

CANCER PATIENTS` AWARENESS OF THE IMPORTANCE OF PHYSICAL ACTIVITY IN TREATING THEIR DISORDERS

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Abstrakt

The further the more attention is paid to the importance of physical activity in cancer patients. In recent years, we have seen a rapid increase in the number of patients having been cured successfully thanks to improved cancer screening, detection and treatment methods. There have been various studies on the effect of exercise as an effective way to prevent and improve the effects of cancer treatment. Given the severity of the disease, physicians and physiotherapists are very thoroughful, and the recommendations are more patient-specific and focused on the particular diagnosis. Objective: To get acquainted with the fulfilment of recommendations for performing physical activities by cancer patients.

Methods: The study group consisted of 102 patients diagnosed with some of the oncological diseases. One of the important criteria for inclusion in the study was the fact that the diagnosis did not prevent performance of physical activity. To obtain the research data we used the questionnaire method. Results: Patients involved in our study, in the prevention and treatment of their health problems, put particular emphasis on regular medical check-ups and nutrition and eating habits. In terms of priorities, physical activity is only ranking fourth in this respect. The vast majority of patients involved in the study had been informed about the importance of purposeful physical activity by physicians; however, nearly half of the patients admitted that they had never talked to the attending physician about recommendations for physical activity. The most common activities that patients undertake are domestic chores and walks.

Conclusions: The data obtained suggest that some patients are not sufficiently physically active, a number of them are not even aware of the role and importance of physical activity in the treatment of their disease. There are even patients who do not consider such information relevant. This study was supported by Grant project 1/0825/17 "Recommendations for physical activities in prevention and control of non-communicable diseases and their implementation in the eastern part of Slovakia" implemented at P.J. Šafárik University in Košice.

Keywords

Oncological diseases. Patients. Physical activity. Prevention. Awareness

INTRODUSTION

It is estimated that regular physical activity (PA) may reduce premature mortality rate in populations at risk by 20% (Buková et al.,2019). Since the times of Sigmund Freud, many experts have been treating mental and social aspects of chronic diseases and not only medical conditions. In addition, they have been also promoting a healthy lifestyle among risk populations (Adam et al., 2019). Currently, patients suffering from invasive

cancer can exceed the five year survival rate due to new therapeutic procedures and early diagnosis. Moreover, the number of such patients is continuously rising. Many patients are experiencing mental problems after their treatment ends. Although such problems are not regarded as clinically significant, they considerably influence life quality.

The leading cause of deaths in the EU and other developed countries worldwide are cardiovascular diseases

(Go et al., 2013; WHO 2014). The second most common cause of death is cancer (Moyad, 2016). The studies published on the prevention of cardiovascular diseases focus mainly on lifestyle and dietary changes, nonetheless such information may apply to cancer prevention as well. Overweight and obesity may also contribute to the high rate of cancer incidence and mortality (Lippman et al., 2009; Rossouw 2002; Wagenlehner, Weidner 2009). The results of the Canadian Heart Health Surveys (1986-1995) demonstrate significant association between BMI and mortality from all causes, CVD and cancer (Katzmarzyk 2012). It is believed that kidney stones and renal cell carcinoma strongly correlate to obesity as well (Taylor 2012; Moyad 2001; Mathew 2009).

According to Forman et al. (2014), breast cancer is a leading cause of cancer-related deaths in women. More than half of the cases are occurring in developed countries. Anderson et al. (2014) claim that breast cancer is the most common diagnosed cancer and the second most common cause of death in Great Britain. According to Kellen et al. (2008), the incidence of breast cancer in Eastern Europe is somewhat low, but it is high in South America, South Africa and Western Asia. Torre et al. (2016) claim the highest incidence in Western Europe and the USA and the lowest in Africa and Asia. The incidence of breast cancer in developing countries is rapidly increasing (Balneaves et al, 2014). In developed countries, about 1 in 8 women will develop breast cancer over the course of her lifetime. In Europe, there is a breast cancer diagnosis every 2 minutes and a death due to breast cancer every 6 minutes (Balogun, Formenti, 2015). There are almost 1.7 million cases diagnosed per year and more than half a million deaths every year.

More attention is paid to the importance of physical activity in cancer patients. In recent years, we have seen a

rapid increase in the number of patients having been cured successfully thanks to improved cancer screening, detection and treatment methods. There have been various studies on the effect of exercise as an effective way to prevent and improve the effects of cancer treatment. Given the severity of the disease, physicians and physiotherapists are very thorough, and the recommendations are more patient-specific and focused on the particular diagnosis. Such recommendations must be clear, meaningful and applicable. PA may help patients to increase lean muscle mass and maintain body weight. It also reduces sarcopenia, increases the sense of satisfaction and decreases belly fat storage (Poehlman, Melby 1998; Braith, Stewart 2006).

Physical activity has overwhelmingly beneficial effects – it reduces the risk of heart diseases, breast cancer, colon cancer and others (Moyad 2009). Regular physical activity provides many health benefits and is recognized as primary prevention and adjuvant treatment. Some studies also suggest that regular PA and exercise have protective and preventive effects (Goh 2012; Caspersen 1985; Woods 2000). It also develops physical and health condition (Platz et al., 2000, Trichopoulou, 2003). Furthermore, it improves the quality of life and reduces fatigue during and after treatment (Schmidt 2010). PA is also associated with a reduced risk of relapse or death. Of the six cohort studies conducted by ACSM specialists, four demonstrated the protective effect of PA with regard to breast cancer survival (Schmidt 2011) by inducing the cancer-suppressing phenotype TAMs (Goh, 2012). PA also includes activities such as housework, gardening, cycling, commuting, dancing, and others. It is a planned, structured, and repeated action to improve or maintain overall fitness.

PURPOSE

This study aimed to obtain information necessary to assess the level of implementation of the PA related recommendations given to cancer patients in eastern Slovakia.

MATERIALS AND METHODS

The research sample in this study comprised of 102 adult cancer patients. (25 males, 77 females, average age; 61,86), who were being treated at 9 oncology outpatient clinics. Thirty-one individuals refused to participate in the survey. Seventy-eight subjects were urban residents and twenty-three were rural residents. The most important condition to participate in the survey was that the disease did not prevent physical activity. The largest subgroup consisted of breast cancer patients (66%). The other subgroups were limited in the number of subjects. Tab 1. presents basic sociodemographic indicators of the cancer patients in the survey.

This study followed a wider study which was conducted from 10/2018 to 2/2019 at outpatient clinics in eastern Slovakia and involved patients of 19 cardiology, 14 metabolic, and 9 oncology clinics. We randomly addressed 1,193 adult patients treated in these clinics, of whom 282 refused to participate in the survey. We further excluded another 18

patients for not meeting one or more of the essential criteria listed below. The criteria for participating in this research were met by 893 patients - 353 males (38.6%) and 540 females (61.4%). Among all participants, 8.29% patients acknowledged more than one chronic disease. The largest group consisted of patients with metabolic diseases (n=407), and patients with cardiovascular disease (n=384). The smallest group consisted of cancer patients.

Patients were enrolled in the research at meeting the criteria below:

- over 20 years of age
- the occurrence of one or more diagnoses of three underlying diseases of affluence that do not prevent physical activity (cardiovascular disease, oncological disease, metabolic disease)
- diagnosis having been treated by a specialist for a minimum of 1 year
- willingness to give informed consent to participate in the research
- willingness to fill in questionnaires regarding physical activity and be provided information about physical activity for a given diagnosis.

Tab. 1 Basic sociodemographic indicators of respondents involved in the survey (n=102)

education (%)	elementary 5,16	vocational 11,2	HS graduate 48,4	university 43,49	
occupation (%)	permanent 53,07	occasional 4,91	unemployed 3,69	student 8,35	retired 29,98
occupation (%)	sedentary 43	physically demanding 18,67		none 38,33	
residence (%)	urban 76,54	rural 23,46			

Data collection

For the data collection we used a non-standardized questionnaire, which

was part of a questionnaire battery designed for our research purposes. Most of the questions used were selected from

previously validated or tested instruments, such as the Behavioral Risk Factor Surveillance System developed by the Centre for Disease Control and Prevention [6], or the International Physical Activity Questionnaire [10]. The questionnaire contained 29 questions and was designed for total completion time of 20 minutes. Most questions were closed-ended, with the option for respondents to elaborate on a certain response and were of a factual nature. The first seven questions focused on sociodemographic indicators, 4 questions covered patients' medical condition and awareness of their medical condition, 14 questions dealt with PA (including short version of IPAQ) and awareness of PA, and 4 questions focused on the selected lifestyle factors.

In this papers we present results from the following items:

- What is the key component in the prevention and treatment of your health problems? (multiple choice)
- Have you ever been informed by your doctor or medical staff on the importance of physical activity in the prevention and treatment of your health problem?
- Have you ever been recommended any physical activity by your doctor?
- Type of physical activity you are mostly engaged in (multiple choice).
- If active, what physical activity do you perform?
- If active, how often do you perform physical activity?
- Daily duration of your physical activity (multiple choice).

Statistical Analyses

Statistical data processing was performed using IBM SPSS version 23 (Reference: IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY). Pearson's Chi Square Test was used to determine the differences in the actual frequency of the occurrence of attributes. Since too many

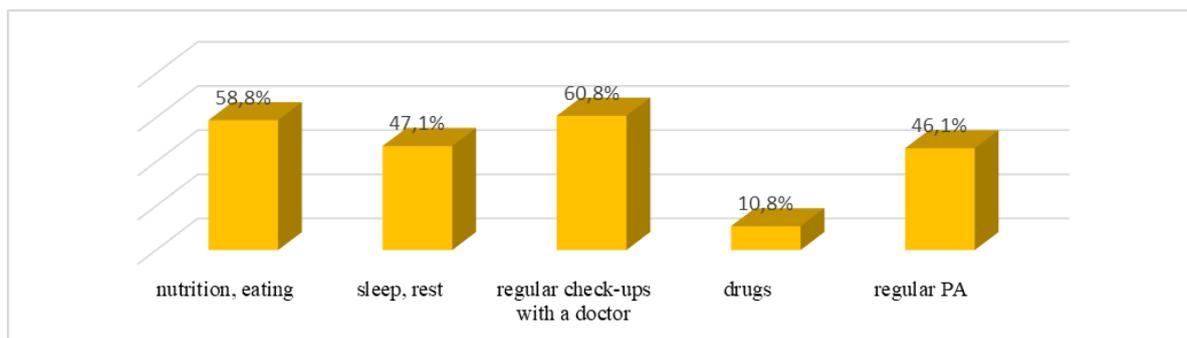
comparison categories do not allow reliable interpretation, χ^2 was calculated from dichotomized responses. Statistical hypothesis testing was performed at the significance level $\alpha < 0.05$. The results were stratified by the disease groups and by gender.

This study was supported by Grant project 1/0825/17 "Recommendations for physical activities in prevention and control of non-communicable diseases and their implementation in the eastern part of Slovakia" implemented at P.J. Šafárik University in Košice. The research was approved by the UPJŠ Ethics Committee (PJSU-1/0825/17).

RESULTS AND DISCUSSION

Cancer is recognized as a family disease" (Vorlíček in Adam et al., 2019, pp. 25). Cancer patients need strong support to better daily functioning. Debilitating symptoms that onset with cancer treatment may result in patients experiencing anxiety, anger, and hopelessness. They often ask: "Can I do anything to prevent cancer recurrence?", "Can I do anything to beat cancer?". We were not surprised when we found that a regular doctor checkup was the most important treatment aspect for more than 60% of respondents. In this particular survey item, respondents could have selected one out of three options or additional option "others" where they could have elaborated on what was the most important factor for improving their medical condition. A healthy lifestyle is the most important factor for 59% of respondents. Sleep, rest and regular physical activity scored evenly (46% - 47%). It was interesting to find that our respondents considered medications to be the least significant factor in cancer treatment. The difference between medications and other factors was statistically significant ($p \leq 0,05$). We recorded no statistical significance in comparing the first four answers.

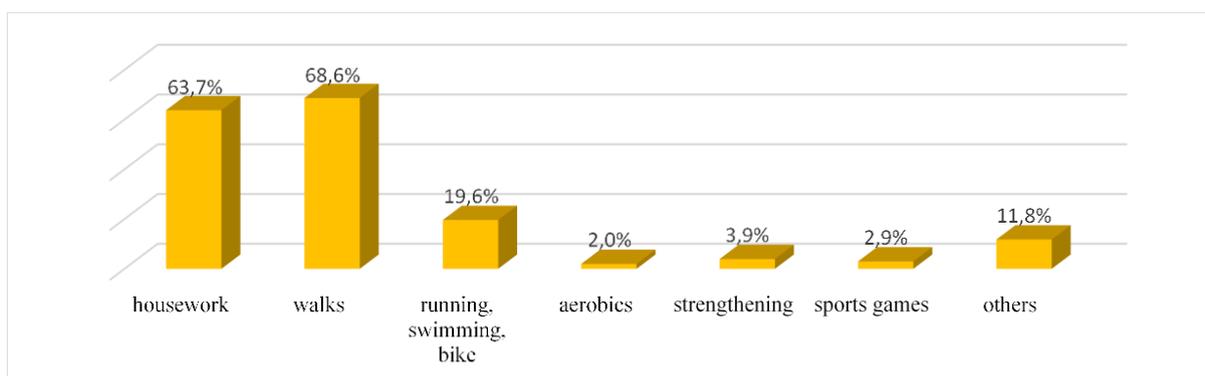
Fig. 1 Importance in prevention and treatment



Many cancer patients in treatment or remission reported that PA had become their new passion. Sport may be as effective as an antidepressant, improve immunity and reduce pathological fatigue (Janíková et al. 2012; Hadrabová, Janíková 2018). The most favourable activity was walking (68,6%). Almost 64% of subjects

preferred household work or gardening (Fig.2). Aerobic activities (activities – running, cycling, aerobic) was regularly performed by 22% of patients. We found a statistically significant difference between the first two responses at $\alpha = 0.05$.

Fig. 2 Type of PA

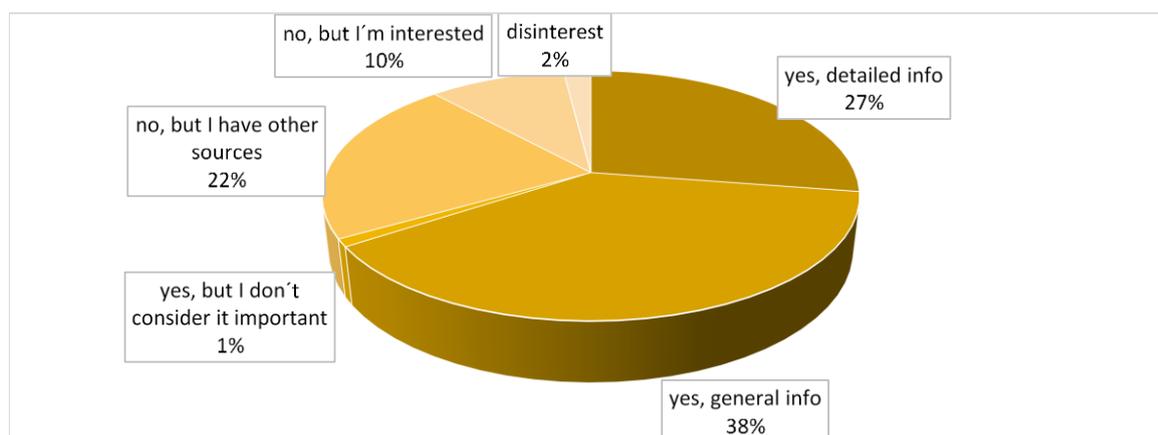


Most patients were informed about the importance of PA by their doctor or nursing staff (Fig.2). The largest group (38%) only obtained general information. Nearly 27% of patients had never been informed by their physicians nor they had recognized the importance of PA in the treatment of their disease. The frequency match test revealed statistically significant differences in almost all responses except for differences between the following responses: yes, but I do not consider it important: I am not interested in information: no, but I am interested in information: I am not interested in the information.

The fact that cancer patients are only obtained general information may be due

to the overuse of out-patient services, as well as a lack of doctors and nursing staff (McKenna, 1998). Large numbers of waiting patients often prevent doctors from engaging in preventive measures other than primary care. This issue concerns most specialized centres for oncological diseases as well as centres for chronic diseases in Slovakia. Another reason might be found in the doctor's approach. Several studies suggest that the doctors, who are personally engaged in physical activity, acknowledge the importance of PA prescriptions.

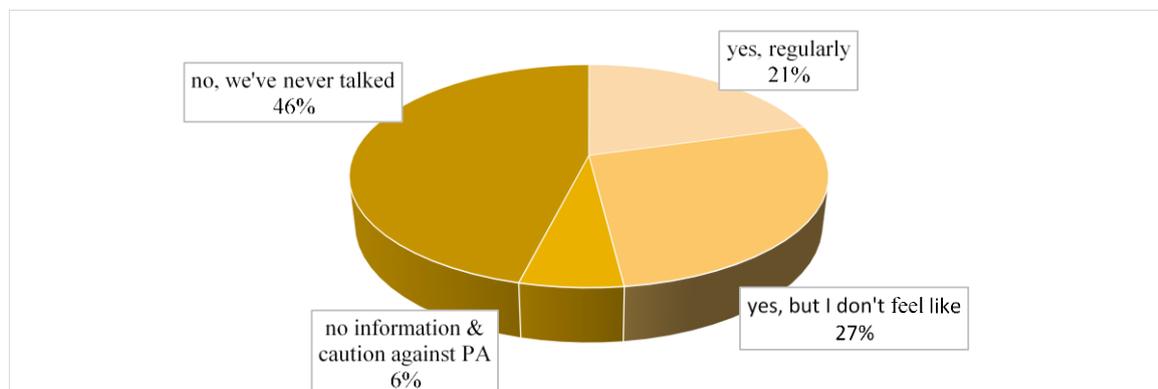
Fig. 3 Information on the importance of PA in prevention and treatment provided by the doctor



Valuable insight was gained from assessing doctor's recommendations on PA and meeting of such recommendations by patients (Fig.4). In the group of patients who were informed about the importance of PA, only 21% followed the guidelines regularly. 27% of respondents admitted being informed, but their passivity prevented them to meet the recommendations. Nearly half of the patients admitted that they had never spoken to their specialist about this.

Several patients (6%) were even warned not to take part in physical activity as a treatment of their condition. The significance match test revealed significant differences between all responses ($p \leq 0.05$) except for the association between yes, regularly: yes, but I don't feel like.

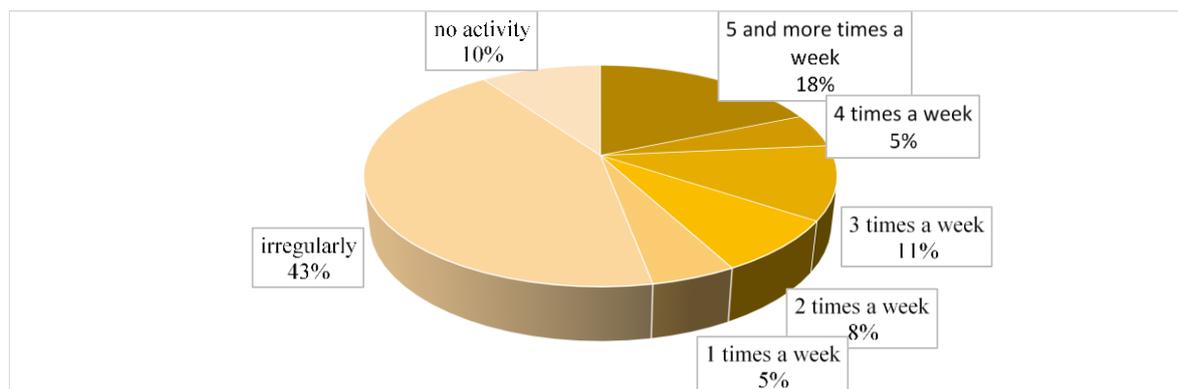
Fig. 4 Doctor's recommendations and their implementation



National Health and Nutrition Examination Survey (NHANES) recommends seven guidelines for a healthy lifestyle and the prevention of deaths from major diseases (Yang et al. 2012). The key component of a healthy lifestyle is daily physical activity. Only 18% of respondents in our survey met this recommendation (Fig.5). 16% performed physical activity 3 to

4 times a week. However, most patients do not perform PA regularly or at all (53%) despite the fact that household work, gardening, and walks were also included in the PA category. The differences in PA participation frequency were significant ($p \leq 0.05$), except for the differences between PA 1x: 2x weekly, 4x: 1x weekly and 4x: 2x weekly.

Fig. 5 Frequency of PA



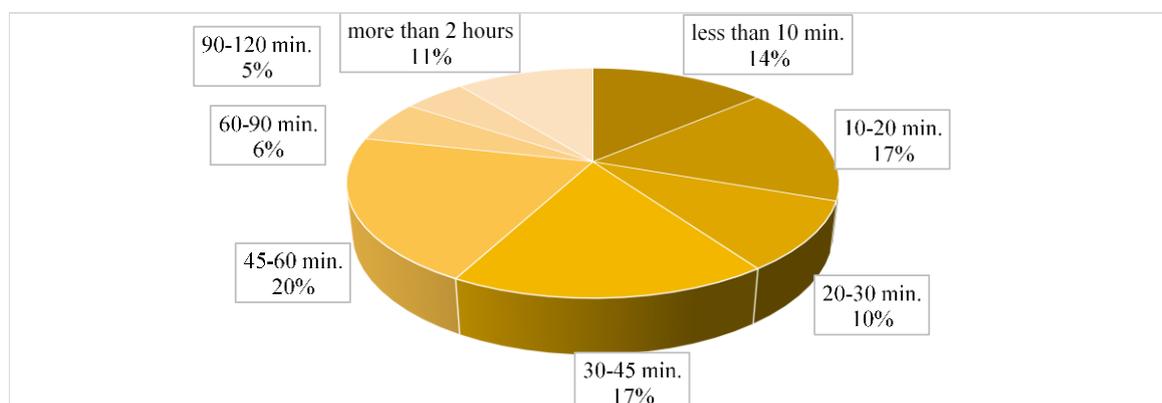
Platz et al. (2000) found that female cancer patients with a healthy weight, who completed 30 minutes of physical activity daily, were in the lower risk of overall mortality compared to inactive females (Trichopoulou et al., 2003). Each type of physical activity should match the individual needs of patients (DeNysschen et al., 2013). Irwin et al. (2015) and Nyrop et al. (2014) found that breast cancer patients, who were performing regular 150 min aerobic activities (brisk walks, cycling, etc.) for three months had significantly improved their health condition. Furthermore, the progress and symptoms of the disease mitigated after one year of regular PA. Lorinzi et al., (2012), Chen et al., (2011), Braith et al., (1998) suggest that 30 to 60 min of PA

daily should be sufficient to maintain healthy weight, mental and physical health and reduce the risk of cancer, relapse, and mortality.

This recommendation was met by 37% of cancer patients in our survey (duration 30-45 min + 45-60 min) (Fig.6). More than 21% performed PA for 60 min and more. 14% of patients were physically active for less than 10 min.

In four cases, a frequency match found the differences between the variables (20-30min: 45-60min; 45-60:> 120 min; 90-120min: 45-60min; 60-90min: 45-60min). In the remaining cases, the difference between the individual variables was not confirmed ($p \leq 0.05$).

Fig. 6 Duration of PA



CONCLUSION

In our research, a majority of cancer patients regard regular medical check-ups as well as nutritional and eating habits as key elements in the prevention and treatment of their health issues. Physical activity ranked third. Most patients were informed by doctors about the importance of PA during the treatment period. More than half of the patients though did not take part in PA or only occasionally. About one-third of the respondents followed the doctors' recommendations. The most common physical activities of the respondents were walking and housework.

The collected data demonstrates that many cancer patients do not engage in PA regularly. There were patients who were never informed about the significance of PA during their illness and convalescence. A small group of individuals was not interested in being informed about PA at all.

Although physical activity along with standard health care for cancer patients may improve their quality of life, mainly, physical functioning, depression, and fatigue, according to Knips (2019) there is no convincing evidence for cancer patients that PA would improve their quality of life, physical functioning or anxiety.

Many patients spend more time performing physical activities during their illness than before it. They subconsciously realize that PA removes pathological fatigue, brings the feeling of joy and feelings they own their health, while at the same time it helps improve physical condition and accelerates recovery. Similarly, PA reduces the extent of fatigue and depression that often brings the treatment itself. (Marker et al. 2018; Plevová, Boleloucký 2000; Boleloucký 1999). Persoon et al. (2013), based on eight randomly conducted studies, confirmed a positive impact of PA on the cardio-respiratory system, development of strength in lower limbs, and fatigue reduction. In the same vein, the research from Hadrabová, Janíková

2018; Persoon et al. 2017; Moore et al. 2016; Janíková et al. 2012; Pan, Morrison 2011, show positive effects of PA not only in relation to cardio-respiratory conditions but also in connection to flexibility, strength or vegetative balance of cancer patients. Patients conducting sports activities display a longer period of entering into relapse than the average population. Wiskemann et al. (2015) recommends regular PA for cancer patients to increase the survival rate. Nonetheless, Wiskemann et al. emphasize that each recommendation must be formulated cautiously in relation to the patient's diagnosis.

In this study, breast cancer was the most frequent type of cancer among the participants (66%). Based on available literature, the authors Ha et al., (2007), Caan, et al. (2005), a Ballard-Barbash a McTiernan (2007) propose a multi-disciplinary approach to breast cancer. It should comprise of physical activity, control of body weight, high intake of fruits and vegetables, and modest fat intake. The results of WHEL (Pierce et al., 2002, 2007) study confirm that a healthy lifestyle, which includes high consumption of fruits and vegetables, maintains low body weight and physical activity provides increase the survival rate (Pierce et al., 2007, Cardoso, 2019). Regular exercise is a relatively simple and effective recommendation, which should be given to all breast cancer patients (Mustian, 2017). Anderson et al. (2014) estimate that the occurrence of this illness could decline by 42% if patients increased their PA, reduced their body fats and cut down on the amount of alcohol.

Despite the fact that the above-mentioned authors showed convincing arguments and knowledge of the PA benefits in the treatment of cancer patients, we are of the opinion that PA fails to draw appropriate attention. The human body is predetermined to activity and a non-active lifestyle is a risk factor for the emergence of many illnesses,

including ODs. Our main goal was to draw attention to this issue and extend knowledge about the importance of PA as a means for convalescence during treatment.

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Ethics approval and consent to participate. The protocol was approved by the Human Research Ethics Committee of Pavol Jozef Šafárik University in Košice (approval No. PJSU-0825/17-1).

Competing interests. The authors declare that they have no competing interests.

REFERENCES

Adam Z., Klimeš J, Pour L, Král Z, Onderková A, Čermák A, Vorlíček J. 2019. Maligní onemocnění, psychika a stres: příběhy pacientů s komentářem psychologa. Praha: Grada publishing, a.s. 2019,208 s. ISBN 978-80-271-2539-5.

Anderson AS, Macleod M, Mutrie N, Sugden J, Dobson H, Treweek S, O'Carroll RE, Thompson A, Kirk A, Brennan G, Wyke S. (2014). Breast cancer risk reduction--is it feasible to initiate a randomised controlled trial of a lifestyle intervention programme (ActWell) within a national breast screening programme? International Journal of Behavioral Nutrition and Physical Activity. 2014 Dec 17;11:156: 1-15. DOI 10.1186/s12966-014-0156-2.

Ballard-Barbash R, McTiernan A. (2007). Is the whole larger than the sum of

the parts? The promise of combining physical activity and diet to improve cancer outcomes. J Clin Oncol. 2007;25:2335–2337.

Balneaves LG, Van Patten Ch, Truant TLO, Kelly MT, Neil SE, Campbell KL. (2014).Breast cancer survivors' perspectives on a weight loss and physical activity lifestyle intervention. Support Care Cancer. 2014;22(8):2057–2065. DOI 10.1007/s00520-014-2185-4.

Balogun OD, Formenti, SC. (2015). Locally advanced breast cancer - strategies for developing nations. Frontiers in Oncology. 2015; 5: 89.

Boleloucký Z. 1999. Psychiatrie a lékařská psychologie v paliativní medicíně. 2. doplněné a přepracované vydání. Brno: Masarykova univerzita, 1999, 92s. ISBN 80-210-2064-4.

Braith RW, Stewart KJ. (2006). Resistance exercise training: its role in the prevention of cardiovascular disease. Circulation. 2006; 113(22): 2642–50.

Bukova A, Horbacz A, Szerdióvá L. et al. (2019). Awareness of patients with metabolic diseases of the importance of physical activity in treating their disorders. In: Physical education, sports and health culture in modern society. In press.

Caan B, Sternfeld B, Gunderson E, Coates A, Quesenberry C, Slattery ML. (2005). Life After Cancer Epidemiology (LACE) Study: a cohort of early stage breast cancer survivors (United States). Cancer Causes Control. 2005;16:545–556.

Caspersen CJ, Powell KE, Christenson GM. 1985. Physical activity, exercise and physical fitness: definitions and distinctions for health related research. Pub Health Rep, 1985; 100(2): 126-131.

Cardoso F, Kyriakides S, Ohno S,

- Penault-Llorca F, Poortmans P, Senkus E, Rubio IT, Zackrisson S. (2019) Early breast cancer: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up. *Annals of oncology*. 2019; 30(8): 1194-1220.
- Denlinger CS, Ligibel JA, Are M, Baker KS, Broderick G, Demark-Wahnefried W, Friedman DL, Goldman M, Jones LW, King A, Ku GH, Kvale E, Langbaum TS, McCabe MS, Melisko M, Montoya JG, Mooney K, Morgan MA, Moslehi JJ, O'Connor T, Overholser L, Paskett ED, Peppercorn J, Rodriguez MA, Ruddy KJ, Sanft T, Silverman P, Smith S, Syrjala KL, Urba SG, Wakabayashi MT, Zee P, McMillian NR, Freedman-Cass DA. (2016). NCCN Guidelines Insights: Survivorship, Version 1.2016. *Journal of the National Comprehensive Cancer Network: JNCCN* 2016; 14(6):715-724.
- DeNysschen CA, Burton H, Ademuyiwa F, Levine E, Tetewsky S, O'Connor T. (2014). Exercise intervention in breast cancer patients with aromatase inhibitor-associated arthralgia: a pilot study. *Eur J Cancer Care (Engl)*. 2014;23(4):493–501. doi: 10.1111/ecc.12155. Epub 2013 Dec 2.
- Eyre H, Kahn R, Robertson RM, Clark NG, Doyle C, Hong Y, Gansler T, Glynn T, Smith RA, Taubert K, Thun MJ. (2004). For the American cancer society; american diabetes association, and the american heart association. Preventing Cancer, Cardiovascular Disease, and Diabetes. A Common Agenda for the American Cancer Society, the American Diabetes Association, and the American Heart Association. *Circulation*. 2004;109:3244–3255.
- Forman D, Bray F, Brewstwr DH, Mbalawa CG, Kohler B, Piñero M, Steliarova-Foucher E, Swaminathan R, Ferlay J. (2014). Cancer Incidence in Five Continents. Volume X. IARC Scientific Publications No. 164. Lyon, France: International Agency for Research on Cancer. 2014. ISBN 978-92-832-2165-4. <http://ci5.iarc.fr/CI5I-X/old/vol10/CI5vol10.pdf>.
- Galantino ML, Desai K, Greene L, Demichele A, Stricker CT, Mao JJ. (2012). Impact of yoga on functional outcomes in breast cancer survivors with aromatase inhibitor-associated arthralgias. *Integr Cancer Ther*. 2012;11(4):313–320. doi: 10.1177/1534735411413270. Epub 2011 Jul 6.
- Go AS, Mozaffarian D, Roger VL, Benjamin EJ, Berry JD, Borden WB, Bravata DM, Dai S, Ford ES, Fox CS, Franco S, Fullerton HJ. et al. American Heart Association Statistics Committee and Stroke Statistics Subcommittee. (2013). Heart disease and stroke statistics—2013 update: a report from the American Heart Association. *Circulation* 2013;127(1):e6–245. DOI: 10.1161/CIR.0b013e31828124ad. Epub 2012 Dec 12.
- Goh J., Kirk EA., Lee SX., Ladiges WC. (2012). Exercise, physical activity and breast cancer: the role of tumor-associated macrophages. *Exerc Immunol Rev*, 2012;18:158-176. PMID: 22876727.
- Ha M, Mabuchi K, Sigurdson AJ, Freedman MD, Linet MS, Doody MM, Hauptmann M. (2007). Smoking cigarettes before first childbirth and risk of breast cancer. *Am J Epidemiol*. 2007;166(1):55–61.
- Hadrabová M, Janíková A. (2018). Význam fyzické aktivity pro přežití a kvalitu života u pacientů s lymfoproliferativním onemocněním.

- Transfuze a Hematologie dnes, 2018;3(24): 182-193.
- Chen X, Lu W, Zheng W, Gu K, Matthews CE, Chen Z, Zheng Y, Shu XO. (2011). Exercise after diagnosis of breast cancer in association with survival. *Cancer Prev Res (Phila)*. 2011 Sept;4(9):1409–1418. DOI: 10.1158/1940-6207.CAPR-10-0355. Epub2011 Jul 27.
- Irwin ML, Cartmel B, Gross CP, Ercolano E, Li F, Yao X, Fiellin M, Capozza S, Rothbard M, Zhou Y, Harrigan M, Sanft T, Schmitz K, Neogi T, Hershman D, Ligibel J. (2015). Randomized exercise trial of aromatase inhibitor-induced arthralgia in breast cancer survivors. *J Clin Oncol*. 2015;33(10):1104–11. DOI: 10.1200/JCO.2014.57.1547. Epub 2014 Dec 1.
- Janíková A, Radvanský J, Vysoký , Bařalík L, Šupitová J, Žáčková D, Ráčil Z, Mayer J. (2012). Význam fyzické aktivity u pacientů s hematoonkologickými malignitami. *Transfuze a hematologie dnes*. 2012;18(1):31-38.
- Katzmarzyk PT, Reeder BA, Elliott S, Joffres MR, Pahwa P, Raine KD, Kirkland SA, Paradis G. (2012). Body mass index and risk of cardiovascular disease, cancer and all-cause mortality. *Canadian Journal of Public Health*. 2012March-Apr,103(2):147–151. <https://link.springer.com/article/10.1007/BF03404221>.
- Kellen E, Vansant G, Christiaens MR, Neven P, Limbergen E. (2008). Lifestyle changes and breast cancer prognosis: a review. *Breast Cancer Research and Treatment, Springer Verlag*. 2008,114(1):13-22. DOI: 10.1007/s10549-008-9990-8ff. fhal-00478334f.
- Knips L, Bergenthal N, Streckmann F, Monsef I, Elter T, Skoetz N. (2019). Aerobic physical exercise for adult patients with a hematological malignancies. *Cochrane Database of Systematic Reviews*. 2019 Jan 31;1:CD009075. DOI: 10.1002/14651858.CD009075.pub3. <https://doi.org/10.1002/14651858.CD009075.pub3>.
- Lippman SM, Klein EA, Goodman PJ, Lucia MA, Thompson IM, Ford LG, et al. (2009). Effect of selenium and vitamin E on risk of prostate cancer and other cancers: The Selenium and Vitamin E Cancer Prevention Trial (SELECT). *JAMA*, 2009;301(1):39–51. DOI: 10.1001/jama.2008.864. Epub 2008 Dec 9.
- Lorinzi PD, Cardinal BJ, Winters-Stone K, Smit E, Loprinzi CL. (2012). Physical activity and the risk of breast cancer recurrence: a literature review. *Oncol Nurs Forum*. 2012 May 1;39(3):269–274. DOI: 10.1188/12.ONF.269-274.
- Marker RJ, Cox-Martin E, Jankowski CM, Purcell WT, Peters JC. (2018). Evaluation of the effects of a clinically implemented exerciseprogram on physical fitness, fatigue, and depression in cancer survivors. *Support Care Cancer*, 2018;26(6):1861-1869. DOI: 10.1007/s00520-017-4019-7. Epub 2017 Dec 21.
- Mathew A, George PS, Ildaphonse G. (2009). Obesity and kidney cancer risk in women: a meta-analysis (1992–2008). *Asian Pac J Cancer Prev*. 2009;10:471–478. PMID:19640194.
- McKenna J. Barriers to physical activity promotion by general practitioners and practice nurses. *British J. of Sports Med.*, 1998. 32/3: 242-247. doi:10.1136 / bjsm.32.3.242.
- Moore SC, Lee IM, Weiderpass E., et al. (2016). Association of Leisure-Time Physical Activity With Risk of 26 Types of Cancers in 1,44 Million

- Adults. *JAMA Intern Med.* 2016;176(6): 816-825. DOI: 10.1001/jamainternmed.2016.1548.
- Moyad MA. (2001). Obesity, interrelated mechanisms, and exposures and kidney cancer. *Semin Urol Oncol.* 2001;19:270–279.
- Moyad MA. (2014). The supplement handbook. New York, NY: Rodale Publishing 2014.512p. ISBN 10: 1623360358.
- Moyad MA. (2016). Integrative medicine for breast cancer: an evidence-based assessment. Springer. International Publishing Switzerland. 2016,395p. ISBN 978-3-319-23421-2. DOI 10.1007/978-3-319-23422-9.
- Mustian KM, Alfano CM, Heckler C, Kleckner AS, Kleckner IR, Leach CR, Mohr D, Palesh OG, Peppone LJ, Piper BF, Scarpato J, Smith T, Sprod LK, Miller SM. (2017). Comparison of pharmaceutical, psychological, and exercise treatments for cancer-related fatigue: a meta-analysis. *JAMA Oncol.* 2017;3 (7):961 –968.
- Nyrop KA, Muss HB, Hackney B, Cleveland R, Altpeter M, Callahan LF. (2014). Feasibility and promise of a 6-week program to encourage physical activity and reduce joint symptoms among elderly breast cancer survivors on aromatase inhibitor therapy. *J Geriatr Oncol.* 2014;5(2):148–155. DOI: 10.1016/j.jgo.2013.12.002. Epub 2013 Dec 28.
- Pan SY, Morrison H. (2011). Physical activity and hematologic cancer prevention. *Recent Results Cancer Res.* 2011;186:135-158. DOI: 10.1007/978-3-642-04231-7-6.
- Persoon S, Chin A, Paw MJM, Buffart LM, Liu RDK, Wijermans P, Koene HR, Minnema MC, Lugtenburg PJ, Marijt EWA, Brug J, Nollet F, Kersten MJ. (2017). Randomized controlled trial on the effects of a supervised high intensity exercise program in patients with a hematologic malignancy treated with autologous stem cell transplantation: Results from the EXIST study. *PLoS One,* 2017;12(7):e0181313. DOI: 10.1371/journal.pone.0181313. eCollection 2017.
- Persoon S, Kersten M, Van Der Weiden K, Buffart L, Nollet F, Brug J, Chinapaw M. (2013). Effects of exercise in patients treated with stem cell transplantation for a hematologic malignancy: A systematic review and met-analysis. *Cancer Treat Rev.* 2013,Oct;39(6):682-690. DOI: 10.1016/j.ctrv.2013.01.001. Epub 2013 Feb 26.
- Pierce JP, Faerber S, Wright FS, Rock CL, Newman V, Flatt SW, Kealey S, Jones VE, Caan BJ, Gold EB, Haan M, Hollenbach KA, Jones L, Marshall JR, Ritenbaugh C, Stefanick ML, Thomson C, Wasserman L, Natarajan L, Thomas RG, Gilpin EA. Women's Healthy Eating and Living (WHEL) study group. (2002). A randomized trial of the effect of a plant-based dietary pattern on additional breast cancer events and survival: the Women's Healthy Eating and Living (WHEL) Study. *Control Clin Trials.* 2002;23:728–756.
- Pierce JP, Natarajan L, Caan BJ, Parker BA, Greenberg ER, Flatt SW, Rock CL, Kealey S, Al-Delaimy WK, Bardwell WA, Carlson RW, Emond JA, Faerber S, Gold EB, Hajek RA, Hollenbach K, Jones LA, Karanja N, Madlensky L, Marshall J, Newman VA, Ritenbaugh C, Thomson CA, Wasserman L, Stefanick ML. (2007a). Influence of a diet very high in vegetables, fruit, and fiber and low in fat on prognosis following treatment for breast cancer: the Women's Healthy Eating and Living (WHEL) randomized trial. *JAMA.*

- 2007;298:289–298.
- Pierce JP, Stefanick ML, Flatt SW, Natarajan L, Sternfeld B, Madlensky L. (2007). Greater survival after breast cancer in physically active women with high vegetable-fruit intake regardless of obesity. *J Clin Oncol.* 2007;25:2345–2351.
- Plevová J, Boleloucký Z. (2000). *Psychofarmakoterapie vyššího věku. 2. přepracované a aktualizované vydání.* Praha: Grada Publishing. 2000,162s. ISBN 80-7169-959-4.
- Platz EA, Willet WC, Colditz GA, Rimm EB, Spiegelman D, Giovannucci E. (2000). Proportion of colon cancer risk that might be preventable in a cohort of middle-aged us men. *Cancer Causes Control.* 2000;11(7):579–588. PMID:10977102. DOI:10.1023/a:1008999232442.
- Poehlman ET, Melby C. (1998). Resistance training and energy balance. *Int J Sport Nutr.* 1998;8(2):143–159. PMID:9637193. DOI:10.1123/ijns.8.2.143.
- Pojednic RM, Polak R, Arnstein F. et al. Practice patterns, counseling and promotion of physical activity by sports medicine physicians. *J. of Science and Medicine in Sport,* 2017.20/2:123-127. doi:10.1016/j.jsams.2016.06.012.
- Rossouw JE, Anderson GL, Prentice RL, LaCroix AZ, Kooperberg C, Stefanick ML, Jackson RD, Beresford SA, Howard BV, Johnson KC, Kotchen JM, Ockene J. Writing group for the women's health initiative investigators. (2002). Risks and benefits of estrogen plus progestin in healthy postmenopausal women: Principal results from the women's health initiative randomized controlled trial. *JAMA.* 2002; 288: 321–33.
- Schmidt KH, Courneya KS, Matthews C, Demark-Wahnefried W, Galvão DA, Pinto BM, Irwin ML, Wolin KY, Segal RJ, Lucia A, Schneider CM, Von Gruenigen VE, Schwartz AL. (2010). American College of Sports Medicine roundtable on exercise guidelines for cancer survivors. *Med Sci Sports Exerc.* 2010 Jul;42(7):1409-1426. DOI:10.1249/MSS.0b013e3181e0c112.
- Schmidt KH. (2011). Exercise for secondary prevention of breast cancer: moving from evidence to changing clinical practice. *Cancer Prev Res (Phila).* 2011 Apr;4(4):476-480, 2011. DOI: 10.1158/1940-6207.CAPR-11-0097.
- Sports Medicine Roundtable on exercise guidelines for cancer survivors. *Med Sci Sports Exerc.* 2010;42:1409-1426.
- Tarasenko YN, Miller EA, Chen Ch, Schoenberg NE. Physical activity levels and counseling by health care providers in cancer survivors. *Preventive Med.* 2017;99:211-217. <https://doi.org/10.1016/j.ypmed.2017.01.010>.
- Taylor EN, Stampfer MJ, Curhan GC. (2005). Obesity, weight gain, and the risk of kidney stones. *JAMA.* 2005;293:455–462. DOI:10.1001/jama.293.4.455.
- Torre LA, Siegel RL, Ward EM, Jemal A. (2016). Global Cancer Incidence and Mortality Rates and Trends-An Update. *Cancer epidemiology, biomarkers & prevention: a publication of the American Association for Cancer Research, cosponsored by the American Society of Preventive Oncology.* 2016; 25(1): 16-27.
- Trichopoulou A, Costacou T, Bamia C, Trichopoulos D. (2003). Adherence to a mediterranean diet and survival in a greek population. *N Engl J Med.*

- 2003;348:2599–608.
DOI:10.1056/NEJMoa025039.
- Yang Q, Cogswell ME, Flanders WD, Hong Y, Zhang Z, Loustalot F. et al. 2012. Trends in cardiovascular health metrics and associations with all-cause and cvd mortality among us adults. JAMA. 2012;307:1273–83.
- Wagenlehner FM, Weidner W. 2009. Prostatitis: No benefit of alpha-blockers for chronic prostatitis. Nat Rev Urol. 2009;6:183–184.
- World Health Organization (WHO). 2010. Global recommendations on physical activity activity for health. http://www.who.int/dietphysicalactivity/factsheet_recommendations/en/ [cit.2018-07-22].
- Wiskemann J, Kleindienst N, Kuehl R, Dreger P, Schwerdtfeger R, Bohus M. (2015). Effects of physical exercise on survival after allogeneic stem cell transplantation. Int J Cancer. 2015 Dec 1;137(11):2749-2756. DOI: 10.1002/ijc.29633. Epub 2015 Jun 19.
- Woods JA, Lu Q, Ceddia MA, Lowder T. (2000). Exercise-induced modulation of macrophage function. Immunol Cell Biol. 2000;78:543-553.
- WHO. World Health Organization. 2016. Global recommendations on physical activity for health. http://www.who.int/dietphysicalactivity/factsheet_recommendations/en/ [cit.2018-07-22].

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