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PARKINSON'S DISEASE, EXERCISE THERAPY AND ACTIVITY OF DAILY LIVING

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ABSTRACT
Parkinson's disease (PD) is a progressive neurological disease with tremor, bradykinesia, akinesia and rigidity. These symptoms significantly hamper the performance of activities of daily living (ADL), which are necessary for normal functioning of every individual. Exercise therapy is part of physical medicine which is using movements and strength of muscles to aim healing, improvement of health, preventing disabilities and acomplishing higher grade of funcitionality. Often exercise therapy is combined with other therapies of physical medicine. The aim is to examine effects of exercise therapy on ADL in patients with Parkinson's disease. There were 40 examinees who had exercise therapy. In the conducted study there was increased representation of female gender, with no statistically significant difference in representation. Average age of examinees was 73,9±11,6 years and duration of hospitalization in group of examinees was 27,1±12,2 days. Comparation of average values between Barthel index (BI) as patients were admitted and released shows that Barthel index was increased from 10,7±6,3 when patients were admitted to 12,45±6,2 which was statistically significant. Statistical analysis showed that difference between genders is not statistically significant (p>0,05), meaning that influence of gender isn't important when Barthel index was measured. Corelation analysis of age and duration of hospitalization on Barthel index showed that non of monitored parametar has not statistically significant influence on improvement of Barthel index. Exercise therapy shows statistically significant improvement in activities of daily living, measured with Barthel index.

KEYWORDS: Parkinson's disease, exercise therapy, activities of daily living, Barthel index.

INTRODUCTION
Parkinson's disease (PD) is a progressive disorder of nervous system who has influence on movement, and is characterized by tremor, akinesia, bradykinesia and rigidity. It develops gradually, sometimes starting with barely noticeable tremor of one hand, or other symptoms who don't imply on this disease.[1]

Etiology of parkinsonism (including Parkinson's disease) can be: primary, secondary, atipically and parkinsonism with genetically inheritable neurodenerative diseases. Primary parkinsonism is idiopathic (unknown origin). Secondary parkinsonism has familiar cause or factors (medications). Atipical parkinsonism has also other disorders included, who don't exist in Parkinson's disease.[2]

Functional disability in patients with Parkinson's disease is known as bradykinesia. In the begining patients have problems with simple activities of daily living (ADL) (dressing up, feeding, etc.). Patients face is like a mask with uncontrolled swelling of saliva and swallowing. Their attitude of entire body is tipical, they are lean in front with bent knees and elbows (like skier). Patient's with PD find hard to start walking, they walk with small steps and small speed, with less moving they feet from floor, and these changes have influence in ADL. Their walk is instable, hard or immobile which makes them prone to falls.[3]

Rigidity is present in musculature and resistance in pasive movements. Patients also have tremor, who is in the begining intermittent, and is losing when they make movement during the sleep. Talk is unclear, incomprehensible, quieter and monotone. Further

progression of disease leads to: anxiety, sleeping disorders, tiredness, disorder of intestinal peristalsis, constipation, disorder of sweating, depression, cognitive disorders and other.[4]

Parkinson's disease starts usually between 50.-70. years of life. Before new pharmacotherapies, length of life after diagnosis was 8-10 years, but today length of life and quality of life is improved because of medical care, therapy and other measures.[5]

Pharmacotherapy which is used in treatmen of PD is symptopmatic and depends on the progress of disease. The best way is to combine terapheutic dose which will lead to reduction or withdrawl of symptoms with minimal side effects.[6] Treatman of PD is focused on saving patients indenpendance and quality of life.[7]

Exercise therapy is part of physical medicine which is using movements and strength of muscles to aim healing, improvement of health, preventing disabilities and acomplishing higher grade of funcitionality. This type of therapy prevents secondary complications who are related with less movement or immobility. This method connects healthcare and physical movements, and it can be applied independently or in combination with other methods of healing. It is very important to know how to exercise properly and how to adjust exercises to every single patient, so that they don't lead to fatigue. It is very important for patients to start exercising well rested, properly dressed and in adequate space. Exercise therapy has direct impact on attitude, walks, easier movements and other everyday activities.[8]

Although symptoms of PD are progressive, other unpharmacological treatmens, like rehabilitation programs are very effective. Rehabilitation aims to save motor functions, to reduce risk of complications including fallings, respiratory infections and unproductive syndrom. Rehabilitation could slow down progression of motoric disability and it could improve prognosis.[9] Dysfuncion of balance and postural instability are usually find in middle and later stages, and isn't controlled easy by medications.[10]

In last decade there has been more information about understanding motor function and types of exercises for physical and functional improvement of individuals with PD, and posibility of reorganization of brain and self-help.[8] Patients with disabilities are less physically active comparing to patients without disabilities. In PD individuals with early and middle stage of disease have bigger reduction in physical activity than individuals with atipical type of PD in the same age.[11] Furthermore, inactivity is important factor in acceleration of degenerative process in PD.[12]

In patient's with PD the therapy focuses on muscles who are incharge of movements which are necessary in ADL. That includes exercises of general coordination, balance, and relaxing exercises because they reduce tremor and improve coordination of muscles, exercises to maintain range of motion, and special exercises who reeducate patients to walk properly. Exercise are important and they need to apply on entire body. Another benefit of exercising is positive effect on cardio-respiratoy system.[8,13]

Exercises protects and promotes regeneration of damaged nerves, and they also improves balance, physical condition, indenpendance, making positive effect on ADL. With apropriate intensity of exercises, levels of dopamin can be higher and motor problems can be reduced. Treatmen in PD should include pharmacotherapy in combination with exercise therapy.[14]

Quality of life is very important especially for individuals with PD, which makes quality of life and social skills lower and makes participation more difficult. Individuals who participate in ADL are less depressive and they have better condition and better quality of life.[15]

The aim is to examine effects of exercise therapy on ADL in patients with Parkinson's disease.

MATERIALS AND METHODS

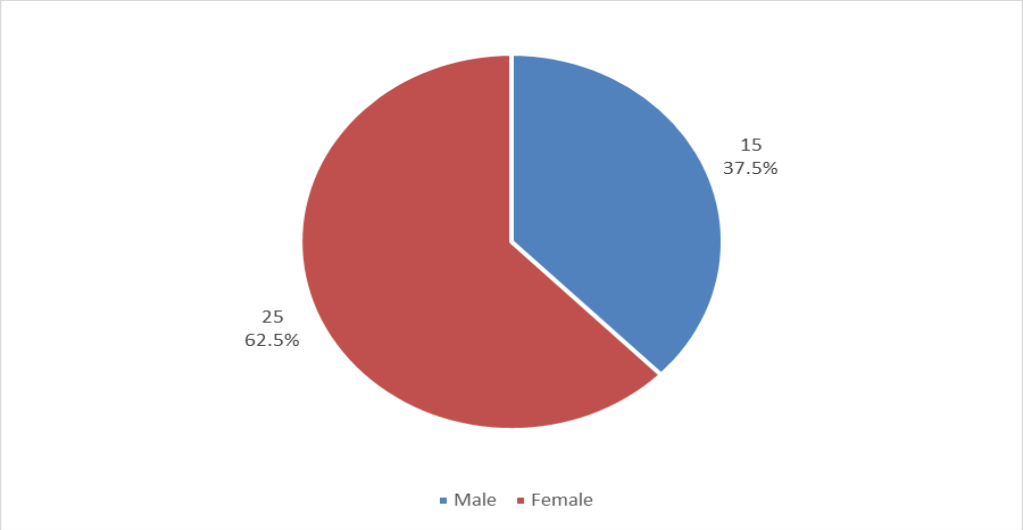
Research is designed as clinical, retrospective and prospective study. Research was made on Clinic for Physical Medicine and Rehabilitation in Clinical Center University of Sarajevo. Study included 40 examinees. All of them had PD and all of them had exercise therapy. Examinees, based on collected data make group with exercise therapy as choosed method of healing. This group was monitored especially their effects of healing, their results were compared with similar researches. Diagnosis was established by specialist of neurology, based on anamnesis, physical review and existing medical documents. We analysed based on criteria the following data: age, gender, length of hospitalization, additional other methods of physical therapy, ADLwhich was measured with BI as they were admitted and released.

Results were shown in tabels and graphical with number of cases, percentage, arithmetic mean with standard deviation, standard error of arithetic mean and range of values.

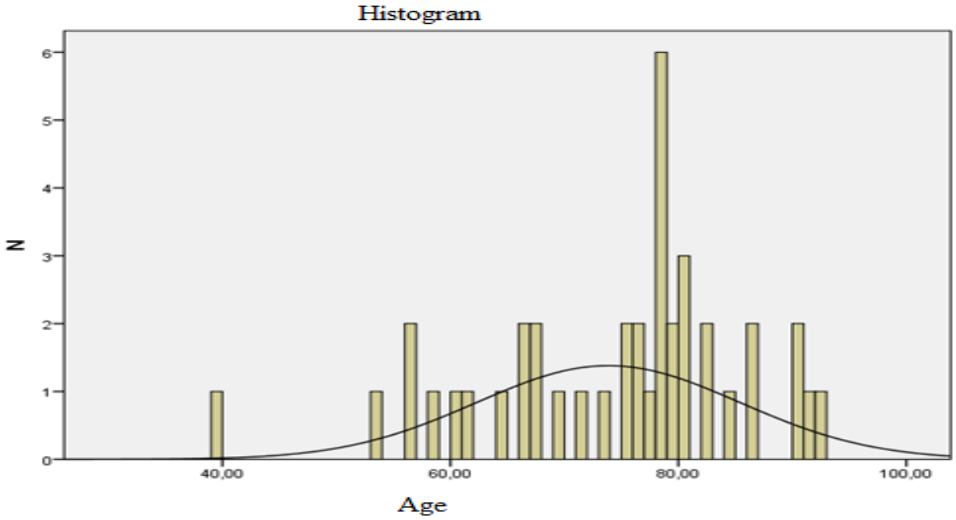
Statistical analysis was made using Hi-square test, Student t-test and Pearson's coefficient linear corelation. Results of this tests showed significant results in reability of 95% or $p<0,05$.

Analysis used statistical package IBM Statistics SPSS v23.0.

RESULTS



Gender distribution shows that in this group was more woman with 25 or 62,5% compared to man with 15 or 37,5%. Statistical analysis form Hi-square test shows that there is no significant difference between gender compared to expected (p>0,05).



Picture 1. Average age of examinees.

Average age of examinees was 73,9±11,6 years with youngest examinee at age 39 and oldest examinee at age 92. Based on interval of reability from 70,2 to 77,5 years, we can conclude that 95% of examinees will be in this age group. Statistical analysis of Student t-test shows that there is significant difference in distribution of age, because there are more older examinees then expected (p<0,05).

Table 1: Duration of hospitalization (days).

Duration of hospitalization	
Average	27,1000
Std. error	1,92214
Median	26,0000
Std. deviation	12,15667
Minimum	3,00
Maximum	62,00

t=4,099; p=0,0001

Average duration of hospitalization in group of examinees was 27,1±12,2 days, where shortest duration was 3 days, and longest duration was 62 days.

Interval of reability is 95% which is 23,2 to 30,8 days, then we can say that most of the examinees will have duration of hospitalization in this range.

Statistical analysis of Student t-test showed significant differences in average duration of hospitalization in benefit of hospitalization which was between 25 and 30 days (p<0,05).

Table 2: Other therapies.

Other therapies		
	N	%
Pharmacotherapy	39	97,5
Electrotherapy	8	20,0
Occupational therapy	14	35,0
Sonotherapy	3	7,5
Magnetotherapy	1	2,5
Cryomassage	1	2,5

$\chi 2$=7,205; p=0,0001

Pharmacotherapy is mostly used therapy in 39 or 97,5% cases, then occupational therapy in 14 or 35% cases, electrotherapy in 8 or 20% cases, sonotherapy in 3 or 7,5%, and magnetotherapy in 1 or 2,5% cases. Statistical analysis of Hi-square test showed that there is significant difference in distribution of other therapies in benefit of pharmacotherapy and occupational therapy (p<0,05).

Table 3. Comparation of Barthel index as patients were admitted and released

Statistics			
	Barthel index when patient is admitted	**Barthel index when patient is released**	**Barthel indeks razlika**
Average	10,7250	12,4500	1,7250
Std. error	,99098	,97924	,38395
Median	12,5000	15,0000	1,5000
Std. deviation	6,26749	6,19326	,42833
Minimum	,00	,00	-5,00
Maximum	20,00	20,00	10,00

t=-4,493; p=0,0001

Comparation of average values between Barthel index as patients were admitted and released shows that Barthel index was increased from 10,7±6,3 (range 0-20) when patients are admitted to 12,45±6,2 (range 0-20).

Statistical analysis shows that this increase is statistically significant (p<0,05), because exercise therapy has influence on improvement measured by Barthel index.

Average improvement was 1,7±0,4 with lowest improvement at -5, and the highest improvment at +10.

Table 4: Analysis influence of gender on improvement measured by Barthel index.

Descriptive						
	N	**Average**	**Std. deviation**	**Std. error**	**Minimum**	**Maximum**
Male	15	2,6000	3,06594	,79162	-1,00	10,00
Female	25	1,2000	1,82574	,36515	-5,00	5,00
Total	40	1,7250	,42833	,38395	-5,00	10,00

t=3,300; p=0,077

Analysis influence of gender on improvement measured by BI showed that better improvement was at male examinees with average improvement from 2,6±3 compared to female examinees with average improvement from 1,2±1,8.

Statistical analysis showed that difference between genders is not statistically significant (p>0,05), meaning that influence of gender isn't important when BI was measured.

Table 5: Corelation analysis of age and duration of hospitalization on Barthel index.

Corelation		
		Barthel index (difference)
Age	rho	,128
	p	,430
	N	40
Duration of hospitalization (days)	rho	,178
	p	,271
	N	40

Corelation analysis of age and duration of hospitalization on BI showed that non of monitored parametar has not statistically significant influence on improvement of BI. Nevertheless, we can say that age and hospitalization has small impact on improvement of BI in a way that better improvement is showed at older examinees with longer duration of hospitalization.

DISCUSSION

Exercise therapy is method of healing and rehabilitation which is part of physical medicine who is successfully applied as method of healing in other patients. This method uses resourses of every individual, meaning it uses strength of muscles and their movement to aim better function and healing. It is very simple and doesn't require equipment, space or apparatus which makes it great choice for rehabilittion of patients.

This research shows that patients who were included were 62,5% females and 37,5% males, which represents statistically significant difference from epidemiological data who shows that PD has greater impact on males, or at least is evenly distributed.[1] Statistical analysis shows that Hi-square test gives results that there is no significant difference in gender distribution compared to expected.

Average age of examinees was 73,9±11,6 years, the youngest examinee was at age 39 and the oldest examinee was at age 92. Statistical analysis shows that there is stastically significant difference in expected distribution of age in monitoring group in benefit of older age patients. This data are similar with the one in literature.[2]

Except exercise therapy, the most used method of healing is pharmacotherapy, than occupational therapy, electrotherapy, sonotherapy and magnetotherapy. Statistical analysis of Hi-square test shows that there is stastically significant difference in expected distribution of other therapies in benefit of pharmacotherapy tehrapy and occupational therapy ($p<0,05$). This data are similar with other researches of this type.[16,17,18]

Average duration of hospitalization was 27,1±12,2 days. Statistical analysis shows that there is stastically significant difference in average length of hospitalization in benefit of length hospitalization which was between 25 and 30 days ($p<0,05$). This data are not smiliar with other researches, because they didn't show this results.[18]

Comparation of average values BI as patients were admitted and released shows increase from 10,7±6,3 when patients were admitted to 12,45±6,2 when patients were released. Statistical analysis shows that this increase is stastistically significant ($p<0,05$), meaning that exercise therapy has influence on better everyday activity measured by BI.

Analysis of gender influence on BI showed greater increase in males with average of 2,6±3 comparing to average increase of BI in females 1,2±1,8. Statistical analsys shows that this difference between gender isn't statistically significant ($p>0,05$), which means that gender hasn't major influence on BI.

Corelation analysis of age and duration of hospitilization on BI shows that none of those parametars has statistically significant influence on increase of BI. Furthermore, we can say that age and duration of hospitalization have mild influence on increase of Barthel index, meaning that increased BI is in patient is in older patient who had longer duration of hospitalization. From this data we can clearly imply that there is positive effect from exercise therapy on patients with PD.

Many studies researched influence of exercise therapy on patients with PD, and most of them showed positive consequences of exercise therapy or its modifications in this types of patients.
Study which examined influence of dance in virtual reality on balance, everyday activities in life and depression disorders in patients with PD showed significant difference in balance, ADL and depression disorder in experimental and control group. Positive effect of dance was proved in all three types of patients with PD.[15,19]

Authors Cugusi L et al. were researching influence of modificatied physical activity on motor and non-motor function and quality of life in patients with PD. Results od study showed that there is increase in distance that patient could walk on their own, significant increase of balance and safety in movements of muscle strength. Authors of study concluded that patients with modificated program of exercise therapy could be effective as additional method to conventional therapy in purpose of better everday acitivities in life, motor and non-motor symptoms with greater quality of life.[20]

Review which was made in 2012. shows effects of physical therapy comparing to placebo or no intervention in patients with PD. This review included 33 researches with 1518 patients. Results showed significant increase in examinee group where was increased speed of walking, length of walking, balance, functional mobility and results on Unified Parkinson's Disease Rating Scale (UPDRS).[21]

Baatile J. et al. studied influence of exercise therapy on quality of life in patients with PD, and results showed great benefits in patients with regular exercising. Results showed statistically significant difference, which was evaluated with UPDRS i Parkinson Disease Questionary 39 (PDQ39).[21]

Exercise therapy and its influence on bradykinesia and muscle stregth in patients with PD were studied in 2016. Results showed significant decrease of bradykinesia and significant increase of muscle strength in patients with PD, as a positive effect on physical function and quality of life.[19,22]

Effects of exercise therapy on physical and psychosocial state were examinated in patients with PD by Kwok JY et al. in 2016. Results of study showed that exercises lead to medium and large improvement of motor function, postural instability and functional mobility which improves quality of life.[23]

Influence of exercise therapy on ADL was examinated in patients with PD in study which was released in 2017. Results suggested that exercise therapy in duration of 6 month improved some aspects of ADL, where examinated group had patients with PD and was compared to control group.[24]

These and other studies suggests on positive effects of exercise therapy in patients with PD. Although, there is less number of studies that suggests absence of effects this type of healing in patients with PD. Study which was released in 2011. included 28 patients, who had exercise therapy for 12 weeks and results showed improved cognitive function on frontal lobe, but not on quality of life.[25]

There is evidently a prove in literature that exercise therapy improves physical and functional ability in different populations.[26]

Some epidemilogical studies suggests that there is inverse corelation betweem physical activity and risks from this disease. Medium and high level of physical activities are connected with less risk from progress of this disease.[27]

Growing number of studies shows that exercise therapy has great benefits on functional ability in individuals with PD than isolated medication therapy and possible surgical procedures.[28,29]

Prescribed exercise therapy was analysed in randomized controlled trials in purpose to minimize negative effects of PD on motor and function ability. This researches showed different forms of physical therapy such as specifed exercise to increase range of motions, trength of muscles, balance, general form and walk.[30-35]

CONCLUSION

Exercise therapy shows statistically significant improvement in ADL, measured with BI. Gender distribution on everyday activities in life measured with Barthel index showed greater improvement in males, but that improvement is not statistically sginificant. Improvement of motor function and activities in everyday life measured with Barthel index contributed quality of life and general condition in patients with PD. Patients are motivated to include themselves in program of rehabilitation and prevention of consequences made with immobility which is not rare in this cases. Exercise therapy has positive influence on activities in everyday life in patients with PD.

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CONFLICT OF INTEREST: NONE DECLARED.

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