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Effect of Exercises on Quality of Life in Women with Osteoporosis and Osteopenia

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A B S T R A C T

Osteoporosis is a disease characterized by decreased bone mass and impaired microarchitecture resulting in bone fragility and an increased risk of fractures. Prevention of osteoporosis and osteoporotic fractures among others include adequate physical activity. Epidemiological studies indicate that fewer fractures in active women, regardless of whether it is a result of direct effects on bone or improve coordination, balance and muscle strength. The aim of research was to examine the impact of exercise program for osteoporosis in the duration of four weeks on health and psychological aspects of patient quality of life using the questionnaire SF-36, used before and after the program. The SF-36 is used for self-assessment of health status and represents the operationalization of two general concept of health such as physical and mental health and consists of 36 particles. The study included 39 participants with osteopenia and osteoporosis. All respondents have implemented a program of exercises for osteoporosis in duration 28 days. The program consisted of exercises for osteoporosis, advice on diet, tips on preventing falls, interviews and examinations performed before and during implementation of the program. Results showed that using a short program of exercises and education leads to significant changes in self-reported quality of life of subjects. The study confirmed a statistically significant reduction in pain using a visual analog scale (VAS) before and after the program.

Key words: *osteoporosis, exercise, quality of life, body mass index*

Introduction

Osteoporosis is a disease characterized by decreased bone mass and disturbed micro architecture resulting in bone fragility and an increased risk of fractures. Prevention of osteoporosis and osteoporotic fractures involves an adequate intake of calcium and vitamin D, adequate physical activity and avoidance of risk factors that may be affected. The diagnosis of osteoporosis densitometry (DXA) is still the gold standard. Osteoporosis is a systemic skeletal disorder in which reduced bone strength and increased risk of fractures. By means of bone strength is its density and bone quality[1]. Density is the amount of mineral content per unit volume (so far the only measurable indicator of bone strength). Bone quality is its shape and volume, architecture, degree of bone turnover, cumulative damage (micro-trauma) and mineralization.

World Health Organization (WHO) has defined osteoporosis by quantitative densitometry measurements of bone mineral density (BMD) and deviations in relation to a young healthy person. According to this definition a BMD value less than –2.5 standard deviations are defined as osteoporosis, while values between –1.5 to –2.5 defined as osteopenia.

In the treatment of osteoporosis, non-pharmacological methods are an integral part of treatment. The prevalence of osteoporosis in postmenopausal women is about 20%[2]. The most important consequence of osteoporosis are fractures. In Croatia, it is estimated that about 90 000 men and 77 000 women older than 50 years has a vertebral fracture[3].

There are several published studies which proved that the regular intake of vitamin D and calcium could prevent the occurrence of osteoporotic fractures[4,5]. Physical activity is an essential element in the prevention of osteoporosis and fractures, although no consensus on the type of exercise, frequency, intensity and duration[6–10]. Epidemiological studies, however, consistently indicate

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fewer hip fractures in active women, regardless of whether the result of direct effects on bone or improve coordination, balance and muscle strength as preventing falls and/or minimize the trauma of falling[11,12]. The principle should be to recommend dynamic antigravity exercises, exercises to correct posture and the strength of extensors of the spine, exercises balance and muscles of the hip, a walk should be interrupted by short intervals (1–2 minutes) brisk walking[13].

Quality of life as a multidimensional concept that unites dignity of persons with emotional, spiritual, psychological and physical components of personality, is significantly compromised in patients with chronic disease often in all aspects as well as in patients with osteoporosis.

Aim

The objective of this study was to investigate how exercise program for osteoporosis in the duration of 4 weeks can impact on health and psychological aspects of patient quality of life using a Quality of Life Questionnaire, SF-36[14,15] before and following the program. SF-36 filled in patients themselves in the two time-points before the implementing this program and 4 weeks from the beginning of the program.

Materials and Methods

The study included 39 female patients suffering from osteoporosis and ostopenia. It was conducted program of exercises for osteoporosis in duration of 4 weeks in the Polyclinic for physical medicine and rehabilitation at Special hospital for medical rehabilitation Krapinske Toplice.

The respondent's age ranged from 36 to 84 years. The mean age is 64.47 years. Their weights are ranged from 50 to 97 kg with corresponding mean of 64.41 kg. The respondent's heights are ranged from 1.45 m to 1.79 with corresponding mean of 1.58 m. Also, respondent's body mass index (BMI) varies from 20.31 to 38.37 with corresponding mean of 25.76.

The proposed survey consisted of five parts:

1. Participants data (number of responders, age, weight, height and body mass index) presented in Table 1
2. SF-36 model measurement before medical treatment, as presented in Table 2 and
3. SF-36 model measurement after medical treatment, as presented in Table 3
4. Visual analog scale (VAS) for pain before and after the program
5. Classification patients into two groups, patients with BMI<25 and patients with BMI>25.

SF-36 model is the health status questionnaire. It is a multi-purpose, short form model containing 36 ordinal scale items on nine dimensions: physical functioning (PF), role physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role-emotional (RE) and mental health (MH). The ninth dimension is comparison of the general health status compared to the period a year ago (HT-Health Transition).

TABLE 1
SAMPLE CHARACTERISTIC

Participants data	Total
Number of respondents	39
Age (years)	64.47
Weight (kg)	64.41
Height (m)	1.58
Body mass index	25.75

The SF-36 represents theoretically grounded and empirically tested two general operationalization of the concept of health – physical health and mental health, as well as two of its general manifestation – the functioning and well-being. The SF-36 contains eight scales of health, and the total score is displayed in the form of profiles. Individual answers to each of the different particles are scored (differentially weighted) according to previously established empirical standards, with regard to the diagnostic value of particular respondents. Particle related to the change in health is reported separately, the distribution of frequencies. Furthermore, some scales or health manifestations have included a different number of particles, and their number has also been empirically determined in accordance with the psychometric criteria of reliability and validity. Therefore, the number of points recorded on each questionnaire scale transformed into standard values and calibrated on a unique scale whose theoretical minimum is 0 and the maximum 100 points. In this way it is possible to quantitatively compare the different manifestations of a questionnaire measure of health and to interpret the overall level of differentiation and profile of eight points. In addition, can be calculated two summary results of measuring results: 1. overall mental (MCS) component summary and 2. overall physical (PCS) component summary. The range of results for all dimensions was 0–100; higher score represents better quality of life.

The Croatian version of SF-36 questionnaire[16] was licensed to »Andrija Štampar« School of Public Health in 1992 as a part of the »Tipping the Balance Towards Primary Healthcare Network« project. At that time two professional translators with experience in »health and quality of life terminology« but not in SF-36, produced two independent forward translations and, after multi-professional discussions, agreed upon a common version. Data were statistically processed using Microsoft Excel for Windows Vista software.

Duration of exercise range was 30–45 min. In patients who were well-tolerated exercises was gradually increasing exercise intensity and load. Patients filled out a questionnaire SF-36 before and after the program and

TABLE 2
ITEM FREQUENCY DISTRIBUTION IN PERCENTAGE BEFORE TREATMENT

Scale	Item	Content (item)	Response percentage (%)**						Avg*
			1	2	3	4	5	6	
Physical functioning (PF)	PF1	Vigorous activities	61.5	30.8	7.7				1.46
	PF2	Moderate activities	43.6	38.5	17.9				1.74
	PF3	Lifting or carrying groceries	33.3	51.3	15.4				1.82
	PF4	Climbing several flights of stairs	46.2	41.0	12.8				1.67
	PF5	Climbing one flight of stairs	28.2	48.7	23.1				1.95
	PF6	Bending, kneeling, or stooping	46.2	48.7	5.1				1.59
	PF7	Walking more than a 1 km	43.6	33.3	23.1				1.79
	PF8	Walking several blocks (around 500 m)	33.3	38.5	28.2				1.95
	PF9	Walking one block (around 100 m)	25.6	33.3	41.0				2.15
	PF10	Bathing or dressing	28.2	43.6	28.1				2.00
Role-physical (RF)	RP1	Cut down amount of time...	74.4	25.6					1.26
	RP2	Accomplished less...	74.4	25.6					1.26
	RP3	Limited in kind of work...	84.6	15.4					1.15
	RP4	Difficulty performing the work....	89.7	10.3					1.10
Bodily pain (BP)	BP1	Intensity of bodily pain	10.3	30.8	35.9	5.1	12.8	5.1	2.95
	BP2	Pain interfered with normal work	10.3	43.6	20.5	20.5	5.1		2.67
General health (GH)	GH1	Health in general...	0.0	5.1	12.8	30.8	51.3		1.72
	GH2	...get ill more easily...	2.6	30.8	38.5	7.7	20.5		3.13
	GH3	...as healthy as anybody...	2.6	15.4	33.3	23.1	25.6		2.46
	GH4	I expect my health to get worse	10.3	20.5	61.5	5.1	2.6		2.69
	GH5	My health is excellent	0.0	12.8	7.7	28.2	51.3		1.82
Vitality (VT)	VT1	Feel full of pep	5.1	28.2	35.9	15.4	10.3	5.1	3.13
	VT2	Have a lot of energy	10.3	46.2	15.4	15.4	10.3	2.6	2.77
	VT3	Feel worn out	5.1	12.8	30.8	28.2	15.4	7.7	3.41
	VT4	Feel tired	5.1	10.3	23.1	25.6	15.4	20.5	3.03
Social functioning (SF)	SF1	Extent of interference with SF	2.6	12.8	33.3	28.2	23.1		3.56
	SF2	Frequency of interference with SF	15.4	17.9	33.3	28.2	5.1		3.23
Role-emotional (RE)	RE1	Cut down amount of time...	53.8	46.2					1.46
	RE2	Accomplished less...	53.8	46.2					1.46
	RE3	Didn't do work as carefully...	59.0	41.0					1.41
Mental health (MH)	MH1	Been a very nervous person	5.1	10.3	10.3	41.0	25.6	7.7	3.95
	MH2	Felt down in the dumps	2.6	5.1	17.9	30.8	20.5	23.1	4.31
	MH3	Felt calm and peaceful	12.8	25.6	30.8	12.8	17.9	0.0	2.97
	MH4	Felt downhearted and blue	5.1	2.6	5.1	51.3	25.6	10.3	4.21
	MH5	Been a happy person	5.1	20.5	33.3	33.3	7.7	0.0	3.18
Health transition (HT)	HT1	Health now compared to 1 year ago	20.5	23.1	28.2	25.6	2.6		2.67

*Avg – average mark, **high score indicates a good health or characteristic

determine the intensity of pain using VAS. Filling the questionnaire is adapted to the patient and requires approximately ten minutes time.

The visual analog scale (VAS) of pain is generally accepted by clinicians to evaluate of pain. It is a 100 mm scale, which is on the left marked »no of pain« and on the right »severe pain«. The patient simply mark the intensity of pain and a centimeter tape measured.

Results

Table 2 and Table 3 show the item frequency distribution for the total population before and after medical treatment, respectively. For all items, the answer distribution was skewed. Respondents are scored »high« in the favourable health/social categories. It means that »high« score is favourable positive feelings and health conditions in comparison with »low« score.

TABLE 3
ITEM FREQUENCY DISTRIBUTION IN PERCENTAGE AFTER TREATMENT

Scale	Item	Content	Response percentage (%)**						Avg*
			1	2	3	4	5	6	
Physical functioning (PF)	PF1	Vigorous activities	53.8	33.3	12.8				2.82
	PF2	Moderate activities	20.5	51.3	28.2				2.08
	PF3	Lifting or carrying groceries	12.8	64.1	23.1				2.10
	PF4	Climbing several flights of stairs	23.1	53.8	23.1				2.00
	PF5	Climbing one flight of stairs	12.8	46.2	25.5				2.28
	PF6	Bending, kneeling, or stooping	28.2	46.2	25.6				1.97
	PF7	Walking more than a 1 km	25.6	46.2	28.2				2.03
	PF8	Walking several blocks (around 500 m)	17.9	33.3	48.7				2.31
	PF9	Walking one block (around 100 m)	20.5	20.5	59.0				2.38
	PF10	Bathing or dressing	17.9	33.3	48.7				2.31
Role-physical (RF)	RP1	Cut down amount of time...	64.1	35.9					1.36
	RP2	Accomplished less...	41.0	59.0					1.59
	RP3	Limited in kind of work...	61.5	38.5					1.38
	RP4	Difficulty performing the work....	59.0	41.0					1.41
Bodily pain (BP)	BP1	Intensity of bodily pain	17.9	7.7	17.9	41.0	15.4	0.0	3.72
	BP2	Pain interfered with normal work	20.5	17.9	35.9	25.6	0.0		3.33
General health (GH)	GH1	Health in general...	0.0	7.7	25.6	33.3	33.3		2.08
	GH2	...get ill more easily...	2.6	25.6	46.2	10.3	15.4		3.10
	GH3	...as healthy as anybody...	2.6	20.5	35.9	33.3	7.7		2.77
	GH4	I expect my health to get worse	2.6	7.7	74.4	15.4	0.0		3.03
	GH5	My health is excellent	5.1	12.8	7.7	61.5	12.8		2.36
Vitality (VT)	VT1	Feel full of pep	2.6	17.9	38.5	23.1	12.8	5.1	3.41
	VT2	Have a lot of energy	2.6	38.5	25.6	23.1	10.3	0.0	3.00
	VT3	Feel worn out	2.6	10.3	15.4	35.9	25.6	10.3	4.03
	VT4	Feel tired	5.1	12.8	15.4	35.9	15.4	15.4	3.90
Social functioning (SF)	SF1	Extent of interference with SF	2.6	12.8	20.5	25.6	38.5		3.85
	SF2	Frequency of interference with SF	2.6	12.8	43.6	17.9	23.1		3.46
Role-emotional (RE)	RE1	Cut down amount of time...	43.6	56.4					1.56
	RE2	Accomplished less...	35.9	64.1					1.64
	RE3	Didn't do work as carefully...	28.2	71.8					1.72
Mental health (MH)	MH1	Been a very nervous person	0.0	0.0	12.8	41.0	30.8	15.4	4.49
	MH2	Felt down in the dumps	2.6	5.1	5.1	28.2	38.5	20.5	4.56
	MH3	Felt calm and peaceful	0.0	28.2	35.9	23.1	12.8	0.0	3.21
	MH4	Felt downhearted and blue	0.0	5.1	7.7	23.1	41.0	23.1	4.69
	MH5	Been a happy person	0.0	15.5	53.8	23.1	7.7	0.0	3.23
Health transition (HT)	HT1	Health now compared to 1 year ago	12.8	33.3	17.9	30.8	5.1		2.82

*Avg – average mark, **high score indicates a good health or characteristic

Each scale score was transformed to a 0 to 100 scale. This transformation converted the lowest and highest possible scores to zero and 100, respectively. A score between those values represented the percentage of the total possible score achieved. Table 4 presents the scaled results of the whole observed group before treatment while Table 5 presents the scaled results of the whole observed group after treatment. For example in Table 4, the maximum score for Physical Functioning (PF) was 1170 points (100%) towards minimum of 390 points (0%). Score for Physical Functioning (PF) before treatment was 707 points and this score presents 40.64% on the 0–100% scale.

Figure 1 presents the comparison of scaled results of all 9 parameters from SF-36 before and after treatment. Figure 2 presents the comparison of scaled results of parameters describing the physical health and parameters describing the mental health before and after treatment.

TABLE 4
SCALED RESULTS OF THE WHOLE GROUP BEFORE TREATMENT

Scale	Score	Max	Min	Diff	SF 36 (%)
Physical functioning (PF)	707	1170	390	780	40.64
Role-physical (RF)	186	312	156	156	19.23
Bodily pain (BP)	219	429	78	351	40.17
General health (GH)	461	975	195	780	34.10
Vitality (VT)	481	936	351	585	22.22
Social functioning (SF)	252	390	78	312	55.77
Role-emotional (RE)	169	234	117	117	44.44
Mental health (MH)	726	1170	195	975	54.46
Health transition (HT)	104	195	39	156	41.67

TABLE 5
SCALED RESULTS OF THE WHOLE GROUP AFTER TREATMENT

Scale	Score	Max	Min	Diff	SF 36 (%)
Physical functioning (PF)	707	1170	390	780	40.64
Role-physical (RF)	186	312	156	156	19.23
Bodily pain (BP)	219	429	78	351	40.17
General health (GH)	461	975	195	780	34.10
Vitality (VT)	821	1170	390	780	55.26
Social functioning (SF)	224	312	156	156	43.59
Role-emotional (RE)	275	429	78	351	56.13
Mental health (MH)	520	975	195	780	41.67
Health transition (HT)	559	936	156	780	51.67

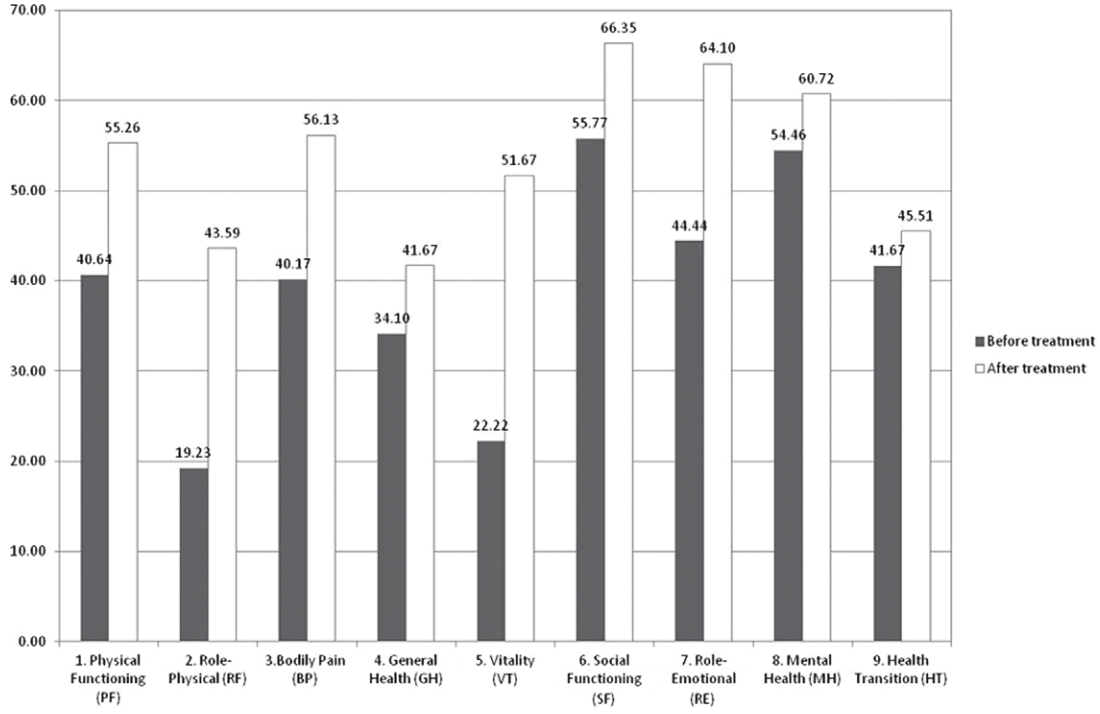

Fig. 1. Comparison of scaled results of all nine parameters from SF-36 before and after treatment.

The results showed that there was statistically significant improvement in all nine dimensions (physical functioning, role-physical, role-emotional, social functioning, mental-health, vitality, bodily pain, general health and general health status compared to the period a year ago).

Figure 3 shows the improvementor perception of pain each of 39 patients by comparison of s the state before and treatment. If the value is more negative (from –1 to –60) that the pain was lower after treatment. The value 0 indicates that the state has not changed.

Before starting treatment the average value of the VAS pain of the patients was 58.33±4.43 as well. At the end of treatment the average pain scores by VAS in statistically significantly decreased and it was 38.95±3.90 (Chi-Square=10.44420, df=3, p=0.01514) (Figure 4).

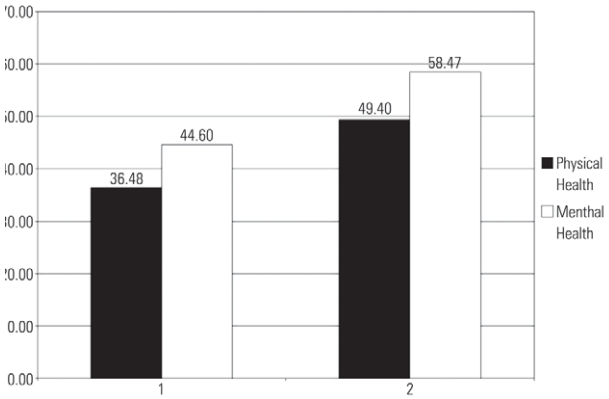

Fig. 2. Comparison of scaled results for skewed physical towards mental health parameters before and after treatment.

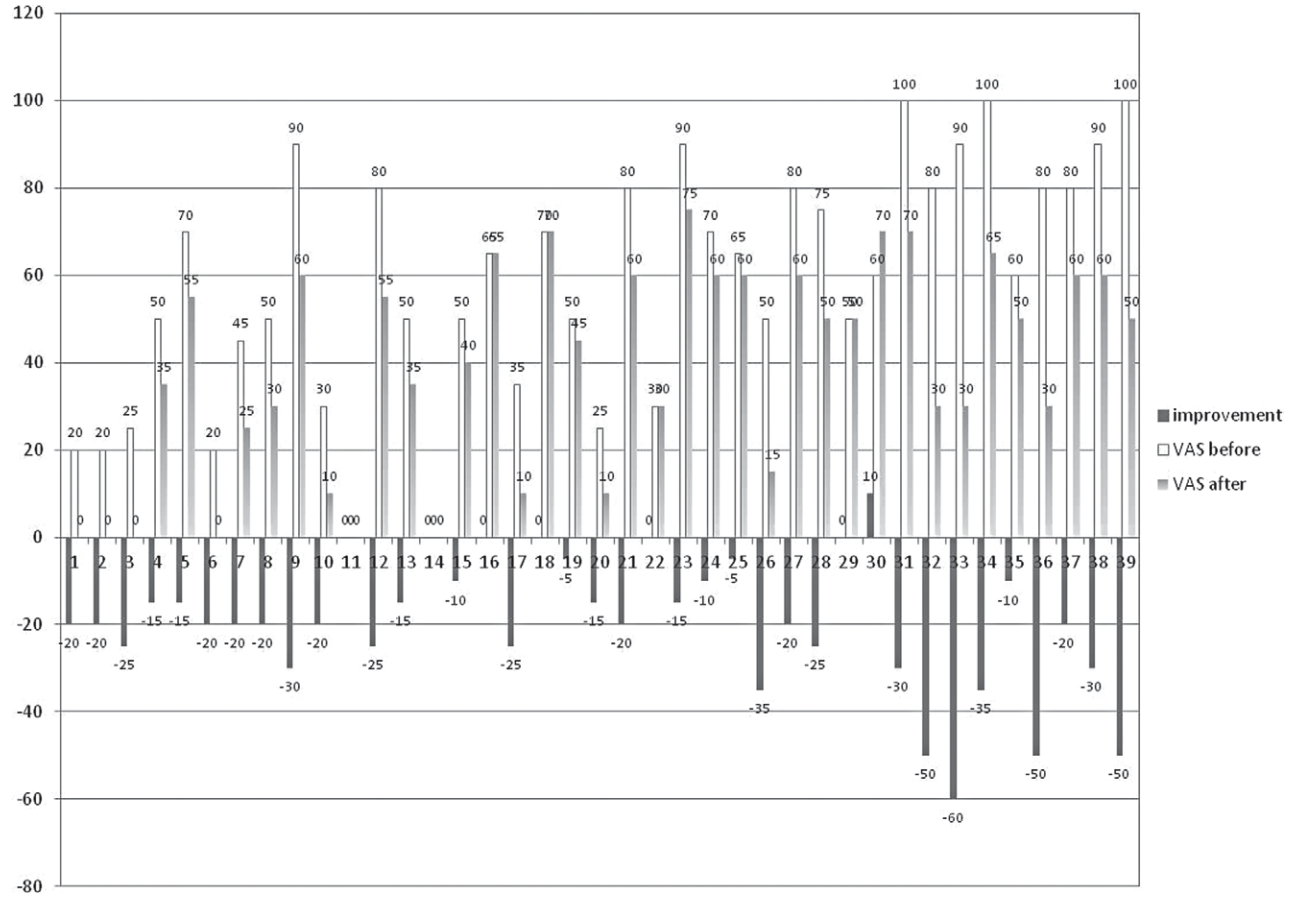

Fig. 3. Perception of pain per each patient.

Figure 5 shows the expected value if we suppose a normal distribution (the assumption was tested by chi-square test, chi-square=10.62318, df=3 (adjusted reduction of decrees of freedom), p=0.01395) based on the progress of VAS. The Figure shows the probability that even 87.96% of patients feel the improvement (VAS before – after VAS=–1) during the described treatment.

The subjects were divided into two groups considering its BMI: a group with BMI<25 contained 19 patients and a group with a BMI over the normal range, BMI>25, with 20 patients.

The results showed that in subjects with BMI<25 after the program was recorded improved quality of life in all dimensions, with greater improvement noted in men-

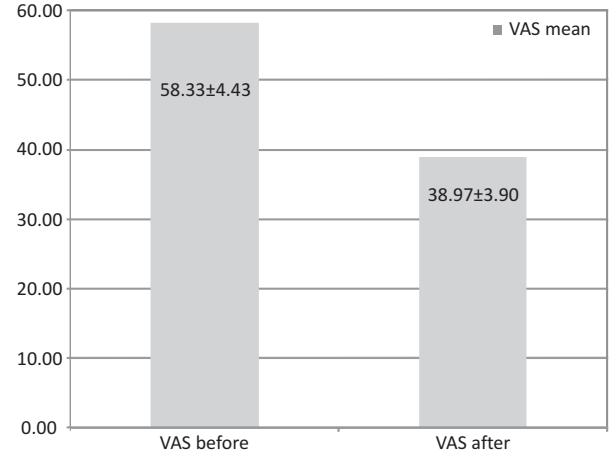

Fig. 4. Mean VAS and standard error for the whole population of patients before and after treatment.

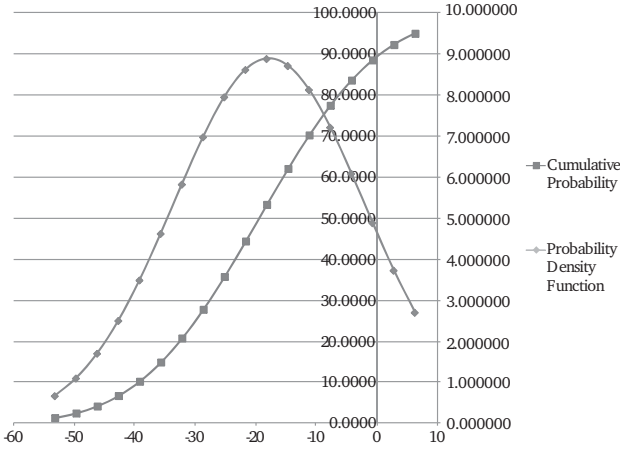

Fig. 5. The expected value.

TABLE 6
SUBJECTS WITH BMI<25

Parameter	Improvement	Average
1.Phisical functioning (PF)	12.4%	Physical 13.3%
2. Role-physical (RP)	22.4%	
3. Bodily pain (BP)	14.6%	
4. General health (GH)	3.9%	
5. Vitality (VT)	24.6%	Mental 15.2%
6. Social functioning (SF)	9.9%	
7.Role emotional (RE)	24.6%	
8. Mental health (MH)	1.9%	
9. Health transition (HT)	6.6%	

TABLE 7
SUBJECTS WITH BMI>25

Parameter	Improvement	Average
1. Phisical functioning (PF)	16.3%	Physical 18.2%
2. Role-physical (RP)	27.3%	
3. Bodily pain (BP)	18.6%	
4. General health (GH)	10.6%	
5. Vitality (VT)	12.7%	Mental 11.6%
6. Social functioning (SF)	9.9%	
7. Role emotional (RE)	12.7%	
8. Mental health (MH)	11.1%	
9. Health transition (HT)	–0.2%	

tal component summary (MCS), in relation to the physical (PCS) component summary (Table 6). In subjects with a BMI above the normal range also showed an improvement in quality of life for all eight dimensions, with recorded greater improvement in PCS relation to MCS (Table 7). In the group of subjects with a BMI above the normal deterioration of the questionnaire was verified self-assessment of general health status compared to the ago year, HT (health transition).

Disscusion

Today it is possible to partially objectified research on quality of life of chronic patients on the basis of existing questionnaires which determine the most clearly quantitative, measurable parameters. Although none of the existing questionnaire is not ideal and does not measure all multidimensional term quality of life. In addition to the generic questionnaires should be used and the disease-specific questionnaires (i.e. Osteoporosis Quality of Life Questionnaire, Quality of Life Questionnaire of the European Foundation for Osteoporosis QUALEFFO)[17,18] with larger groups of patients according to age, sex, BMI and chronic disease. There is a good number of publications on the effect of physical activity and strengthening exercises to improve the quality of life in patients with osteoporosis and also about the impact of programs in addition to physical activities include educating and advising patients.

Some studies show the impact of group exercise on muscle strength and quality of life in the elderly and suggest that programmed physical activity leads to improved muscle strength and improve the quality of life[19]. The paper by Teoman N., Ozcanand A., Acar B., »The effect of exercise on physical fitness and quality of life in post menopausal women«, have proved that after the exercise program in postmenopausal women for 6 weeks, there is a significant change in strength, endurance, flexibility and balance[20].

Li WC, Yc Chen and colleagues searched MEDLINE meta-analysis has been done, and CINAHL, Pedro and EMBASE and Cochrane databases supplements from January 1966 to March 2007. The aim of this study was to examine the effect of exercise on quality of life in postmenopausal women with osteoporosis or osteopenia using the SF-36 questionnaire and quality of life of the European Foundation for Osteoporosis (QUALEFFO). This meta-analysis showed a significant improvement in physical function, vitality and pain in patients with osteoporosis after a exercise program conducted by different durations of exercise it shows improvement in different domains[21]. Our study is in accordance with results of previous studies and proves that the program for osteoporosis and osteopenia, which implemented effective.

Conclusion

The results of testing indicate that the application of programmed physical activity significantly affects the psychological aspects of patients health, and thus their self-assessment of quality of life.

We want to emphasize the importance and significance of short-term exercise program in chronic patients. It is necessary to improve knowledge of patients about the disease and encourage them to change their own behaviour.

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UTJECAJ VJEŽBI NA KVALITETU ŽIVOTA U ŽENA S OSTEOPOROZOM I OSTOPENIJOM

S A Ž E T A K

Osteoporoza je bolest karakterizirana smanjenom koštanom masom i poremećenom mikroarhitekturom što za posljedicu ima krhkost kostiju i povećan rizik za nastanak prijeloma. Prevencija osteoporoze i nastanka osteoporotičnih prijeloma između ostalog uključuje i primjerenu fizičku aktivnost. Epidemiološke studije ukazuju na manje prijeloma u aktivnih žena bez obzira da li je to rezultat direktnog djelovanja na kost ili poboljšanja koordinacije, balansa i mišićne snage. Cilj istraživanja je ispitati utjecaj programa vježbi za osteoporozu u trajanju od četiri tjedna na zdravstvene i psihološke aspekte pacijenta pomoću upitnika kvalitete života SF-36, korištenog prije i nakon provedenog programa. Upitnik SF-36 se primjenjuje za samoprocjenu zdravstvenog stanja i reprezentira operacionalizaciju dva generalna koncepta zdravlja kao što su fizičko i mentalno zdravlje a sastoji se od 36 čestica. U istraživanju je sudjelovalo 39 sudionica sa osteopenijom i osteoporozom. Sve ispitanice su provele program vježbi za osteoporozu u trajanju 28 dana. Program se sastojao od vježbi za osteoporozu, savjeta o načinu prehrane, savjeta o prevenciji padova, razgovora i pregleda liječnika prije i u tijeku provođenja programa. Rezultati istraživanja su pokazali da korištenjem kratkotrajnog programa vježbi i edukacije dolazi do značajnih promjena u samoprocjeni kvalitete života ispitanika. Procjenom boli pomoću vizualno analogne skale (VAS) prije i nakon provedenog programa potvrđeno je statistički značajno smanjenje boli.