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Can physical activity influence the quality of sleep among the elderly?

Czy aktywność fizyczna może wpływać na jakość snu wśród osób w wieku podeszłym?

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Streszczenie:

Wstęp: Badania pokazują, ze ponad połowa osób po 50. roku życia ma problem z obniżoną jakością snu. Przyczyną obniżonej jakości snu jest m.in. wczesne budzenie się, wydłużony czas latencji snu, zwiększona liczba przebudzeń w ciągu nocy czy też skrócony czasu snu. Celem pracy było pokazanie jak dużym problem są zaburzenia snu jakie występują u osób po 50 roku życia, oraz jak regularna aktywność fizyczna może poprawić jakość snu i wpłynąć na poprawę funkcjonowanie osób starszych. Ponieważ aktywność fizyczna wpływa na

opóźnienie zmian inwolucyjnych oraz procesu starzenia się, co pozwala utrzymać jak największą samodzielność i niezależność w czynnościach dnia codziennego.

Cel badań: Badanie miało na celu określenie związku między intensywnością aktywności fizycznej a jakością snu osób starszych.

Materiał i metody: Badania do pracy zostały przeprowadzano za pomocą anonimowej ankiety, która składała się z dwóch kwestionariuszy: Kwestionariusza Jakości Snu Pittsburgh (PSQI) oraz Międzynarodowego Kwestionariusza Aktywności Fizycznej. Ankieta skierowana była do osób po 50 roku życia. W badaniach wzięło udział 100 osób.

Wyniki: Uzyskano istotne statystycznie korelacje między szybkim zaśnięciem, budzeniem się w nocy lub nad ranem z intensywnym lub umiarkowanym wysiłkiem fizycznym w ciągu dnia.

Wnioski: Badania pokazały, że osoby które częściej wykonywały czynności wymagające intensywnego lub umiarkowanego wysiłku fizycznego rzadziej budzili się w nocy, krócej zasypiali oraz zgłaszali lepszą jakość snu. Dodatkowo pokazały, iż obniżona jakość snu wpływa na funkcjonowanie m.in. spadek energii oraz problemy z utrzymaniem czujności.

Słowa kluczowe:

Sen, aktywność fizyczna, osoby starsze, geriatria

Summary:

Introduction: Research shows that over the half of people in the age of more than fifty have got problems with lowered quality of sleep. The cause of lowered quality of sleep is i.a. waking up early, lengthened sleep latency, increased number of waking during the night or shortened time of sleep. The aim of the study was to show how significant are sleep related problems which appear after the age of fifty and how regular physical activity can improve the quality of sleep and as a result functioning of the elderly. Physical activity delays involutional changes and the process of ageing, which lets the elderly stay independent and self-reliant in everyday activities.

The aim of the study: The study was to mark the connection between physical activity intensity and the quality of sleep of the elderly.

Material and methods: Research for the study was made by means of anonymous survey which consisted of two questionnaires: The Pittsburgh Sleep Quality Index (PSQI) and The International Physical Activity Questionnaire. The survey was targeted at people in the age of over fifty. 100 people took part in the research.

Results: Significant statistical correlation between early falling asleep, waking up at night or before dawn with the intensive or moderate physical effort has been obtained.

Conclusions: The research has shown that people who performed intense or moderate physical activity woke up less frequently during the night, fell asleep faster and reported better quality of sleep. In addition, it has been noticed that the lowered quality of sleep has got a negative influence on i.a. energy levels and staying alert.

Key words:
sleep, physical activity, the elderly, geriatrics

Sleep is defined as a physical state of central nervous system during which a periodic cessation of physical activity and consciousness in the circadian rhythm occurs. Proper functioning of the body requires between 4 to 10 hours of sleep. Nevertheless, the demand for sleep is individual and changes with age. Important physiological processes take place during sleep i.a. body and mind regeneration, memory processes consolidation and the creation of new connections between neurons. Also, the secretion of anabolic hormones which precipitate cells reconstruction and the amount of mitotic division [1,2] increases.

Phases of sleep are divided into: non-rapid eye movement sleep (NREM) and rapid eye movement sleep (REM). The phases alternate and one cycle lasts about 70 to 120 minutes. During the night 4 to 6 cycles can be observed. With age the proportion of phases duration and stages decreases. In newborns REM phase encompasses 50% and in adults and older people about 20%. In the elderly REM phase may not occur at all [3].

Research shows that over the half of people over the age of sixty has got problems with lowered quality of sleep caused by the increased amount of waking at night or waking up

early.

Sleep latency, that is the time needed to fall asleep measured from the moment a person lies down to falling asleep, extends and loses efficiency with age. The need for sleep declines and the elderly sleep for about 5 to 6 hours. It is caused by more frequent naps during the day and not to active lifestyle. Sleep disorders are also caused by somatic, neurological and mental diseases. In the elderly, sleep disorders hinder functioning during the day and they have a negative influence on health - both mental and physical, and they predispose to cognitive functions disorders or memory processes. They can also cause difficulties in making decisions and solving everyday life problems. They cause elevated level of anxiety and lead to weakening organism's immune functions. Chronic sleep disorders can be the cause of serious health problems [4,5].

Pharmacological treatment of sleep disorders is effective, however carries certain risks: it can cause disorientation and drowsiness during the day, weaken cognitive functions and memory processes. Sometimes it causes problems with motor coordination, what, as a result, increases the risk of falls and fractures. Furthermore, barbiturates may interact with other pharmaceuticals and weaken or enhance their effect. Studies show that non-pharmacological methods of sleep disorders treatment are as effective and much safer. These methods include: behavioural therapy (however not available easily) and introduction of regular physical activity and taking care of the proper sleep hygiene [6,7].

Aim of the study

The aim of the study is to examine the connection between physical activity and the quality of sleep in the population of the elderly.

Material and methods

The studied group consisted of 100 randomly selected elderly patients of clinics in Bydgoszcz in the age from fifty to seventy-five.

Research for the study was made by means of anonymous survey which consisted of

two questionnaires: The Pittsburgh Sleep Quality Index (PSQI)[8] and The International Physical Activity Questionnaire (IPAQ). IPAQ questionnaire assesses the quality of sleep in the last 4 weeks. Constituent aspects are assessed: time needed to fall asleep, sleep duration, sleep effectiveness, sleep disorders, barbiturates intake, subjective sleep quality assessment and difficulties in functioning during the day. First four questions evaluate time of going to bed, time needed to fall asleep, moment of waking up and average length of sleep. The answers require to state specific values expressed in minutes or hours. Next question consists of 10 subsections in which the frequency of certain problems influencing the quality of sleep is marked. These are i.a. waking at night or before dawn, going to the toilet, problems with breathing, loud snoring, temperature in the bedroom, pain occurrence or other reasons. In these questions the frequency was marked according to following answers: not once during the past 4 weeks, less than once during the week, once or twice during the week and three times or more during the week. In the next question the subjects are to assess their quality of sleep starting with very good, quite good, rather bad or very bad. The next question checks the frequency of barbiturates usage. The last two questions concern the frequency of feeling lack of energy during the day and problems with staying alert. Second questionnaire consists of 7 questions concerning different types of physical activity connected with everyday life, work and rest during the last 7 days. The activities that last minimum of 10 minutes without brakes are taken into consideration. The subject determines incidence and duration of activities that demand intense and moderate physical effort, walking and sitting during the day.

Methods of statistical analysis

All of the obtained results were entered into the STATISTICA 13 database. Calculations of basic statistical characteristic were applied to the studied parameters. Numerical amount of answers and percentage share in the population were calculated. The results were presented by means of bar charts. Spearman's rank correlation coefficient was used. Value of $p \leq 0.05$ was identified as statistically significant level. The results of correlation were presented by means of scatterplots. The strength of correlations (R Spearman):

- less than +/- 0.2 ◊ weak correlation (practically no dependence)
- from +/- 0.2 to +/- 0.4 ◊ low correlation (marked dependence)
- from +/- 0.4 to +/-0.6 ◊ moderate correlation (significant dependence)
- from +/- 0.6 to +/-0.8 ◊ high correlation (major dependence)
- from +/- 0.8 to +/-0.9 ◊ very high correlation (very high level dependence)
- from +/- 0.9 to +/-1.0 ◊ practically full dependence.

Results

Obtained data presenting correlations between results from The Pittsburgh Sleep Quality Index (PSQI) and The International Physical Activity Questionnaire are shown in Table 1.

Tab.1. Correlations between results from The Pittsburgh Sleep Quality Index (PSQI) and The International Physical Activity Questionnaire

Correlations of the studied parameters of physical activity and sleep quality.	1. Intense physical effort during the last 7 days [in days]	2. Moderate physical effort during the last 7 days [in days]	3 .Walking during the last 7 days [in days]	4. Walking during these days [minutes]
1. Time of going to bed	0,07	0,03	-0,06	0,14
3. Time of getting up	0,04	0,05	-0,05	-0,01
5a. Poor quality of sleep: Could not fall asleep during 30 minutes	-0,28*	-0,11	0,02	-0,06
5b. Poor quality of sleep: Waking up at night or before dawn	-0,30*	-0,30*	0,00	-0,06
5c. Poor quality of sleep: Going to the toilet	-0,05	0,13	-0,01	-0,27*

5d. Poor quality of sleep: Problems with breathing	-0,01	0,04	0,08	-0,01
5e. Poor quality of sleep: Cough or loud snoring	0,08	0,00	-0,15	0,10
5f. Poor quality of sleep: Too cold	0,14	-0,09	0,11	-0,07
5g. Poor quality of sleep: Too hot	0,13	0,10	0,17	0,04
5h. Poor quality of sleep: Bad dreams	-0,11	-0,01	0,02	0,15
5i. Poor quality of sleep: Pain	-0,10	0,06	0,01	-0,20
5j. Poor quality of sleep: Other reasons	0,11	-0,02	-0,07	-0,05
6. Quality of sleep	0,12	0,27	0,03	0,22
7. Barbiturates	-0,15	0,02	0,00	0,02
8. Problems with staying alert	0,01	-0,15	-0,02	-0,02
9. Lack of energy	-0,08	-0,19	-0,06	-0,11
10a. Snoring	-0,18	-0,04	-0,06	-0,21*
10b. Pauses in breathing	-0,11	-0,07	-0,03	-0,14
10c. Physiological myoclonus	0,26*	0,03	-0,02	0,07
10d. State of agitation or orientation disorders at night	-0,03	-0,06	-0,12	-0,07

Dependence of the incidence of activities demanding intense physical effort during the day to the incidence of not being able to fall asleep within 30 minutes was marked and statistically significant ($p<0.05$) and equalled $R=0.23$. This dependence means that the more frequently the subjects performed activities demanding intense physical effort, the more rarely they were unable to fall asleep within 30 minutes. The dependence is presented in Figure 1.

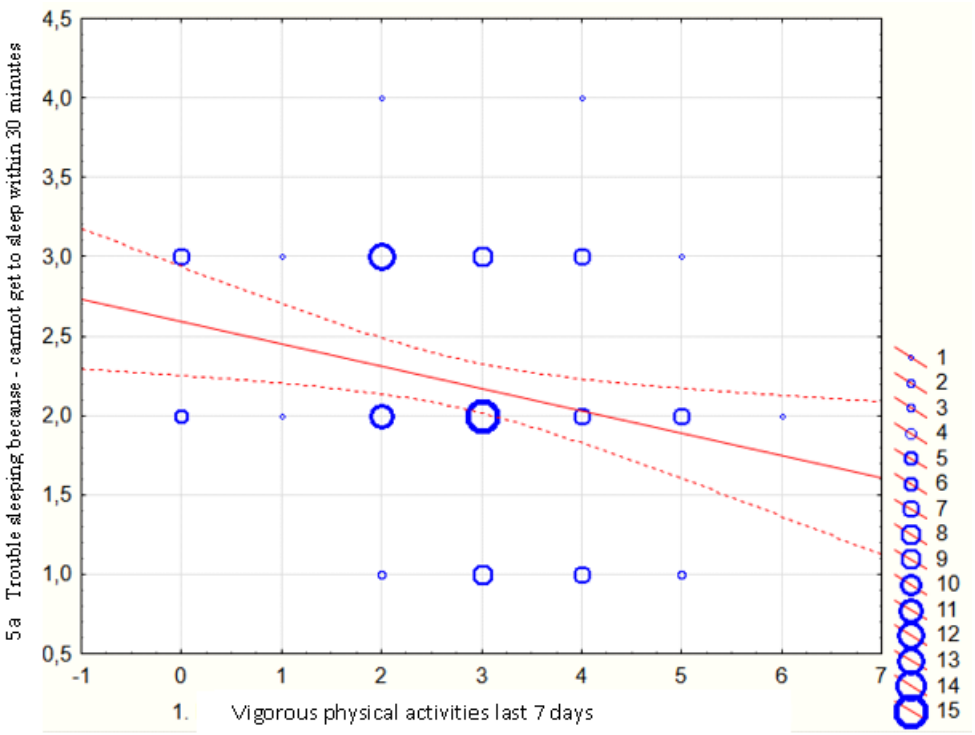

Fig.1. Dependence of the incidence of activities demanding intense physical effort during the day to the incidence of not being able to fall asleep within 30 minutes

The dependence of frequency of performing activities demanding intense physical effort to the frequency of waking at night or before dawn was marked and statistically significant ($p<0.05$) and equalled $R=0.23$. The dependence means that the more frequently the subjects performed activities demanding intense physical effort, the more rarely they woke up at night or before dawn. The dependence is presented in Figure 2.

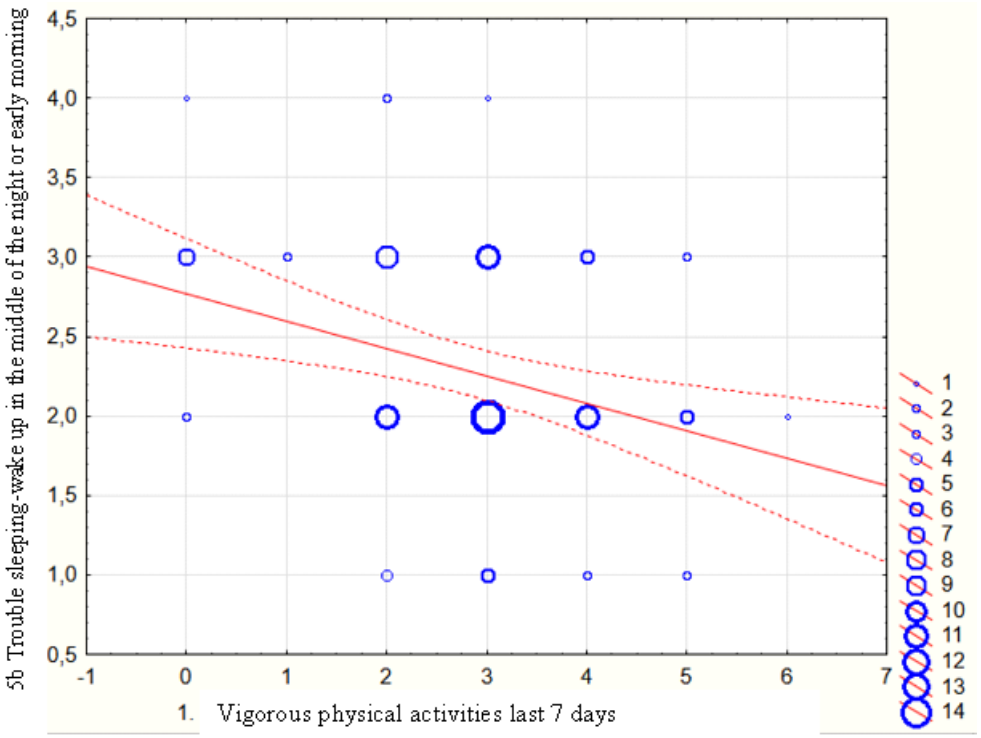

Fig. 2. The dependence of frequency of performing activities demanding intense physical effort to the frequency of waking at night or before dawn

Dependence of frequency of performing activities demanding intense physical effort during the day to frequency of waking caused by physiological myoclonus was marked and statistically significant ($p<0.05$) and equalled $R=0.23$. The dependence means that the more frequently the subjects performed activities demanding intense physical effort, the more frequently the subjects experienced physiological myoclonus. The dependence is presented in Figure 3.

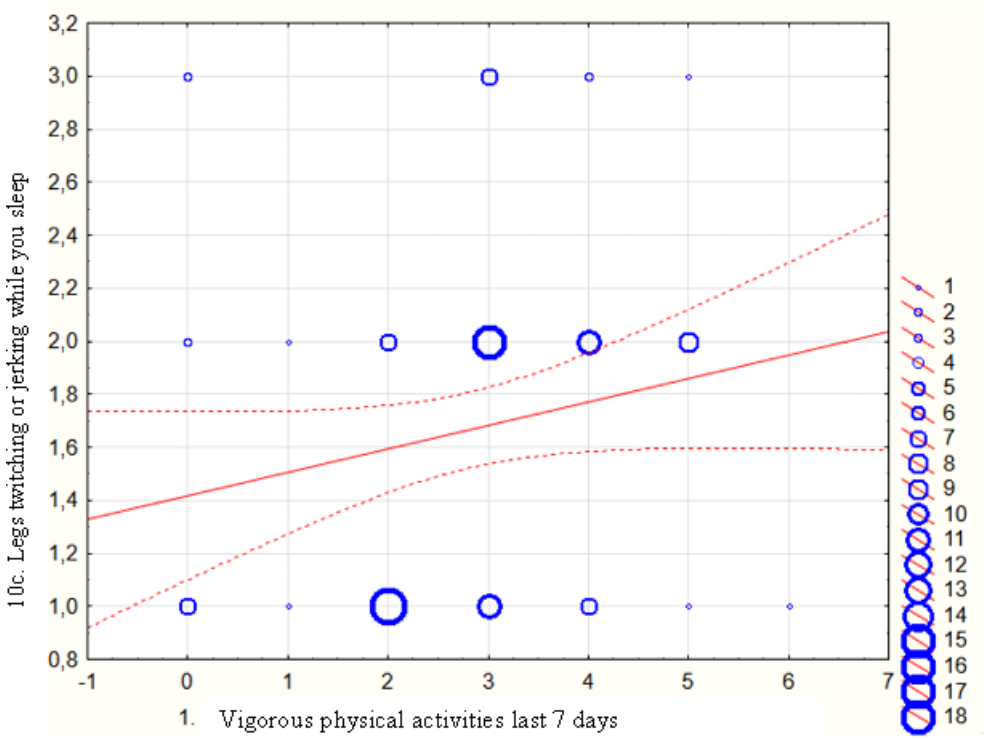

Fig. 3. Dependence of frequency of performing activities demanding intense physical effort during the day to frequency of waking caused by physiological myoclonus.

Dependence of performing activities demanding moderate physical effort during the day to frequency of reporting low quality of sleep caused by waking at night or before dawn was marked and statistically significant ($p<0.05$) and equalled $R=0.23$. The dependence means that the more frequently the subjects performed activities demanding moderate physical effort the more rarely they woke up at night or before dawn. The dependence is presented in Figure 4.

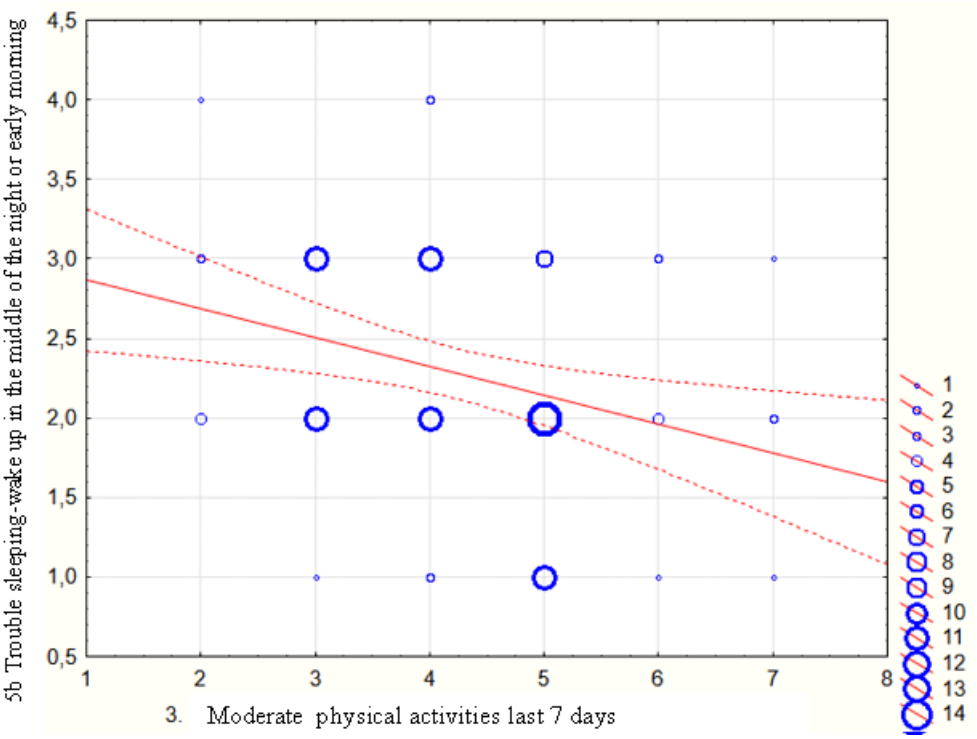

Fig. 4. Dependence of performing activities demanding moderate physical effort during the day to frequency of reporting low quality of sleep caused by waking at night or before dawn

Dependence of frequency of performing activities demanding moderate physical effort during the day to the quality of sleep was marked and statistically significant ($p<0.05$) and equalled $R=0.23$. The dependence means that the more frequently the subjects performed activities demanding moderate physical effort, the more frequently they defined sleep quality as quite good or very good. The dependence is presented in Figure 5

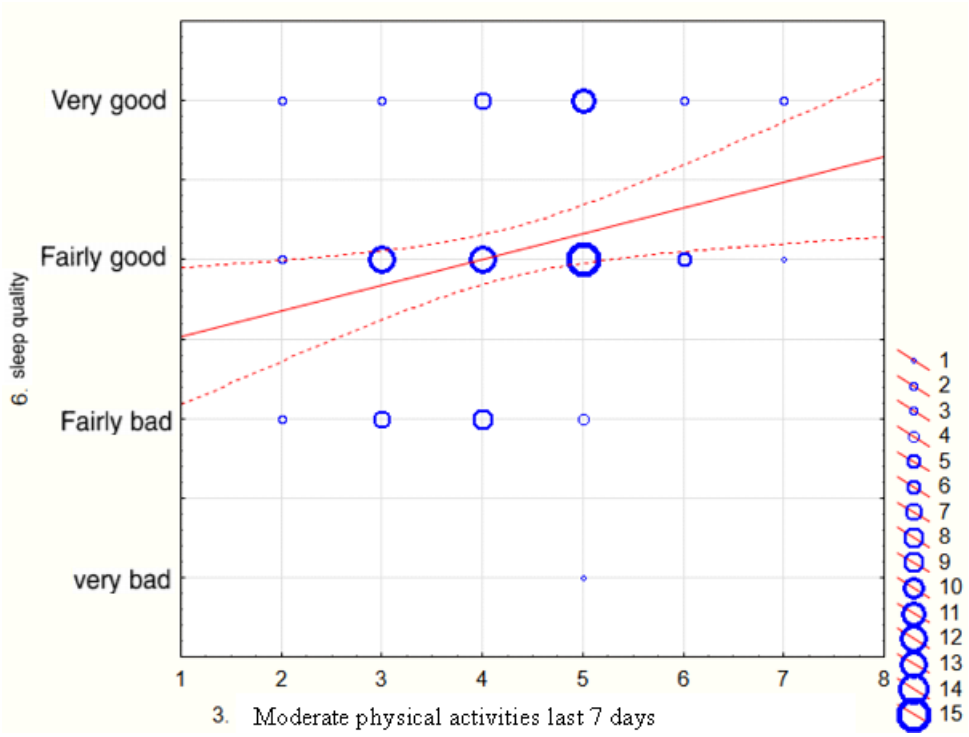

Fig. 5. Dependence of frequency of performing activities demanding moderate physical effort during the day to the quality of sleep.

Dependence of duration of walking to the frequency of subjects reporting low quality of sleep caused by going to the toilet was marked and statistically significant ($p<0.05$) and equalled $R=0.23$. The dependence means that the longer the subjects walked, the less often they went to the toilet. The dependence is presented in Figure 6.

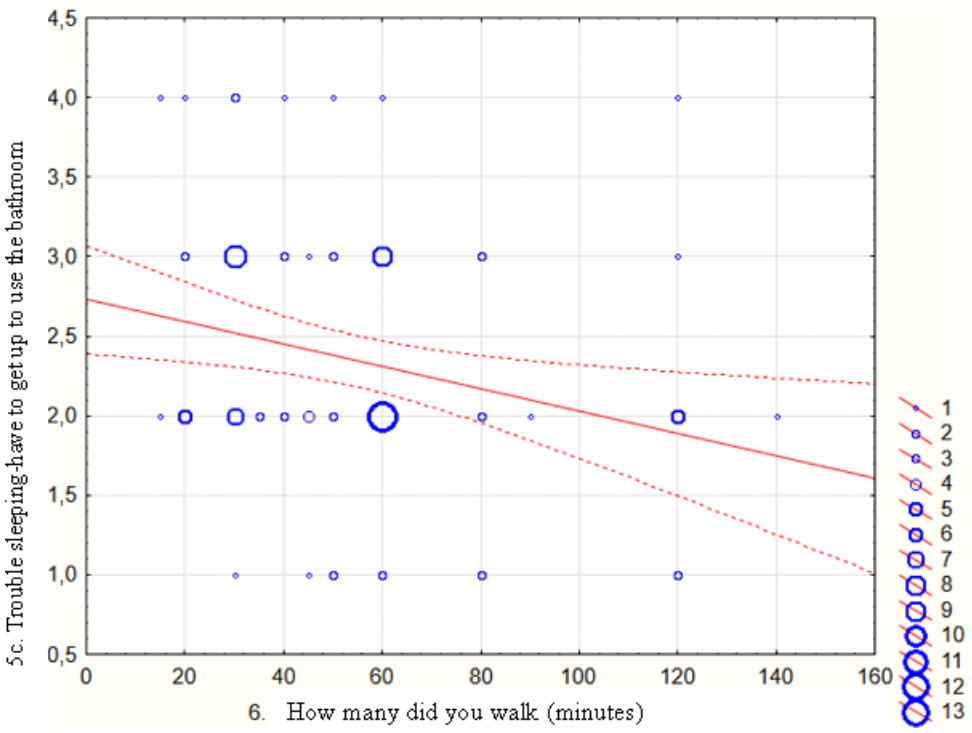

Fig. 6. Dependence of duration of walking to the frequency of subjects reporting low quality of sleep caused by going to the toilet

Dependence of walking duration in minutes to the frequency of reporting low quality of sleep caused by snoring was marked and statistically significant ($p<0.05$) and equalled $R=0.23$. The dependence means that the longer the subjects walked, the less often they woke up because of snoring (Figure 7.).

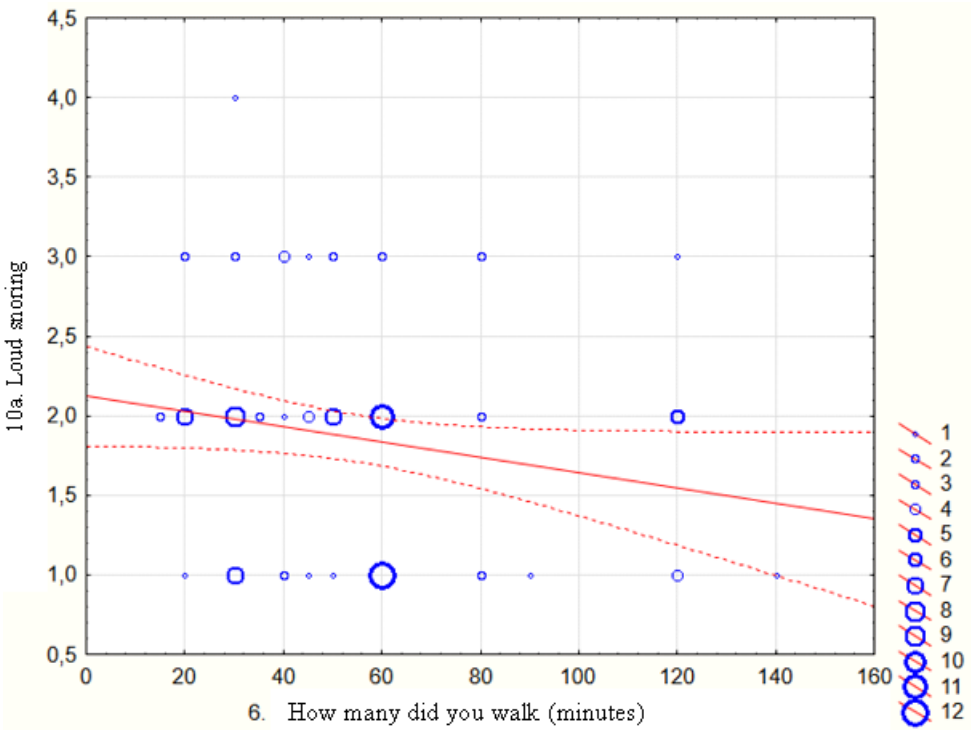

Fig.7. Dependence of walking duration in minutes to the frequency of reporting low quality of sleep caused by snoring

Dependence of walking to sleep quality was marked and statistically significant ($p<0.05$) and equalled $R=0.23$. The dependence means that the longer the subjects walked, the more frequently they defined the quality of sleep as quite good or very good. The dependence is presented in Figure 8.

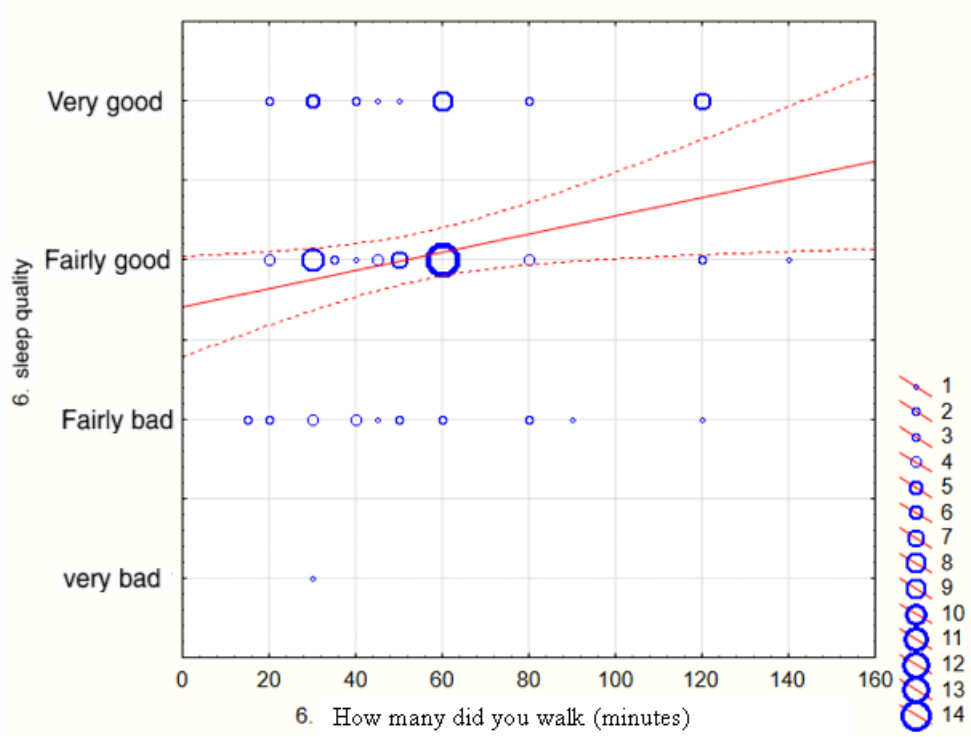

Fig.8. Dependence of walking to sleep quality

Discussion

Previous research carried out in a similar subject area showed that lowered quality of sleep in the elderly is a big problem and that the solution may be regular physical activity. In a systematic review of literature made by Pei- Yu Yang in meta-analysis concerning "Exercise Training Improves Sleep Quality in Middle-aged and Older Adults with Sleep Problems: a Systematic Review". Middle-aged and older people suffering from insomnia, depression or lowered sleep quality participated in the study. The subjects took part in circuit training, walks or Tai Chi or in a programme based on resistance exercises. The subjects reported improvement in the subjective sleep quality, shortening sleep latency duration and barbiturates usage. Sleep duration did not lengthen, however sleep quality improved. Yang came to a conclusion that physical activity improves the quality of sleep in the middle-aged and elderly people and can be an alternative to the existing methods of sleep disorders treatment [9].

Abby King and Leslie Pruitt came to similar conclusions, which were described in the

article “Effects of Moderate-Intensity Exercise on Polysomnographic and Subjective Sleep Quality in Older Adults With Mild to Moderate Sleep Complaints”. Subjects at the age of fifty five and more with mild or moderate problems with sleep quality participated in the study. The subjects were randomly assigned to two groups, the first group took part in 12-month programme of circuit training of moderate intensity, whereas the second group was assigned to health education control programme (control group). The group which executed the circuit training programme reported both subjective and objective sleep quality improvement and the duration of the second sleep phase lengthened, waking at night diminished in number and sleep latency shortened. The subjects also reported that they wake up well-rested. In the group that took part in the health education control programme no improvement of sleep parameters was observed [10].

A research studying the influence of Tai Chi on the improvement of sleep quality was also carried out. Aileen Chan and Doris Yu in the article “Tai Chi Qigong as a Means to Improve Night-time Sleep Quality Among Older Adults with Cognitive Impairment: a Pilot Randomized Controlled Trial” described their study which examined the elderly with cognitive impairment and sleep disorders. The subjects were divided into two groups: one control group and the second group, which took part in Tai Chi Qigong programme with 2 sessions of 60 minutes every week for 2 months. The participants of Tai Chi Qigong group reported improvement of sleep and life quality. The conclusion is that even in the elderly with cognitive impairment Tai Chi Qigong can be successfully used as a non pharmacological treatment of sleep disorders in the elderly with cognitive impairment [11].

Next study of similar subject matter was carried out by Michael Irwin and Richard Olmstead and presented in their dissertation „Improving Sleep Quality in Older Adults with Moderate Sleep Complaints: A Randomized Controlled Trial of Tai Chi Chih”. Group of 112 volunteers in the age of 59-86 who reported moderate sleep disorders took part in 16-week Tai Chi training, which took place 3 times a week for 120 minutes. The subjects reported improvement of sleep quality, hence the researchers came to a conclusion that Tai Chi Chih can also be used as a non pharmacological method to fight lowered sleep quality in the

elderly [12].

The carried out study indicates that regular physical activity influences sleep quality by improving such parameters as lengthening sleep duration, shortening sleep latency or diminishing the number of waking at night, all of which improve sleep effectiveness. The research also showed that sleep disorders frequently occur in the elderly and have negative influence on their functioning during the day causing problems with staying alert and lack of energy.

Conclusions

Based on the carried out studies the following conclusions were drawn:

1. People who were physically active reported better sleep quality and slept longer, woke up at night less frequently and fell asleep faster.

2. People reporting problems with sleep more frequently experienced lack of energy or problems with staying alert during the day.

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