DOI 10.26773/jaspe.210404

Journal of Anthropology of Sport and Physical Education

Review Paper

The Effect of Exercising on the Decrease Back Pain: A Systematic Review

Borko Katanic[1], Predrag Ilic[1], Lora Kostic[1], Aleksandar Stojmenovic[1], Mima Stankovic[1], Manja Vitasovic[2]

[1]University of Nis, Faculty of Sports and Physical Education, Nis, Serbia, [2]Equestrian Club Gorska Team, Nis, Serbia

Abstract

The aim of this study was to determine the impact of exercising on the back pain. Tools used for the literature review are electronic databases: Google Scholar, PubMed, Medline, Mendeley, for the time period from 2010 to 2019. After the selection of papers regarding the criteria, 20 studies that suit the needs of this systematic review were selected. Therapeutic training for relieving back pain is very heterogeneous, a total of 12 different therapeutic exercise programs were conducted. The most used programs are pilates and conventional (traditional) program for relieving back pain, followed by stabilization exercises, as well as other methods, such as: sling method, motor control exercises, stretching exercises, segment stabilization, as well as combined programs. Based on the analysis of the research conducted so far, it has been determined that exercising has positive impact in decreasing pain intensity and the level of disability, on the increase of the maximum strength, durability and trunk flexibility, as well as on the improvement of the overall health related functionality of patients with back pain. It has been concluded that program of exercises has a multiple positive impact on the health of patients with the chronical back pain and that exercising to these patients is, therefore, recommended.

Keywords: *Back Pain, Lumbar Syndrome, Training Effects, Exercise*

Introduction

Technological and organizational changes in the industry during the last couple of decades have significantly increased a number of jobs conducted in monotonous and body postures with limited movements (Amit, Manish, & Taruna, 2013). Moreover, looking at the daily activities of the contemporary human, it can be noticed that almost all activities, from having breakfast, to working in the office, to watching television in the evening, humans conduct in the sitting position. This indicates that the sedentary lifestyle is one of the leading causes of the back pain occurrence (Sarabon, Palma, Vengust, & Strojnik, 2011). Back pain develops in over 80% of population at some point in their lives and it is considered to be the main health issue in the developed countries and to be responsible for major treatment, work absence and invalidity related expenses (Sarabon et al., 2011). Back pain syndrome is one of the most common causes of disability and is increasing faster than any other (Amit et al., 2013; Sarabon et al., 2011). Pain is the consequence of the pressure of abdomen on the thoracic and lumbar-sacral part of the spine in sedentary position. Long-term irregular sitting position puts large load on the back muscles and on the inter-vertebral discs. Due to the additional pressure on the soft tissues (muscles, tendons and joints), work in sedentary position highly increases the back pain (Pranjic & Males-Bilic, 2015). Biomechanical risk factors for the lower back pain include: extended static posture (McGill, 2007), work in sitting position, frequent folding with rotations, lifting, pulling, pushing and vibrations, as well as the muscle weakness, especially in the sedentary position (Sarabon et al., 2011). Norris & Matthews (2008) stipulate that the causes of the back pain are multiple, but that the basis is the muscle dis-balance of the lumbar and abdominal region. Pranjic & Males-Bilic (2015) are warning us that the main cause of weakness of back and stomach muscles is insufficient physical activity (hypokinesis). The more and more prevalent sedentary lifestyle, incorrect sitting posture and hypokinesis are the factors that contribute to the decrease of the endurance of lumbar extensors

Correspondence:

Montenegro Sport

B. Katanic
University of Nis, Faculty of Sports and Physical Education, Carnojevica 10a, 18000 Nis, Serbia
E-mail: borkokatanic@gmail.com

and, therefore, to the appearance of the lumbar syndrome (McGill, 2007). Deep abdominal muscles, primarily m. transversus abdominis and m. multifidus, are responsible for maintaining spine stability and, therefore, their stability impacts the reduction of the lower back pain (Amit et al., 2013). Physiotherapists are using therapeutic exercises to reduce the pain, reduce the level of disability and to return some muscle functions (Brumitt, Matheson, & Meira, 2013). Sarabon et al. (2011) noticed that therapeutic training nowadays, in order to reduce the pain, is very heterogenic and varies significantly in type, intensity, frequency and training duration. The main purpose of the training is the improvement of the body posture, release of contracted muscles, improvement of strength, intensity and endurance of the abdominal muscles, as well as the improvement of the overall aerobic physical condition (Quittan, 2002).

The aim of this research was to determine the impact of exercising on the back pain. Gathering of the adequate data has been conducted from the previous experimental researches in the time period from 2010 to 2019, under the assumption that implementation of the exercising program decreases the back pain.

Methods

Data sourcing and strategy

For the literature review, following electronic databases were used: Google Scholar, PubMed, Medline, Mendeley in the period between 2010 and 2019. Key words used in the research were: back pain, training program, exercise. Research strategy was customized for each electronic database, wherever it was possible, in order to increase sensitivity. All titles and abstracts were examined for potential papers that will be included in the systematic review. Also, reference lists from previous systematic reviews and original researches were examined. Relevant studies were systematized after detailed examination, based on fulfilling the criteria to be included.

Inclusion criteria

Criteria for being included from the study: experimental research determining the impact of exercising on the back pain, research in English language, research published between 2010 and 2019, research published as a full paper.

Exclusion criteria

Criteria for being excluded from the study: research written in any language other than English, research published before 2010, research not published as a full paper (abstracts), systematic research, research that did not show systematical approach to obtaining results, duplicates.

Data extraction and selection

Experimental research which met the set criteria was then analyzed and presented based on the following parameters: references (the first author and year of publication), the sample of participants, research duration, type of treatment, measurement instruments, results and conclusion.

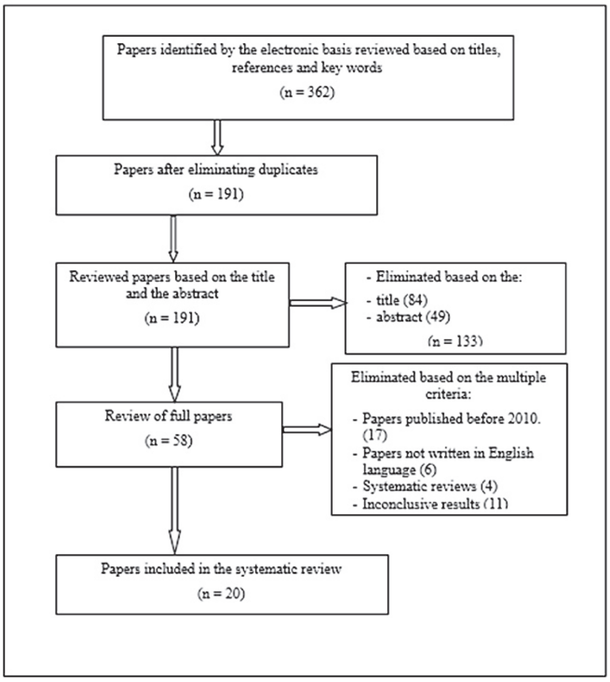

FIGURE 1. Diagram of the paper analysis

Results

This systematic review included 20 studies that examined the impact of exercising on the back pain. Studies jointly included 1174 participants who suffered from back pain, at least 10 and at most 296 participants per study. The most frequently used measurement instruments were: VAS (Visual Analogue Scale) with emphasis on the following muscles: musculus multifidus, musculus quadratum lumborum, musculus erector spinae, 18 out of 20 papers, followed by ODI (Osvestri Disability Index) used in 11 studies and RMQ (Roland-Morris's Questionnaire) used in 6 studies. Several studies examined the muscle activation after the back pain relief treatment, and musculus transversus abdominis, therefore, the deep muscles that are, according to Amit et al. (2013) responsible for spine stability. In these 20 studies a total of 35 interventions was implemented, which were a part of 12 different programs of therapeutic exercises, in line with claims by Sarabona et al. (2011), who stipulate that contemporary therapeutic training for back pain relief are very heterogenous, but that the basis for all the programs is strengthening of the abdominal deep muscles. Duration of programs was from 4 to 16 weeks, out of which the most frequent duration was 8 weeks (in 8 papers), and the treatments included were from 1 to 3 times per week.

Table 1. Systematic review and characteristics of the papers included

Authors and year of study	Sample	Research duration	Type of treatment	Measurement instruments	Results	Conclusion
Franca et al., 2010.	30 PNSCLBP	6 weeks	G1: SS, 2x per week per 30 m G2: SE, 2x per week per 30'	VAS (cm) MGPQ ODI PBU (mmHg)	G1: VAS (5.8±1.61↓), MGPQ (31.80±6.06↓), ODI (15.26±3.43↓), PBU TrA (4.46±2.22↓) G2: VAS (3.6±1.56↓), MGPQ (17.87±6.73↓), ODI (8.86±2.82↓), PBU TrA (-0.40±1.60↓)	Both treatments proved efficient in pain relief and reducing the level of disability. SS group has shown significant difference in all the variables related to strengthening the surface muscles, including the m. transversus abdominis, where relative results were 48.3%.
Unsgaard-Tondel et al., 2010.	109 PNSCLBP (G1=36, G2=36 G3= 37); 19-60y.	8 weeks	G1: MC, 1 x per week per 40' G2: SL; 1 x per week per 40' G3: CBE, 1 x per week per1h	VAS (0-10 cm) ODI FT PAAQ	G1: NPRS (PP 1.54↓ HLP 1.16↓), ODI (7.66↓), FT (4.50↓), FAB (PA 0.44↓; J 1.33↓) G2: NPRS (TБ 0.97↓ HLP 1.49↓), ODI (6.10↓), FT (3.87↓), PA (PA 2.02↓; J 1.74↓) G3: NPRS (PP 0.57↓ HLP 0.96↓), ODI (3.09↓), FT (1.21↓), PA (PA 0.62; J 1.09↓)	No significant differences were found between groups, even though MC group had somewhat better results than the CBE group.
Chan et al, 2011.	46 PNSCLBP (G1=22, G2=24)	8 weeks	G1: CBE 3 x per week G2: CBE + AE (40% -60%) HR max, 3 x per week per 20'	VAS (100mm) AS DAE	G1: VAS (25↓), AS (10↓), DAE (7.1↑) G2: VAS (28↓), AS (9.8↓), DAE (12.6↑)	Both groups achieved improvement, but there was no significant difference between groups. This implies that aerobic training, compared to the existing conventional training, does not improve the PNSCLBP status.
Cuesta-Vargas et al, 2011.	46 PNSCLBP	15 weeks	EG: MMP (SE, manual therapy, CBE) + 20 min AE running in the water, 3 x per week CG: MMP (SE, Manuel therapy, CBE), 3 x per week	VAS (100mm) RMQ SFT FT MISLP	EG: VAS (36.1±25↓) RMQ(3.0±4.8↓) SFT (10.6 ±12.9↓), FT (12.7±24.4↓), MISLP (12.8±9.1) CG: VAS (34.1±26↓) RMQ (1.6±1.5↓) SFT (8.9±13↓), FT (13.1±17.3↓), MISLP (16.8±21.9)	Pain, disability, health condition, strength and muscle durability and lumbar range of movement has significantly increased in both groups. MMP +AE performed better than MMP, but difference was not significant.
Sarabon et al., 2011.	10 PNSCLBP (3 males, 7 females) 47.7y.	8 weeks	EG: ABS by using the unstable surfaces and unexpected movements, 2 x per week per 50-70'	VAS ODI MAS FT	EG: ODI (3.9↓), VAS (15.0↓), MFAS (42±15%↑), MFLAS (33± 25%↑), FT EC(p<0.05↑) FT PC (p<0.01↑)	Treatment has proven to be efficient in decreasing the pain and increasing the strength and flexibility. Significant decrease after the intervention for 39% in disability and 15% in the pain intensity. Significant increase in the maximum flexor strength and lateral abdominal flexor, as well as passive flexibility of the extensors and joint flexors in the hip joint. No significant difference in sex and age.
Franca et al., 2012.	30 PNSCLBP M and F, 41.9 y.	6 weeks	G1: SS, 2x per week per 30' G2: SG, 2x per week per 30'	VAS (pain, 10cm) MGPQ (pain, 0-78 questions in 4 groups) ODI (0-47) PBU activation (mmHg)	SS: VAS (5.88↓), MGPQ (32.8↓), ODI (15.27↓), PBU (4.66↓) SG: VAS (3.20↓), MGPQ (14.86↓), ODI (9.53↓), PBU (0.67↓),	SS group achieved significant improvement in regard to the pre-test variables, in the range 90-99%, only PBU was 48%. On the other hand, SG has also achieved improvement, but in the range 37-56%, and PBU statistically insignificant 6,6%. Both techniques have decreased pain and level of disability, but SS was superior.

(Continued on next page)

Authors and year of study	Sample	Research duration	Type of treatment	Measurement instruments	Results	Conclusion
Javadian et al., 2012.	30 PNSCLBP 18-45 y	8 weeks	EG: ABS + CBE CG: CBE	VAS (mm) ODI (%) SLFT DAFM DAE	EG: VAS (29.60↓), ODI (32.34↓), DAFM (34.03↑), DAE (43.70↑), RLFD (33.85↑), DLLF (31.85↑) CG: VAS (21.06↓), ODI (23.18↓), DAFM (26.44↑), DAE (29.56↑), RLFD (26.50↑), DLLF (12.35↑)	Stabilizing exercises in combination with routine exercises have proven to be more efficient than solely routine exercises for pain relief, decrease of the functional stability and muscle durability in patients with lumbar syndrome symptoms, even though both programs have created positive effects. Stabilizing exercises increased the level of muscle activity and decreased the tiredness of local muscles.
Yoo & Lee, 2012.	30 PNSCLBP (G1 = 15, G2 =15); 20.3 y	4 weeks	G1: SL; 3 x per week G2: PT, 3 x per week	VAS (0-10cm) MAS (N)	G1: VAS (3.2±2.6↓), MAS (276.7±171.4↑) G2: VAS (2.8±0.8↓), MAS (135.2±61.1↑)	Both sling and pilates training decreased the chronical lower back pain, increased patients' strength in the lumbar area and decreased VAS results, even though sling program was somewhat more successful.
Masharawi & Nadaf, 2013.	40 PNSCLBP female, (G1 = 20, G2 =20); 45-65 y.	4 weeks	EG: AS + SG, 2 x per week per 45' KG: DNE	VAS RMQ SLFT	EG: VAS (2.32↓), RMQ (4.9↓), SLFT (9.26↑), SLFT (5.95↑) CG: no significant changes	Functional exercising program increased functionality, pain status, lumbar flexion and widening the movement range of women who suffer from the lumbar syndrome.
Shnayderman & Katz-Leurer, 2013.	52 PNSCLBP (G1 = 26, G2 =26); 18-65 y	6 weeks	G1: AE walking on the treadmill (50% HR max), 2 x per week G2: CBE, 2 x per week	W6 FT ODI DAFM DAE PAAQ	G1: W6 (71.0↑), FT (10.1↑), ODI (11.8↓), DAFM (1.1↑), DAE (1.2↑), FAB (2.0↓) G2: W6 (43.0↑), FT (8.11↑), ODI (8.4↓), DAFM (0.6↑), DAE (1.3↑), FAB (6.0↓)	Significant increase in all measurements in both groups was noticed. Six-weeks-program of walking on the treadmill was as efficient as the six-weeks-program of lower back strengthening exercises.
Sung, 2013.	46 PNSCLBP G1: 25 (47.7g) G2: 21 (53.1)	4 weeks	G1: ABS, 2 x per week per 20' G2: DNE, 2 x per week per 20'	ODI MF	G1: ODI (13.16 /28.8%↓), MF no difference G2: ODI (2.23/8.3%↓), MF no difference	ABS intervention has decrease the level of disability after the intervention period. Nevertheless, no significant difference was proven to exist in muscle tiredness during the 4-weeks period of intervention in both groups.
Cho et al., 2014.	30 PNSCLBP (EG = 15, CG =15);	4 weeks	EG: CSE, 3 x per week per 30' CG: DNE	VAS (100mm) APMT FT	EG: VAS (20.5↓), VASM (24.4↓), APMT m. quadratum lumborum (1.4↓), AMR (22.4↑) CG: no significant changes	Core strengthening program has proven to be efficient in decreasing the pain and increasing the range of movement in patients with chronical lower back pain.
You et al., 2014.	40 PNSCLBP (19 males, 21 females)	8 weeks	EG: ASE + DEAS CG: ASE	ODI RMQ VAS BT PDI	EG: ODI (8.90↓), RMQ (7.40↓), VAS (2.95↓), PDI (11.75↓), PRS(22.15↓), BT (5.35↑)	Experimental group has shown significant improvement compared to the control group. Significant decrease of 32.5% (VAS), 23.2% (PDI) и 21.5% (PRS).
Mostagi et al., 2015.	22 PNSCLBP (G1 = 11, G2 =11); 18-55 y	8 weeks	G1: PT 2 x per week per 1h G2: CBE 2 x per week per 1h	VAS QQ 0-100 FT SFT	G1: VAS (2.6↓), QQ (11.5↓), FT (16.6↓), SFT (24↑) G2: VAS (1.8), QQ (17.7↓), FT (10.39↓), SFT (19↑)	No significant difference was found between groups, QQ was somewhat more successful than pilates in improving functionality and flexibility.

Authors and year of study	Sample	Research duration	Type of treatment	Measurement instruments	Results	Conclusion
Shamsi et al., 2015.	39 PNSCLBP (G1 = 19, G2 =20); 18–60y, VAS 3-6	16 training sessions	G1: ABS 3 x per week per 20 ' G2: CSE 3 x per week per 14 '	VAS ODI SLFT	G1: VAS (36.3↓), ODI (17.8↓), SLFT (0.44↓) G2: VAS (38.1↓), ODI (12.4↓), SLFT (0.23↓)	Both tests achieved positive effects in all variables. No significant differences between groups were found.
Kliziene et al., 2017.	54 PNSCLBP females (EG = 27, CG = 27), 45.31 y.	16 training sessions	EG: PT, 2 x per week per 60' CG: HR	MAS (isokinetic) ID VAS	MAS extensor (41.21%↑), MAS flexor (21.53%↑), ID (p<0.001↑), VAS (2.01↓) CG: no significant changes	Pilates program had significant impact on the improvement of the maximum extensor and flexor, and on the decrease of pain in the lumbar area and on the isometric durability of the abdominal muscles.
Valenza et al., 2017.	54 PNSCLBP (EG = 27, CG = 27)	8 weeks	EG: PT 1 x per week CG: HR	RMQ VAS ODI SLFT FT BT	EG: RMQ (5.31±3.37↓), VAS (2.3±1.9↓) ODI (16.35 ± 14.07↓), SLFT (7.62±2.56↑), TF (10.11 ± 8.84↑), BT (70.48±71.24↑)	Pilates program has proven to be efficient in decreasing the level of disability, pain, increasing flexibility and balance in patients with unspecified lumbar back pain.
Cruz-Díaz et al., 2018.	64 PNSCLBP (EG = 32, CG = 32);	12 weeks	EG: PT 1 x per week CG: HR	RMQ VAS PAAQ	RMQ (5.00↓), VAS (2.75↓), PAAQ (7.0↓) CG: no significant changes	Significant difference between groups was noticed as well as the improvement of the pilates group in all variables. Bigger changes were achieved in the disability tests, tests of the pain intensity and on the Tamp kinesiophobia scale.
Miyamoto et al., 2018.	296 PNSCLBP, 4 groups of 78 participants, 18-80 y	8 weeks	G1: HR G2: PT, 1 x per week G3: PT, 2 x per week G4: PT, 3x per week	RMQ VAS PSD GEE	PT 3x: VAS (5.6↓), RMQ (11.3↓), PSD (5.0↓) PT 2x: VAS (4.0↓), RMQ (7.8↓), PSD (6.3↓) PT 1x: VAS (3.3↓), RMQ (6.8↓), PSD (6.9↓)	All pilates groups had significant difference in relation to the control group. Nevertheless, it was established that there was no significant difference between pilates groups, even though group PT3S achieved the best results.
Sipaviciene et al., 2018.	106 PNSCLBP, (EG = 55, CG = 51); 53.3 y.	12 weeks	EG: ABS CG: HR	MAS and ANS (isokinetic) ODI VAS	EG: VAS (44.0%↓), ODI (48.74%↓), IPTF (21.53%), DAE (41.25%), CSA -R m.multifidus (37.41%), CSA - L (37.53%) CG: No significant changes	After 12-weeks exercising program for lumbar muscle stabilization, multi-fundus muscles and abdomen muscles stabilization, rotation was improved, while the level of disability and of the chronic back pain was decreased.

Note: AE – Aerobic Training; ABS – Abdominal Stabilization; AMR - Active Movement Range; ANS – Angle Speed; APTM - Anglo Meter for the Pain Tolerance Measurement; AS - Aberdeen Scale; ASE - Abdomen Stretching Exercises; BT – Balance test; CBE - Conventional Back Exercises; CG – Control Group; CSA – L - Cross-Sectional Area, Left Side; CSA – R - Cross-Sectional Area, Right Side; CSE - Core Strengthening Exercise; DAE- Durability of the Abdominal Extensor; DAFM - Durability of the Abdominal Flexor Muscles; DEAS - Dorsiflexion Exercises of the Ankle with Straps; DLLF - Durability of the Left Lateral Flexor; DNE - Did Not Exercise; EC-m. erector spinae; EG - Experimental Group; F – Female; FAB - Fear-Avoidance Beliefs Questionnaire FT - Flexibility Test; G (1-3) – groups (1-3); GEE - Global Expected Effect; HLP - Highest Level of Pain; HR - Heart Rate; ID - Isometric Durability; IPTF - Isokinetic Peak Torque Flexion; J –Job; M - Male; MAS - Maximum Abdominal Strength; MC - Motor Control; MGPQ – Mc Gill Pain Questionnaire; MF - Muscle Flexion; MFAS - Maximum Flexor Abdominal Strength; MFLAS – Maximum Flexor Lateral Abdominal Strength; MISLP - Maximum Isometric Strength of the Lumbar Part; MMP- multi-modal physical therapy; NPRS-Numeric Pain Rating Scale; ODI - Osvestri Disability Index; PA – Physical Activity; PAAQ - Physical Activity Avoidance Questionnaire; PBU – Pressure Biofeedback Unit; PC - Physical Condition; PDI - Pain Disability Index; PFT - Passive flexibility test; PNSCLBP - Patients with Non-Specific Chronic Lower Back Pain; PP - Present Pain; PRS - Pain Rating Scale; PSD - Patients Specific Disability; PT - Pilates training; QQ - Quebec Questionnaire; RLFD - Right Lateral Flexor Durability; RMQ - Roland-Morris's Questionnaire; SE - Strengthening Exercises; SFT – Sorensen Functionality Test; SG – Stretching Group; SL – Sling Exercises; SLFT - Schobert's Lumbar Flexibility Test; SS – Segmental Stabilization; TrA - m. transversus abdominis; VAS - Visual Analog Scale; VASM - Visual Analog Scale During; W6 – Walking for 6 minutes.

The most frequent therapeutic programs were: pilates and conventional (traditional) program for back pain relief (8 programs), followed by the stabilization exercises (6 programs), as well as other methods, such as: sling method, motoric control exercises, stretching exercises, segmental stabilization, as well as combined programs, in which participants were succumbed to different treatments simultaneously (such as back exercises and walking in the aerobic zone etc.). The main purpose of all therapeutic exercising programs is the posture improvement, relief from muscle cramps, improvement of the intensity, strength and abdominal muscle durability, as well as the increase of the overall aerobic physical condition (Quittan, 2002).

Discussion

Exercising program has proven to be efficient in decreasing the level of disability (Valenza et al., 2017) and lumbar pain intensity (Cruz-Díaz, Romeu, Velasco-González, Martínez-Amat, & Hita-Contreras, 2018; Kliziene et al., 2017; Yoo & Lee, 2012). Also, positive impact on flexibility and balance has been stipulated (Valenza et al., 2017), as well as on the maximum extensors and abdominal flexors strength (Kliziene et al., 2017; Yoo & Lee, 2012), on the isometric abdominal muscle durability (Kliziene et al., 2017), as well as on the Tamp kinesiophobia scale (Cruz-Díaz et al., 2018). No significant differences were found between pilates groups, even though it has been determined that group who exercised pilates three times per week has shown better results (Miyamoto et al., 2018).

Stabilization exercises have proven to be efficient in decreasing pain intensity (Javadian, Behtash, Akbari, Taghipour-Darzi, & Zekavat, 2012) and the level of disability (Shamsi, Sarrafzadeh, & Jamshidi, 2015; Sipaviciene, Kliziene, Pozeriene, & Zaicenkoviene, 2018; Sung, 2013; Sarabon et al., 2011). Significant improvement of the maximum flexor strength and lateral abdominal flexor strength, as well as of the passive flexibility of extensors and flexors of the hip joint has been established (Shamsi et al., 2015; Sarabon et al., 2011). Program had positive impact on increasing the level of lumbar muscles and deep muscles activation (Javadian et al., 2012; Sipaviciene et al., 2018). When it comes to the impact on the muscle tiredness, Sung (2013) did not find any significant difference, compared to Javadian et al. (2012) who determined that pilates impacted the decrease of local muscles tiredness.

Conventional therapeutic back exercises had significant impact on decreasing the level of disability and pain intensity (Chan, Mok, & Yeung, 2011; Cuesta-Vargas, García-Romero, Arroyo-Morales, Diego-Acosta, & Daly, 2011; Mostagi et al., 2015; Shnayderman, & Katz-Leurer, 2013; Unsgaard-Tøndel, Fladmark, Salvesen, & Vasseljen, 2010). Exercises had positive impact on the increase of functionality and trunk flexibility (Cuesta-Vargas et al., 2011; Mostagi et al., 2015; Shnayderman & Katz-Leurer, 2013; Unsgaard-Tondel et al., 2010). Improvement of the durability of muscle flexors and abdominal extensors has been determined too (Chan et al., 2011; Cuesta-Vargas et al., 2011; Shnayderman & Katz-Leurer, 2013). Additionally, significant improvement has been established by using: questionnaire on avoiding physical activity (Unsgaard-Tondel et al., 2010), walking test (Shnayderman & Katz-Leurer, 2013), as well as on the assessment of the abdomen muscle strength and the overall health condition of the patient (Cuesta-Vargas et al., 2011).

The rest of the studies were less represented in the review, even though a certain effectiveness of programs has been established. For example, a method of segmental stabilization has proven to be extremely efficient in pain relief and in decreasing the level of disability compared to the pre-test range of 90-98% for all variables, except on the PBU test, where an improvement of 48% has been detected (Franca, Burke, Caffaro, Ramos, & Marques, 2012; Franca, Burke, Hanada, & Marques, 2010). Sling method had significant impact on decreasing the pain intensity (Unsgaard-Tondel et al., 2010; Yoo & Lee, 2012), level of invalidity, on the improvement of the trunk flexion and on the results of the questionnaire on the fear of physical activity (Unsgaard-Tondel et al., 2010), as well as on the improvement of the patient's lumbar strength (Yoo & Lee, 2012). Strength exercises have proven to be efficient in pain relief (Cho, Kim, & Kim, 2014; Cuesta-Vargas et al., 2011; Franca et al., 2010), in decreasing the level of disability (Cuesta-Vargas et al., 2011; Franca et al., 2010), in increasing the lumbar area range of movements (Cho et al., 2014), as well as on the overall health condition of the patient and muscle durability (Cuesta-Vargas et al., 2011). Stretching method has proven to have positive impact on the pain relief (Masharawi & Nadaf, 2013; Sung, 2013), on decreasing the level of invalidity in the range 37-56% (Sung, 2013), and in improving lumbar area flexibility (Masharawi & Nadaf, 2013). It had statistically insignificant impact on the lumbar area muscle activation of 6.6% (Sung, 2013). Only one study considered motor control, but has proven a significant impact of this method on decreasing the level of disability and pain intensity, on increasing the abdominal flexion and on the results of the questionnaire on avoiding physical activity. (Unsgaard-Tondel et al., 2010). Additionally, one paper examined the impact of the exercises of dorsiflexion of the ankle with straps in combination with exercises for stretching of the trunk. A significant decrease of 32.5% on the pain questionnaire and of 23.2% on the disability index has been established (You, Kim, Oh, & Chon, 2014). Besides the exercising systems, impact of aerobic walking training and walking has been examined and it was determined that it has positive effects on: decreasing the level of disability and pain intensity, increasing the level of flexibility, abdominal flexor muscles durability, as well as on the results on the walking test and questionnaire on avoiding physical activity (Shnayderman & Katz-Leurer, 2013).

Therefore, it has been established that all therapeutic exercising programs have significant impact on decreasing the level of disability and back pain intensity. Also, exercising has positive impact on the maximum strength, muscle durability and trunk flexibility. Positive effects have been achieved in the level of muscle activation, functionality, balance, health status and the results on the kinesiophobia scale.

Certain authors compared two and more therapeutic programs, in order to determine differences between them. Therefore, it has been concluded that there are no significant differences between conventional therapeutic program and pilates, except the fact that conventional program has proven to be somewhat more successful than pilates in improvement of functionality and flexibility (Mostagi et al., 2015). When comparing sling and pilates, pilates has proven to be somewhat more successful (Yoo & Lee, 2012). Also, no significant differences between stabilization and conventional program were found. No significant differences between groups of motor control, conventional and sling method were found, even though the group who was undertaking motor exercises achieved somewhat better results than the conventional group (Unsgaard-Tondel et al., 2010). Certain authors have in their papers stipulated segmental stability as a significantly superior program compared to strength and stretching exercises (Franca et al., 2010, Franca et al., 2012). Walking on the treadmill program and abdomen strengthening exercises program have proven to be more efficient than aerobic activities (Shnayderman & Katz-Leurer, 2013), while the additional aerobic training has not been proven to have any impact on the back pain (Cuesta-Vargas et al., 2011).

In general, exercising positively impacts the decrease of the level of disability and lumbar pain intensity, as well as on other factors. Nevertheless, there are certain limitations when it comes to comparing different programs and their results. One of the main limitations is the large number of various exercising programs reviewed, a total of 12. Other limitations are related to the fact that many programs include similar or same elements, so it was not easy to determine a border between them. Also, there are other differences to be considered, such as the duration of the program, number of training sessions per week, the duration of the single training session, differences related to sex, age, level of disability and so on. On the other hand, mentioned parameters are pointing us towards the topics for future research.

Conclusion

Systematic review included 20 studies and analyzed the impact of a total of 35 exercising programs. The most frequently used therapeutic programs were as follows: pilates, conventional (traditional) program for back pain relief, stabilization exercises, as well as sling, motor control exercises, stretching, segmental stabilization, combined programs and so on. Mostly, the impact examined was the one that particular exercising program can have on the level of disability, pain intensity, motoric capabilities, muscle activation level and so on.

Based on the results obtained, it has been established that the exercising program has multiple positive impacts on the patients with the back pain, as follow: decreasing the level of disability, decreasing the lumbar area pain intensity, development of the maximum flexor strength, strength of the lateral flexors and abdomen extensors, increase of extensors and hip joint flexors, improvement of stability and balance, isometric durability of muscle flexors and abdomen extensors, increasing of the level of lumbar and abdomen muscles activation, improvement of the overall health condition and functionality of the patient, better results at the questionnaire on avoiding physical activity.

Finally, it can be concluded that exercising has multiple positive effects on the back pain patients. For these reason, exercising is being recommended to all patients with back pain.

Acknowledgements
There are no acknowledgements.

Conflict of Interest
The authors declare that there are no conflicts of interest.

Received: 29 November 2020 | **Accepted:** 10 January 2021 | **Published:** 16 April 2021

References

Amit, K., Manish, G., & Taruna, K. (2013). Effect of trunk muscles stabilization exercises and general exercises on pain in recurrent non specific low back ache. *International Research Journal of Medical Sciences*, *1*(1), 23-26.

Brumitt, J., Matheson, J.W., & Meira, E.P. (2013). Core stabilization exercise prescription, part I: current concepts in assessment and intervention. *Sports Health*, *5*(6), 504-509.

Chan, C.W., Mok, N.W., & Yeung, E.W. (2011). Aerobic exercise training in addition to conventional physiotherapy for chronic low back pain: a randomized controlled trial. *Archives of physical medicine and rehabilitation, 92*(10), 1681-1685.

Cho, H.Y., Kim, E.H., & Kim, J. (2014). Effects of the CORE exercise program on pain and active range of motion in patients with chronic low back pain. *Journal of physical therapy science, 26*(8), 1237-1240.

Cruz-Díaz, D., Romeu, M.,Velasco-González, C., Martínez-Amat, A., & Hita-Contreras, F. (2018). The effectiveness of 12 weeks of Pilates intervention on disability, pain and kinesiophobia in patients with chronic low back pain: a randomized controlled trial. *Clinical rehabilitation*, *32*(9), 1249-1257.

Cuesta-Vargas, A.I., García-Romero, J.C., Arroyo-Morales, M., Diego-Acosta, Á.M., & Daly, D.J. (2011). Exercise, manual therapy, and education with or without high-intensity deep-water running for nonspecific chronic low back pain: a pragmatic randomized controlled trial. *American journal of physical medicine & rehabilitation, 90*(7), 526-538.

Franca, F.R., Burke, T.N., Caffaro, R.R., Ramos, L.A., & Marques, A.P. (2012). Effects of muscular stretching and segmental stabilization on functional disability and pain in patients with chronic low back pain: a randomized, controlled trial. *Journal of manipulative and physiological therapeutics, 35*(4), 279-285.

Franca, F.R., Burke, T.N., Hanada, E.S., & Marques, A.P. (2010). Segmental stabilization and muscular strengthening in chronic low back pain: a comparative study. *Clinics*, *65*(10), 1013-1017.

Javadian, Y., Behtash, H., Akbari, M., Taghipour-Darzi, M., & Zekavat, H. (2012). The effects of stabilizing exercises on pain and disability of patients with lumbar segmental instability. *Journal of back and musculoskeletal rehabilitation*, *25*(3), 149-155.

Kliziene, I., Sipaviciene, S., Vilkiene, J., Astrauskiene, A., Cibulskas, G., Klizas, S., & Cizauskas, G. (2017). Effects of a 16-week Pilates exercises training program for isometric trunk extension and flexion strength. *Journal of bodywork and movement therapies*, *21*(1), 124-132.

Masharawi, Y., & Nadaf, N. (2013). The effect of non-weight bearing group-exercising on females with non-specific chronic low back pain: A randomized single blind controlled pilot study. *Journal of back and musculoskeletal rehabilitation, 26*(4), 353-359.

McGill, S. (2007). *Low Back Disorders*. Champaign: Human Kinetics, 568–574.

Miyamoto, G.C., Franco, K.F.M., van Dongen, J.M., dos Santos Franco, Y.R., de Oliveira, N.T.B., Amaral, D.D.V., ... & Cabral, C.M.N. (2018). Different doses of Pilates-based exercise therapy for chronic low back pain: a randomised controlled trial with economic evaluation. *British Journal of Sports Medicine, 52*(13), 859-868.

Mostagi, F.Q.R.C., Dias, J.M., Pereira, L.M., Obara, K., Mazuquin, B.F., Silva, M.F., ... & Lima, T.B. (2015). Pilates versus general exercise effectiveness on pain and functionality in non-specific chronic low back pain subjects. *Journal of bodywork and movement therapies*, *19*(4), 636-645.

Norris, C., & Matthews, M. (2008). The role of an integrated back stability program in patients with chronic low back pain. *Complementary therapies in clinical practice*, *14*(4), 255-263.

Pranjic, N., & Males-Bilic, LJ. (2015). Lumbar pain syndrome in a new work environment in the era of the new economy: occupational risk factors. *Acta Medica Croatica*, *69*(1), 49-57.

Shamsi, M.B., Sarrafzadeh, J., & Jamshidi, A. (2015). Comparing core stability and traditional trunk exercise on chronic low back pain patients using three functional lumbopelvic stability tests. *Physiotherapy theory and practice, 31*(2), 89-98.

Shnayderman, I., & Katz-Leurer, M. (2013). An aerobic walking programme versus muscle strengthening programme for chronic low back pain: a randomized controlled trial. *Clinical rehabilitation, 27*(3), 207-214.

Sipaviciene, S., Kliziene, I., Pozeriene, J., & Zaicenkoviene, K. (2018). Effects of a Twelve-Week Program of Lumbar-Stabilization Exercises on Multifidus Muscles, Isokinetic Peak Torque and Pain for Women with Chronic Low Back Pain. *Journal of Pain & Relief, 7*(309), 2167-0846.

Sung, P.S. (2013). Disability and back muscle fatigability changes following two therapeutic exercise interventions in participants with recurrent low back pain. *Medical science monitor: international medical journal of experimental and clinical research, 19*, 40.

Sarabon, N., Palma, P., Vengust, R., & Strojnik, V. (2011). Effects of trunk functional stabilitz training in subjects suffering from chronic low back pain: a pilot study. *Kinesiologia Slovenica, 17*(2).

Unsgaard-Tøndel, M., Fladmark, A. M., Salvesen, Ø., & Vasseljen, O. (2010). Motor control exercises, sling exercises, and general exercises for patients with chronic low back pain: a randomized controlled trial with 1-year follow-up. *Physical therapy*, *90*(10), 1426-1440.

Valenza, M.C., Rodríguez-Torres, J., Cabrera-Martos, I., Díaz-Pelegrina, A., Aguilar-Ferrándiz, M.E., & Castellote-Caballero, Y. (2017). Results of a Pilates exercise program in patients with chronic non-specific low back pain: a randomized controlled trial. *Clinical rehabilitation, 31*(6), 753-760.

Quittan, M. (2002). Management of back pain. *Disability and rehabilitation*, *24*(8), 423-434.

Yoo, Y.D., & Lee, Y.S. (2012). The effect of core stabilization exercises using a sling on pain and muscle strength of patientswith chronic low back pain. *Journal of physical therapy science, 24*(8), 671-674.

You, J.H., Kim, S.Y., Oh, D.W., & Chon, S.C. (2014). The effect of a novel core stabilization technique on managing patients with chronic low back pain: A randomized, controlled, experimenter-blinded study. *Clinical rehabilitation, 28*(5), 460-469.