew to make it consistent with one's current experience. A special focal area of work with a group of post-mastectomy patients, as compared to other types of cancer patients, is the relationship with an intimate partner, including sexuality, proximity, and tenderness [2].

The subject of people's suffering from the treatment of malignant tumors and its effects on sexuality has been discussed for some time in scientific publications and brochures for patients in the context of quality of life. They usually focus on descriptions of medical

problems, without also referring to psychological mechanisms that could allow them to better understand patients' behavior, as well as to formulate the principles of providing patients with adequate help from medical staff. This article aims to fill in these gaps.

NEGATIVE PSYCHOLOGICAL CHANGES RELATED TO THE TREATMENT OF BREAST CANCER

Patients who are diagnosed with cancer are affected by strong negative emotions, especially surrounding a fear of declining health and quality of life and also by a sense of threat. Patients report a low mood and other symptoms of depression, as well [3]. When the treatment begins and symptomatic improvement occurs, a patient's emotional state also gradually improves. Then, the patient begins to expect a return to everyday life, of the kind which she experienced before falling ill. This is the same for her expectations about her sex life.

As research has shown, after a mastectomy, women declare a lower quality of relationship with their intimate partners compared to before the disease [4]. Surgical treatment causes injury to the body and therefore, a disturbance of the patient's self-image [5,6]. The disconnect between reality and personal expectations of physicality can be a source of suffering and internal conflict. Most of the time women choose the mechanism of accommodation, which consists of changing one's own way of seeing oneself and one's body image under the influence of unfavorable and unaccepted bodily changes. The decrease of self-esteem experienced by patients after the surgical treatment of breast cancer is called the "half woman" complex [7].

Szadowska-Szlachetka and colleagues [8], studying the quality of functioning of breast cancer patients treated with radiotherapy, revealed low results of sexual satisfaction and functioning in this area, following an assessment of the surveyed women. Patients achieved similar low ratings in the field of body image. Negative body image was associated with the avoidance of a sex life, which may trigger a vicious cycle, as avoiding this activity strengthens the lack of acceptance of body changes related to the cancer treatment. Women may then feel that their physicality does not correspond to a sense of socially-defined "sexiness." Moreover, they are characterized by being less sexually spontaneous. Additionally, feeling embarrassed and lacking control in terms of sexual activity may cause a deterioration in the quality assessment of this sphere of life compared to the period before the disease.

When asked about the reasons for the decline in their sexual activity and the abandonment of various forms of activity in this area, women affected by cancer pointed first to physical factors, which was similar to the response from men given similar questions about their decline in sexual activity. Women specifically noted things like vaginal dryness, while men

noted erectile dysfunction or fatigue. However, while men later mentioned aging as the reason for the decline of their sexual functioning, women pointed to illness-related changes in appearance that led them to feel unattractive [9].

In conclusion, it can be said that for post-mastectomy women, an important element of returning to a functioning sex life is the ability to once again feel feminine which, in turn, raises their own self-esteem, and ultimately helps them return to life as it was before the disease happened at all.

SEXUAL ACTIVITY AND THE HEALING PROCESS

A review of research on women post-mastectomy indicates that having a positive body image is associated with feeling greater sexual pleasure and may result in greater self-confidence in sexual contacts [7,10]. Furthermore, the indicators of body image correlate with a sense of sexual attractiveness. These can be influenced by the ability to take care of weight and physical condition and thoughts about their own appearance during sexual activity. Sexual satisfaction has also been significantly associated with the assessment of individual parts of the body, including the breasts [11]. Therefore, it can be affirmed that experiencing intimacy in sexual contacts makes it easier for women to cope with cancer and its treatment, which promotes recovery [7].

Solving sexual problems is also important for strengthening relationships with a partner. It would seem that the unconditional acceptance of the woman's situation by her partner is of great importance to the progress of her cancer treatment [2]. It also makes the partner open to the introduction of new solutions in the sphere of sexual activity, the aim of which is adaptation to the partner's health situation and the increase of satisfaction she feels. The research emphasizes that the partners of women affected by breast cancer are convinced that in the process of treatment, sexuality is a neglected aspect of the lives of their female partners [7].

MEDICAL STAFF PROCEDURES

According to the published data, it is possible to identify a group of women at risk of sexual problems related to cancer treatment. These risk factors include: mental disorders occurring before initial cancer diagnosis, sexual dysfunction, mastectomy (compared to a breast-sparing surgery or mastectomy with deferred reconstruction), the first year post surgery, low self-esteem and libido, and associated behaviors such as avoidance strategies (lack of conversation with a partner or medical staff about sexual difficulties) [7].

The results of the study indicate that about 20–30% of patients ask the doctor conducting oncological treatment for help with sexual problems [7,12]. Assessment

of sexual dysfunctions and the monitoring of related coping strategies should be a component of routine care for this group of patients. It is recommended to use a multi-level model of intervention, also called PLISSIT, which takes into account the current psychophysical state of the patient and the patient's level of readiness to confront subjects related to the sexual sphere (for further explanation of this shortcut, see fig. 1; [13,14]).

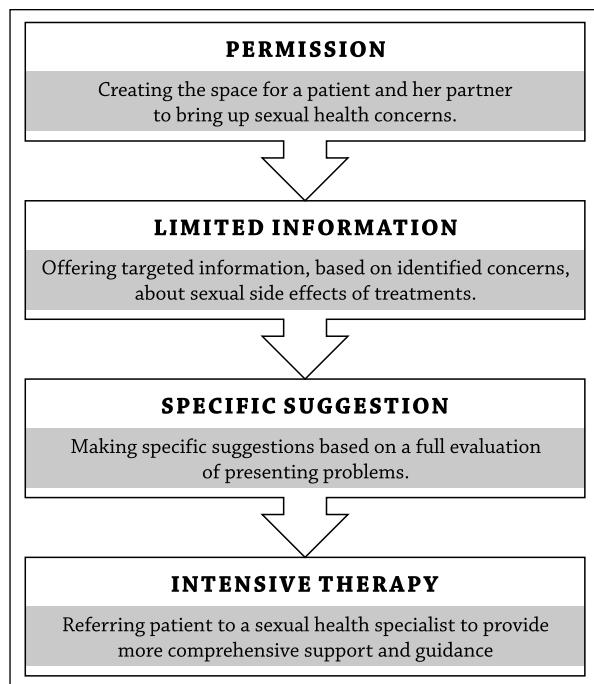


Figure 1. PLISSIT Model. Principles of intervention in the treatment of sexual dysfunction of patients with breast cancer.

Source: Authors' adaptation based on Faghani, Ghaffari, 2016; Ratner, Richter, Minkini, Foran-Tuller, 2012.

The first level (P—Permission) consists of medical staff initiating a conversation about sexual difficulties, showing acceptance of taking up such issues in the treatment process and in obtaining patient consent. The second level (LI—Limited Information) is based on medical staff providing basic information and correcting mistaken beliefs about sexual problems in the treatment of breast cancer. The next level of intervention (SS—Specific Suggestions) involves a discussion of the real difficulties reported by the patient, including a determination of what their subjective meaning is for

the functioning of the patient in terms of her assessment of herself and of her quality of life or the quality of her relationship with her partner, and whether or not strategies have thus far been used to attempt to overcome these difficulties. If the reported problems can be solved by the medical staff, then specific instructions and recommendations should be given. If, however, the solution is difficult due to the coexistence of complex life problems (e.g. addictions, depression, or anxiety disorders), then we are dealing with the fourth level of intervention (IT—Intensive Therapy) which consists of specialized treatment. In this case, it is necessary to refer the patient to a specialist, like a psychologist, psychiatrist, sexologist, or gynecologist. Help can be found for patients in accepting the losses associated with a mastectomy, including a perceived loss of femininity and the resulting difficulties navigating their own sexuality [15].

The use of the described intervention model in individual work, and also with couples or groups, makes possible an adequate and effective level of support for the needs of breast cancer patients during oncological treatment, which has been proven in research (Faghani, Ghaffari). The introduction of the PLISSIT method reflects the subjective treatment of the patient and also allows the identification of a group of patients requiring specialist assistance. In this sense, it is also an economic method.

CONCLUSIONS

There are still few publications that deal with the issue of the psychological mechanisms' influence on the sex life of post-mastectomy patients. The type of cancer they struggle with and the specificity of treatment used in this disease affect both body image and self-esteem, which are directly related to changes in sex life and in the relationship with an intimate partner. Close relations often feel helpless because they are afraid that they may hurt their partner by raising this topic. They are therefore not able to communicate their needs and readiness to provide support in restoring sexual intimacy in the relationship. Hence, it would be worth educating the staff and families of patients, as well as the patients themselves, in the basic mechanisms that can cause sex life difficulties.

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TELOMEROPATHIES – RARE DISEASE SYNDROMES

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ABSTRACT

Telomeres are located at the end of the chromosomes. They protect chromosomes from fusion and degradation. Every cell division causes a shortening of the telomeres. A special enzymatic complex called telomerase is responsible for maintaining telomere length in intensively dividing cells, such as epithelial cells and bone marrow cells. The enzymatic complex includes the TERT subunit, which has reverse transcriptase activity, and the TERC subunit, which acts as a template. Other important components of telomerase are the proteins that are responsible for structural stability. Telomerase remains active only in the dividing cells of the body. The rate of telomere shortening depends on many factors including age, sex, and comorbidities. Faster shortening of telomeres is caused by gene defects, which have an impact on telomerase action. Collectively, these are called telomeropathies. Common causes of telomeropathies are mutations in the TERT and TERC telomerase genes. Types of telomeropathies include dyskeratosis congenita, idiopathic pulmonary fibrosis, and aplastic anaemia, among others. Clinical manifestations and prognoses depend on the type and quantity of mutated genes. Diagnosis of telomeropathies is often problematic because they present with the same symptoms as other diseases. So far, no effective therapeutic methods have been developed for telomeropathies. A therapeutic method for patients with bone marrow failure may be the transplantation of hematopoietic stem cells. For patients with idiopathic pulmonary fibrosis, treatments include immunosuppressive therapy, lung transplantation, or palliative care. In the future, gene therapy may be an effective treatment strategy for telomeropathies. Lifestyle changes may also have a positive impact on the person. Physical activity combined with a healthy diet rich in antioxidants and unsaturated fatty acids can decrease the oxidative stress levels in cells and lead to a slower shortening of the telomeres.

KEYWORDS: telomeres, telomerase, telomeropathies

BACKGROUND

Telomeres, which are located on the ends of chromosomes, are composed of multiple six-nucleotide sequences (5'-TTAGGG-3') (fig. 1). They play an important role in determining the biological age of a cell because they are shortened with each division. Achievement of the telomeres' critical length signals the cell to begin the process of apoptosis (programmed death). The average length of human telomeres is 10–20 kbp (kilobase pairs). The dynamic of telomere shortening is differential and depends on sex, lifestyle, coexisting diseases, and exposure to harmful factors [1]. Depending on the rate of telomere shortening, the biological age of the cells may differ from the recorded age of the human. The increased rate of telomere shortening is accompanied by some illnesses including atherosclerosis, esophageal and breast cancer, and obesity [2–4]. This is why telomere length has become a biomarker for the risk of developing some diseases, including lifestyle diseases.

TELOMERASE

Several disease syndromes associated with the faster shortening of telomeres have been defined. They are referred to as telomeropathies [5]. The main causes of telomeropathies are defects of the genes involved in maintaining telomere length. In the dividing cells of the body, such as progenitor cells, stem cells, or activated leukocytes, telomeres are elongated due to telomerase activity. In other cells, telomerase activity remains low and decreases with age. Telomerase consists of the RNA strand, which is a template for the telomere repeat sequence (TERT), and a protein with reverse transcriptase activity (TERC). The telomerase complex also includes the dimer of the dyskerin complex (including the dyskerin, NOP10, NHP2, and GAR1 proteins) (fig. 2). Telomeres' DNA is protected by the shelterin protein complex, which is responsible for the stability of the genome. It consists of the following proteins: TRF1, TRF2, TIN2, POT1, RAP1, and TPP1.

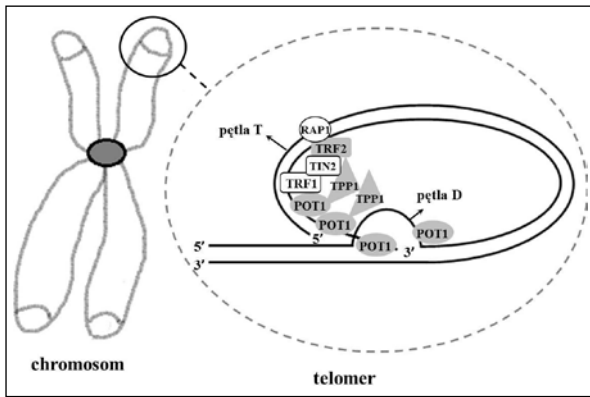


Figure 1. Diagram of telomere structure

Mutations within the genes encoding the telomerase subunits and proteins of the shelterin complex are the cause of telomeropathies (tab. 1) [6].

TELOMEROPATHIES

Dyskeratosis congenita (DC) is a rare disease that is detected at a frequency of less than 1 case per 1 million per year. The first symptoms of DC can be observed in childhood. These symptoms include skin hyperpigmentation, nail dystrophy, and leukoplakia (white keratosis), most commonly in the oral cavity. Dyskeratosis congenita may be diagnosed following the observed occurrence of a total of three symptoms. The average age at which all three symptoms are present is 8. DC is caused by hereditary autosomal mutations of the TERC, TERT, TIN2, and DKC1 genes, which are located at chromosome X [7–10]. In addition to the typical aforementioned symptoms, people with dyskeratosis also tend to have a number of other disorders including haematological, respiratory, or neuropsychiatric disorders. Thus, dyskeratosis congenita is now treated as a multi-organ disease [9]. Neuropsychiatric disorders affect 55% of children and 75% of adults with DC. These include anxiety, psychotic disorders, attention deficit disorders, and learning problems [11]. In addition, kin problems affect the vast majority of DC patients and include nail atrophy and hyperhidrosis of hands and feet. Some patients also suffer from symptoms of mucosal disorders like narrowing of the esophagus, tear ducts, or urethra. About 5% of people with DC have abnormalities in the structure of the skeletal system and osteoporosis [12]. In addition,

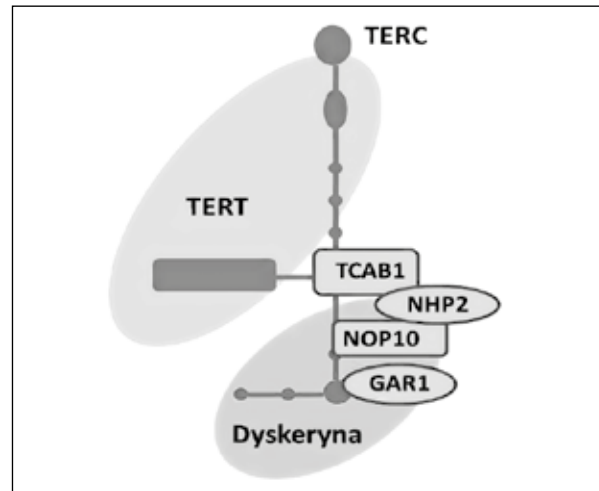


Figure 2. Telomerase complex structure

people with dyskeratosis congenita have an increased risk of squamous cell carcinoma and leukemia [13].

Hoyeraal-Hreidarsson syndrome (HHS) is one manifestation of DC that is characterized by extremely severe symptoms. Clinical symptoms of HHS can be observed during gestation and infancy. These include delayed intra-uterine development, microcephaly, and hypoplasia of the cerebellum. In addition to the typical symptoms of DC, the majority of patients with HHS also have immunodeficiency, lymphopenia, and nervous system disorders (including demyelinating disorders and convulsive tendencies). Digestive system disorders such as abnormalities in esophageal constriction and enteropathies can also be symptoms of HHS [14,15]. HHS patients have extremely short leukocyte telomeres (with telomere lengths below 1 centile for a given age) due to mutations in the genes responsible for maintaining telomere length: TERT, DKC1 (dyskerin gene), TIN2 [16,17]. Another manifestation of dyskeratosis congenita is the Revesz syndrome (RS). RS was named and characterized for the first time in 1992 by Revesz and coworkers who were diagnosing a one-and-a-half-year-old child with the following symptoms: bilateral exudative retinopathy and bone marrow failure [18]. Clinical symptoms of this disease syndrome also include intrauterine growth retardation, intracranial calcification, developmental delay, and nail dystrophy. The molecular cause of RS is associated with a mutation in the TIN2 gene, coding for the TIN2 protein, which is part of the shelterin complex [19].

Table 1. Gene mutations that cause telomeropathies

Gene	Gene function	Disease
TERC	Encodes a protein with reverse transcriptase activity	DC, aplastic anaemia, IPF
TERT	Encodes RNA that is a template for amplifying the telomere sequence	DC, aplastic anaemia, IPF, HHS
DKC1	Encodes the dyskerin, a protein responsible for the stability of the RNA molecule	DC, aplastic anaemia, IPF, HHS
TIN2	Codes the shelterin protein, regulates telomerase access to telomeres	DC, HHS, RS
RTEL1	Encodes a protein with helicase activity and plays an important role in maintaining genome stability	DC, HHS
CTC1	Encodes a protein that is a component of the CST complex	Coats plus syndrome
NOP10	Encodes a protein that is a component of the dyskerin complex	DC, aplastic anaemia, IPF
NHP2	Encodes a protein that is a component of the dyskerin complex	DC, aplastic anaemia, IPF

Coats plus syndrome, also known as cerebral microangiopathy with calcifications and cysts, is another telomeropathy. Clinical symptoms include bilateral exudative retinopathy, retinal telangiectasia (presence of enlarged small blood vessels), intracranial calcification, and anomalies in bone formation. In addition, some patients have thin hair and anaemia [20]. The cause of Coats plus syndrome is a mutation in the CTC1 gene responsible for telomere extension [21].

Aplastic anaemia is one of the clinical symptoms of telomeropathy in adults. It occurs with a frequency of 1–2 cases per million inhabitants per year in Europe and North America [22]. In some patients, significantly shortened telomeres [23] are observed as a result of mutations in the TERT and TERC genes. Aplastic anaemia usually is accompanied by other symptoms like mild cytopenia, leukaemia, pulmonary fibrosis, and squamous cell carcinoma.

Idiopathic pulmonary fibrosis (IPF), also called interstitial pneumonitis, is a serious disorder with a poor prognosis. It occurs with a frequency of 5–32 cases per 100,000 people, depending on the region [24]. The average survival period is 2–3 years from the diagnosis. Lung inflammation is often accompanied by bronchial inflammation and emphysema. Autosomal dominant TERT and TERC gene mutations are identified in familial pulmonary fibrosis (FPF) which affects 20% of cases. These mutations are detected in 15–20% of patients without the familial burden of dyskeratosis congenita and 1–3% of sporadic cases of the disease occurrence. In addition to the aforementioned mutations, some patients also have mutations of genes such as DKC1, TIN2, RTEL1, and PARN [17].

DISCUSSION

Due to the genetic causes of telomeropathies, as well as their diverse pathways of progression, therapeutic strategies are limited. In patients with bone marrow failure, the only therapeutic method is the transplantation

of hematopoietic stem cells. For patients with idiopathic pulmonary fibrosis, treatment includes immunosuppressive therapy, lung transplantation, or palliative care [25]. Gene therapy seems to be a promising future treatment for patients with telomeropathies. Studies conducted by Bär et al. [26] on the aplastic anaemia mouse model showed that gene therapy can effectively induce telomerase expression in bone marrow cells and result in telomere extension and increased survival time.

Regular physical activity reduces the level of oxidative stress and, as a result, prevents telomere shortening [27]. On the other hand, smoking accelerates the shortening of telomeres [28], as does obesity [29,30]. Long-term alcohol abuse in people over 65 also results in shortened telomeres [31]. Changes in lifestyle and eating habits – may reverse the unfavorable trend of telomere shortening. This is indicated by the results of studies with people who have switched to the Mediterranean diet [32,33]. In turn, weight loss in obese patients who underwent bariatric surgery resulted in telomere elongation within 10 years of surgery [34].

CONCLUSIONS

Disorders related to telomere length, called telomeropathies, constitute a group of multi-organ diseases with various clinical symptoms but a common genetic etiology. Defects in telomere protection systems lead to their excessive shortening, which in turn result in faster ageing and cell death. This is extremely important for intensely dividing cells like bone marrow, lymphocytes, and epithelial cells. Heterogeneity of symptoms often causes problems in the diagnostic process. Some of the symptoms associated with telomeropathies are accompanied by other diseases. Telomere length measurement can be useful in determining the direction of further diagnostics. In turn, identification of a patient's gene mutations may provide information on possible therapeutic strategies and the future prognosis for the patient.

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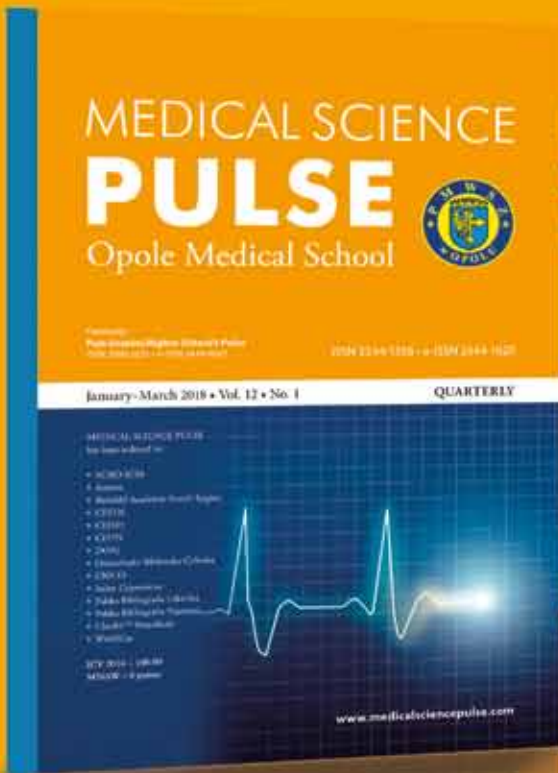
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