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The Effects of Retro-Walking in Non-Specific Low Back Pain among Young Individuals: A Systematic Review

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Abstract

Objectives: The purpose of this systematic review was to determine the effect of retro-walking in non-specific low back pain (LBP) among young individuals. **Methodology:** This systematic review study has been carried out through PRISMA guideline. This systematic review has been conducted by researcher who searched articles using electronic search for publications in various electronic database: Google Scholar, PubMed/Medline, and Research gate. After implementing the selection criteria, articles published between the years 2000–2020 have been selected. Total 70 full-text published articles were selected from different electronic database. Out of 70, only 36 articles were included in this systematic review on the basis of selection criteria. Studies of human participants of 18–35 years of age having history of non-specific LBP were eligible. All the articles have been determine using Modified Downs and Black scale and scores have been awarded for the items selected on a 27 point scale. **Findings:** On reviewing the previous published articles, the result of this systematic review study shows that there is significant effect of retro-walking in non-specific LBP. Furthermore, there is considerable effect of retro-walking found in terms of improving muscles strength and reducing disability associated with the non-specific LBP. **Novelty:** Many studies have been carried on the effect of retro-walking in LBP. However, there is scarcity of literature based on systematic review on the effect of retro-walking in non-specific LBP among young individual.

Keywords: Retro-walking, Non-specific Low Back Pain, Disability

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Introduction

Non-specific low back pain (LBP) is defined as LBP not attributable to recognizable, known specific pathology such as infection, tumor, osteoporosis, lumbar spine fracture, structural deformity, inflammatory disorder, radicular syndrome, or cauda equina syndrome.[1] LBP studies are important in public health, as pain causes considerable discomfort, disability, and impaired activity of daily life. Everyone gets back pain once in life, at least 80% of the humans have to face it once in life.[2] However, mild pain will frequently remain and most patients will have at least one return in 1 year.[3] Studies conducted with college students show that the prevalence of non-specific LBP ranges between 30% and 70%, depending on periodic analysis, physical area, and development time.[4]

In addition, back pain due to inflation in healthcare has economic outgrowth, low productivity, further unwell leaves, work disability, and continued occupational disability recommencement.[5] For approximately 85% of back pain founded with no specific cause of mechanical (non-specific) LBP, suchlike structural changes or ammunition can be identified.[1] Mostly, in an episode of acute back pain patients improve within 1–3 months.[6] Some factors are often examined in the literature and included in clinical examination, including measuring the strength and endurance of trunk, flexors and extensors reduced extremity flexibility, physical activity, depression, and posture.[7] Several different populations were investigated to find the interrelationship between these components and variable but no logical result established.[8]

The most common exercise of aerobic is walking and has been favored by public health initiatives.[9] Walking prevents several chronic medical conditions and walking speed is linked with survival in golden agers, adults.[10] A study recommended that a timed usual gait provides predictive value for disability onset, 4–5 km walk in daily routine is good for health and improves mood, behavior, quality of life, self-confidence, and reduces metabolic risk.[11] Retro-walking is an activity that results in the kinetic variables of the joints experienced during further walking.[12] Retro-walking is a translational and dynamic activity with cardiovascular benefits.[13] The walking that gets moving in the backward direction and retro-walking is a visible rehabilitation approach that is used to promote the recovery of forwarding walking.[14]

Due to loss of neuromuscular control or balance and fall is a result of moving in the backward direction or dizziness.[15] The first and important goal during physiotherapy treatment for patients

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with back pain is to achieve adequate flexibility and mobility of the spine.[16] Some studies have shown that Retro-walking on a treadmill can ease LBP.[17] According to the Journal of Exercise Physiology, researchers have found the retro-walking leads to increases knee flex and hip extensions, as well as open the discs in the spine.[17]

The preferred gait patterns for walking by a human are like horizontal velocity and stride frequency and length, independently chosen according to the preferred form of locomotion by an individual.[18] Some options affect the gait economy because it reduces metabolic costs due to which, indirectly an optimal walking speed gets affected.[19] The difference in metabolic cost between the two methods of walking is attributed to the reduction in stride length, raised stride frequency, and the fact is that during retro-walking, the muscles of the quadriceps converge instead of being eccentric.[20] When the cost of energy increases compared to moving forward.[21] Another study conducted and concluded that for the benefit of retro-walking performance, specific disease conditions produce benefits in parameters such as pain and disease-related disability.[22]

As per the previous literature, modified walking patterns occur in individuals with non-specific LBP because pain alters physical, mechanical, and other parameters of the walking pattern of the patients.[23] Some reviews suggested that decreasing in walking speed reflects the individual facing pain and fear.[24] In addition, it took changes in muscle activity; LBP is accompanied by different task-specific changes in muscle control, which evident as recast in pattern of muscle recruitment.[25] The study observation supports the conjecture that, retro-walking can enhance the hamstring flexibility and spinal flexion, presenting as an exercise to reduce hamstring tightness and non-specific LBP for individuals who improve the condition.[26] Low flexibility and reduced ROM of lumbar spine often result in people who experience LBP, thus limiting function.[27] The purpose of this review article was to determine the effect of retro-walking in non-specific LBP among young individuals.

Methodology

Search strategy was performed by the using various search engines and the study was performing by searching the literature published by the various authors on different electronic database. By using the PRISMA guidelines, a systematic search of the existing systematic literature from year (2000–2020) was performed using of electronic database such as ResearchGate, PubMed/Medline, and Google Scholar. Therefore, some of the keywords and sentences in text used in research and term were used to like as "low-back-pain" or "low back-pain," "Retro-walking," "retro-walking," and "retro-walking" "random-controlled-trial" or "controlled-clinical-trial" effectiveness, based on the study topic, and The "RETRO-WALKING" was the most used word to search for studies because here, the retro-walking was a treatment arm for non-specific LBP. All included literature in the study was published in the English language only.

Study Design

It was a systematic review. All related articles were searched in full text and included on the basis of inclusion criteria.

Inclusion Criteria

According to the nature and setting demands of the study, the inclusion criteria were taken in the process after reviewing the related articles having the following characteristics:

- The age of individuals between 18 and 35 years
- Both female and male were included
- Only those individuals who have history of non-specific LBP
- Effect of retro-walking in musculoskeletal disorders

Exclusion Criteria

According to the nature and setting demands of the study the exclusion criteria were taken in the process after reviewing the related articles with a profound understanding and this exclusion criterion excludes the following:

- The individual having any recent surgery.
- The individual having recent injury, fracture, or any trauma
- The individual having chronic LBP, ankylosing spondylitis, scoliosis, spinal arthritis, and prolapsed disc
- Individuals older than 35 years of age

Search Terminologies

There were similar words, phrases, and terms that used in this systematic review and this data was taken from the previous literatures with same terminology and expression as in form of:

- LBP in general population
- LBP in youth or students
- Different age group whether juvenile, different occupation and genders (male or female).
- Different treatments protocols: backwards walking, forward walking, and retro-walking.
- Lumber muscle and spine

Data Extraction

Extracted data were logically on the basis of reviewing the articles and analyze the each research paper after analyzing the criteria was set according to the title of the study. Those articles who meets the criteria of research can be included in our study and those were not meet those criteria were excluded from the study. Criteria were mentioned above but broadly the three things were taken into the consideration-

- Survey based descriptive study
- Treatment based study on LBP
- Retro-walking and non-specific LBP

These were most important parameter taken into the consideration and help in conducting the study. The data extraction tools were survey based approach experimental comparative and retro-walking there were many articles who suggested the same condition but there studies were not meet the criteria. The data extracted after reviewing and some articles were intervention approached, neurological interventions, and surgical intervention and rest were showing biomechanical changes during. So they were extracted on this ground. After including other articles were help in measuring the results and outcome of the study.

Results

The systematic search revealed 121 studies, of which 13 were added retrospectively through reference screening of the included

articles. After title and abstract screening, 70 studies remained for full-text screening, and, eventually, 38 studies in Table 1 fulfilled the predetermined eligibility criteria in this systematic review. The complete flow diagram of the screening procedure is shown in Figure 1.

Table 1: Included studies in the review

S. No.	*Author and Publication Year*	*Title*	*Methodology*	*Remark*	*Outcome measure*
1.	Jenkins 2002	Classification of LBP[28]	The algorithm presented during this text provides a useful screening tool to differentiate between non-specific LBP amenable to chiropractic treatment and non-specific LBP because of a pathological cause.	The study concluded that a useful screening tool to differentiate between non-specific LBP amenable to chiropractic treatment and non-specific LBP thanks to a pathological cause. This categorization method allows the practitioner to avoid making assumptions supported heuristics and pattern recognition until it's been firmly established that the patient may be a candidate for chiropractic care.	Algorithmic approaches were used.
2.	Nourbakhsh and Arab 2002	Relationship between mechanical factors and incidence of LBP[29]	Total no. of subjects=600 4 groups:-asymptomatic M (*n*=150, asymptomatic F (*n*=150, 17 physical characteristics were measured, therefore the relative relationship of every characteristic with LBP was assessed.	Concluded that muscular endurance and weakness are related to LBP in association with the dimension of the lumbar curve, pelvic tilting, lower limb length discrepancy, and therefore the length of iliopsoas, hamstring, abdominal, muscles are not related to the occurrence of LBP.	A typical flexible ruler was wont to measure the dimensions of the lumbar curve within the standing position And Inclinometer wont to measure pelvic tilt.
3.	Taylor *et al*. 2003	The effect of walking faster on people with acute LBP[30]	Eight participants with acute non-specific LBP were assessed again for 6 weeks after pain get resolved. Eight participants of control group were examine during self-managed speed and fast walking on a treadmill. To measure the three-dimensional angular ROM of the pelvis and lumbar region of every participant walking on a treadmill.	Concluded that to steer faster, those with acute LBP have seen with increased stride length and therefore the movements of pelvic in frontal plane and lumbar lateral flexion (pelvis) to the extent till the symptoms get resolved. Author also founded that 10 min of treadmill walking at self-managed speed led to a discount within the level of back pain which there was an intense degree of indirect correlation between level of back pain and stride length	1. T video analysis system, 2. The timing and distance parameters of walking 3. VAS
4.	Taguchi 2003	Diagnosis and characters of non-specific LBP in Japan: The Yamaguchi LBP study[31]	In this study author discussed the nonspecific LBP, which is clinically the foremost common non-specific LBP in young and middle-aged people. Symptomatic therapies and directions on lifestyle are performed mainly because the treatment methods, thereby its important to eliminate patients' anxiety by explaining that the condition isn't a disease of malignant nature which no concern is required during this regard	Concluded that non-specific LBP involves many factors. Not only structural and physiological abnormalities within the lumbar region but also socio-psychological factors are often a serious cause like other Complex factors comprising of obesity, overwork, lack of exercise, and mental stress can induce non-specific LBP as a complaint	1. History-taking, Physical findings, X-ray examination 2. Blood tests 3. CT scans and MRI
5.	Kool *et al*. 2003	Exercise reduces sick leave in patient with non-acute non-specific LBP: A Meta-analysis[32]	A meta-analysis of RCT was performed. A chemical analysis of the leave results was done applying pre-defined levels of evidence. In studies comparing exercise with usual care, pooled effect sizes were computed.	In conclusion author provides strong evidence that exercise significantly reduces sick days during the primary follow-up year.	A meta-analysis

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Table 1: *(Continued)*

S. No.	*Author and Publication Year*	*Title*	*Methodology*	*Remark*	*Outcome measure*
6.	Hayashi 2004	Classification, diagnosis, and treatment of LBP[33]	Author Approaches for the diagnosis and the treatment of varied sorts of non-specific LBP are described during this paper.	Author concluded that, LBP a disorder of the axis of physical body, features a critical influence not only on quality of life, but on the lifetime of the elderly in an aged society	Diagnose And treatments
7.	Lamoth *et al*. 2006	Effects of chronic non-specific LBP on trunk coordination and back muscle activity during walking: changes in motor control[34]	In this study the data collection is done by involving 22 individuals with chronic non-specific LBP=13 F, 9 M and 17 healthy individuals=8 F, 9 M Thanks to storage failure, the EMG data of three of the LBP group (2 F, 1 M) and 3 of the healthy group (all Females) were lost, as a result of which the info had to be restricted to 33 individuals.	Concluded that, in LBP participants, the coordination between transverse thoracic and pelvic rotations and lumbo pelvic rotations was more rigid and fewer variable than in healthy controls, whereas the coordination between the segments within the frontal plane was less tight and more variable, particularly at walking velocities above the comfortable velocity.	1. TSK 2. RDQ 3. VAS
8.	Koes *et al*. 2006	Diagnosis and treatment of LBP[35]	Author used the Cochrane Library to identify relevant reviews of literatures that evaluate the effects of complementary, conservative, and surgical interventions. Medline searches were used to find other relevant papers and literature reviews on diagnosis and treatment of LBP.	This review presents, No results available at now.	This review presents the current state of science regarding the diagnosis and treatment of low back pain.
9.	Morsø *et al*. 2006	Nordic walking and chronic LBP: design of a randomized clinical trial[36]	Sample size=150, with non-specific LBP for a minimum of 8 weeks and mentioned a specialized OPD with non-specific LBP are included within the study. After completion of OPD treatment patient are randomized into one among three groups: 1.Under supervision Nordic Walking is done twice every week for 8 weeks. 2.Unsupervised Nordic Walking is done for 8 weeks. 3.Motivational talk for 1 h including pushing advice to remain physically fit and active.	No satisfactory results available at this point.	1.Rating Scale 2. Patient Specific Function Scale 3. EQ-5D is a standardized 5-item generic measure of health related quality of life. 4. Watt Max BicycleTest is a standardized test to determinate a persons cardiovascular capacity 5. Accelerometers
10.	Fielda *et al*. 2007	LBP and sleep disturbance are reduced following massage therapy[37]	A randomization between the groups just to evaluate the effects of massage therapy versus relaxation therapy effects on chronic LBP. Under age ¼ 41 years with non-specific LBP with a minimum duration of 6 months participated within the study. The groups did not differ on age, socioeconomic status, ethnicity or gender. 30 min long session, twice a week for 5 weeks.	In the conclusion of the study, comparison between two groups, the massage therapy relief group, both groups reported experiencing less pain, anxiety, depression and sleep disturbance. Also showed improved trunk flexion performance and pain reduction.	1. POMS-D Scale 2. STAI 3. VAS 4. Sleep Scale

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Table 1: *(Continued)*

S. No.	*Author and Publication Year*	*Title*	*Methodology*	*Remark*	*Outcome measure*
11.	Dagenais *et al*. 2008	A systematic review of non-specific LBP cost of illness studies in the United States and internationally[38]	Author searched to midline published articles in English from 1997–2007, about the direct or indirect costs of LBP. Data extracted for each eligible study included: Definition of LBP, the study design, methods of estimating costs, subjects, year of data, and estimates of direct, indirect, or total costs.	This review didn't identify any studies estimating the entire costs of LBP within us from a societal perspective. Such studies could also be helpful in determining appropriate allocation of health-care resources dedicated to this condition.	Considerable methodological heterogeneity
12.	Manckoundia *et al*. 2008	Backward disequilibrium in elderly subjects[39]	Author review BD, author examine the, consequences, etiological factors, evaluation, diagnosis, management and. Among the tests to assess balance and gait in elder subjects, only the Minimum Motor Test includes items for a chemical analysis of BD, tasks like sit-to-stand, back-to-sit, maintaining as static stable standing posture or walking	In this paper, author reviewed current knowledge about BD within the elderly. Although it's been known by physicians for several decades, BD, which could have serious physical, psychological or social consequences, has rarely been studied within the literature. The few published studies on BD concern Parkinson syndromes.	1. The other usual tests 2. The Timed Up and Go test 3. The Berg Balance Scale
13.	Prince *et al*. 2008	A comparison of direct versus self-report measures for assessing physical activity in adults: a systematic review[40]	Eight electronic databases were searched to spot observational and experimental studies of adult populations. Searching identified 4463 potential articles. Initial screening found that 293 examined the connection between self-reported and directly measured physical activity and met the eligibility criteria.	Results show the association between direct measures& self-report were generally low-to-moderate and ranged. No clear emerged patterns were seen for the mean differences between both the measures and therefore the gender of participants. Results had low quality score (38%) as per bias assessment indication.	1. DLW 2. Indirect or direct calorimetry, 3. Accelerometry, 4. Pedometry, 5. HRM, 6. Global positioning systems
14.	McIntosh and Hall 2008	Lower Back Pain (chronic)[41]	This study was conducted a scientific review and aimed to answer the subsequent clinical questions: 1.What are the consequences of oral drug treatments? 2.What are the consequences of injection therapy? 3) What are the consequences of non-drug treatments? And web searched: Medline, EMBASE, The Cochrane Library, and other important databases up to May 2007	In this systematic review author concluded that, the present information concerning The effectiveness and safety of the subsequent interventions: acupuncture, behavioral therapy, electromyography biofeedback, exercise, analgesics, muscle relaxants, NSAIDs, injections antidepressants, intensive multidisciplinary treatment program, traction, lumbar supports, massage, spinal manipulative therapy, and TENS.	1. Pain intensity (VAS) 2. Numerical rating scaleMorris Questionnaire 3. Oswestry questionnaire
15.	Fairley *et al*. 2010	The Effect of treadmill walking on the stride interval dynamics of children[42]	Sample size=31 children completing a minimum of three, 10-min walking trials, under the subsequent conditions i.OW, ii.unsupported walking on treadmill iii.supported walking on treadmill	Study concluded that for EACH walking condition, no significant differences between right and left foot were detected by paired t-tests. Hence, the results that follow are reported for right foot data only	Box plots of scaling estimates, α, for all (A), younger (B) and older (C) children.

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S. No.	*Author and Publication Year*	*Title*	*Methodology*	*Remark*	*Outcome measure*
16.	Hendrick *et al*. 2010	The effectiveness of walking as an intervention for LBP: a systematic review[43]	Author searched PubMed CINAHL, AMED, EMBASE, Medline, Scopus databases and Cochrane. The search was restricted in English language. Involved study met inclusion criteria, and was assessed with a top quality checklist.	There was only low-moderate proves for walking as an efficient intervention strategy for LBP. Further investigation is required.	Quality check list
17.	Huang *et al*. 2011	Gait adaptations in non-specific LBP patients with lumbar disc herniation: trunk coordination and arm swing[44]	Patients of non-specific LBP patients with lumbar disc herniation and healthy controls were recruited by word of mouth , included individuals must be under age of 20 and 45 years, lumbar disc herniation confirmed by CT-scan, pain not beyond the knee, and ready to walk a couple of blocks. For both the groups 30, leg length discrepancy 2 cm, previous back or leg surgery, or other diseases affecting gait Excluded.	Concluded that LBP patients with lumbar disc herniation walked with larger pelvis rotations, and reduced relative phase between pelvis and thorax horizontal rotations, specifically in large steps. They did so by rotating the thorax more in-phase with the pendular movements of the legs, which allowed them to limit amplitudes of spine rotations. Within the patients, arm swing was out-of-phase with the leg. Therefore, the phase association between arm swing and thorax rotations and was altered.	VAS
18.	Shiri *et al*. 2010	Incidence of non-specific and radiating LBP: follow up of 24–39-year-old adults of the Young Finns study[45]	Participating subjects under age of 24–39 years, which were free from non-specific LBP at baseline in 2001, were included. Author estimated the incidence of nonspecific and radiating non-specific LBP in 2007.	In results incidence of moderate (8–30 days duration within the past 12 months) non-specific LBP was 13.2%, which of radiating. Non-specific LBP was higher in women than in men.	Nordic questionnaire.
19.	Dufek *et al*. 2010	Effect of Retro-walking as a modality for non-specific LBP in athletes[46]	Five NCAA Division-I athletes currently experiencing LBP and five active, healthy collegiate free from LBP volunteered to participate within the study. Inclusion criteria (LBP group) Experienced LBP within the past 8 months and currently electing to permit the pain to resolve without physician involvement for this time and therefore the duration of the study. Obtained data from all study volunteers both pre- and post-intervention. Pre- and post-testing consisted of first subjectively reporting a LBP pain value (LBP group only)	Study results supports BW in compression of pain reduction and increased low back ROM for athletes with LBP. Single-subject evaluation provided insight into possible mechanistic changes elicited by the BW for specific individuals with LBP, including a rise in SL amid increased sROM. Clearly, additional research into the consequences of BW is warranted for athletes presenting with unresolved LBP	1. Uniaxial accelerometers 2. Biaxial electrogoniometer 3. DV included walking velocity.
20.	Dufek *et al*. 2011	Retro walking: A possible active exercise for non-specific LBP reduction and enhanced function in athletes[47]	Included Respondents are athletes with NAAC Division I with LBP (n=5) and healthy, active athletes without LBP (n=5), performed a pre and post-test, 3-week intervention of Retro-walking, Low back range of motion, stride parameters, shock attenuation and pain scores were measured and recorded during each test session.	This study support Retro-walking to scale back pain and increase lumber range of motion for athletes with LBP. Single-subject evaluation provides insight into mechanistic changes elicited by the intervention for specific individuals with LBP, including a rise in SL possibly amid a rise in sROM. Investigations into the role of lumbar musculature in postural stability and dynamic function could also be particularly insightful to further understand the potential relationship between Retro-walking and LBP reduction	1. Uniaxial accelerometers 2. A biaxial electrogoniometer 3. Bioware data acquisition software

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Table 1: *(Continued)*

S. No.	*Author and Publication Year*	*Title*	*Methodology*	*Remark*	*Outcome measure*
21.	Bhakti 2011	The effectiveness of Retro-walking post anterior cruciate ligament reconstruction -results of a randomized controlled trial[48]	30 subjects were randomly allotted into the 2 groups: experimental group received Retro-walking additionally to the traditional program. The intervention was given for 4 weeks. Post intervention assessment was wiped out terms of strength of hamstring and quadriceps muscles, gait parameters and proprioception (stride length, step length, cadence). Strength of the hamstrings and quadriceps was measured by 10 RM with the assistance of weight cuffs and control group in which Pre intervention assessment was wiped out terms of strength, gait parameters and proprioception (cadence, stride length, and strep length). Conventional program is used for control group. Proprioception at the knee was measured at different angles by active positioning test. Gait parameters were assessed by foot print analysis method.	After group analysis study concluded that there was statistically significant improvement within the 10 RM of quadriceps and hamstrings muscles, gait parameters and proprioception in both experimental and control groups improved substantially.	Pre-intervention assessment was done by the therapist.
22.	Handrakis *et al.* 2011	Key characteristics of non-specific LBP and disability in college-aged adults: A Pilot study[49]	This study was observational, Subjects were measured to the factors associated with LBP and were grouped by both VAS (minimum [min]/no pain, pain) and ODI (no disability, A convenience sample (*n*=84) of English speaking students (34 M, 5F) between 18 and 30 years aged.	Results revealed that, Back extensor endurance was consistently different between both the pain and disability groups. Addressing reduces endurance in low back extensor group of muscle and reduction in levels of physical activity in young individuals.	1. VAS, 2. Baecke Physical Activity Questionnaire 3. ODI.
23.	Delitto *et al.* 2012	LBP clinical practice guidelines linked to the international classification of functioning, disability, and health from the orthopaedic section of the American Physical Therapy Association.[50]	The authors did a scientific search of the MEDLINE, CINAHL, and therefore the Cochrane Database of Systematic Reviews (1966-2010) for any relevant articles associated with classification, examination, and intervention for musculoskeletal conditions associated with the low back region. The lead author (A.D.) assigned a selected subcategory (classification, measures, and intervention strategies for musculoskeletal conditions of the low back region) to look based upon their specific area of experience.	Clinicians should consider 1.For patients with chronic non-specific LBP without generalized pain follow moderate-to high-intensity exercise 2. For patients with chronic non-specific LBP with generalized pain follow the low-intensity, endurance activities and sub maximal fitness for pain management and maintain the health strategies.	Review literature

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Table 1: *(Continued)*

S. No.	*Author and Publication Year*	*Title*	*Methodology*	*Remark*	*Outcome measure*
24.	Yadav 2016	Effectiveness of retro-walking in chronic OA of knee joint[51]	30 Subjects with grade three OA changes on radiological findings patients were included and fulfilling inclusion criteria were selected within the study. All subjects underwent retro-walking on 15° angle inclined motorized treadmill with (self-tolerated) minimal pace and gradually increased counting on the patients comfort up to 10 min for 10 days.	Study concluded that the retro-walking is very effective in reducing symptom and overcome disability in patient affected by chronic OA	1. VAS, 2. WOMAC, 3. Dynamic balance through step test was also recorded
25.	Gondhalekar *et al.* 2013	Retro-walking as an adjunct to conventional treatment versus conventional treatment alone on pain and disability in patients with acute exacerbation of chronic knee osteoarthritis: A Randomized clinical trial[52]	Subjects *n*=30 with chronic knee osteoarthritis patients were randomly divided into two groups. (Group "A"=7 M,8 F) received conventional treatment. (Group B' =8M,7F) received conventional treatment and Retro-walking walking.	Concluded that, Retro-walking is an efficient adjunct to standard treatment in decreasing disability in patients with knee osteoarthritis.	Primary outcomes 1. VAS 2. WOMAC Secondary outcomes 1. Knee ROM 2. Hip abductor and extensor strength
26.	Laird *et al.* 2014	Comparing lumbo-pelvic kinematics in people with and without back pain: a systematic review and meta-analysis[53]	Cochrane Central, CINAHL, MEDLINE, Scopus, AMED, EMBASE, AMI, ISI Web of Science was searched from inception to the January 2014 for relevant studies.	Study suggests that, The search includes 43 eligible and accurate studies. Compared to people without LBP, i.(8 research papers) says no difference in lumbar curve angle. ii.(19 research papers) shows reduced lumbar ROM iii.(4 research papers) shows no difference in lumbar relative to hip contribution to end-range flexion iv.(3 research papers) no difference in standing pelvic angle v.(8 research papers) slow movement and vi.(17 research papers) reduced proprioception	Meta-analyses were performed.
27.	Almoallim *et al.* 2014	A simple approach of LBP[54]	This study presents comprehensive review for diagnosis and evaluation of LBP consistent with current clinical studies guidelines. Our objectives are to define LBP, to determine the way to take an in depth history and the way to physically examine it so as to enable physicians to form an appropriate medical diagnosis for LBP, and to spot relevant investigations and referrals of patients with LBP	Study suggested that, the way to outline a primary plan for managing and treating LBP. The article is ready within the format of question and answer to form it targeted and accessible	History of the patient and physical examination like:- GAIT, Inspection Palpation ROM Special tests to diagnose the pain

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Table 1: *(Continued)*

S. No.	*Author and Publication Year*	*Title*	*Methodology*	*Remark*	*Outcome measure*
28.	O'Connor *et al.* 2014	Walking exercise for chronic musculoskeletal pain: Systematic review and Meta-analysis[55]	Six electronic databases was searched by author (Medline, PsychINFO, PEDro, CINAHL, Sport Discus and therefore the Cochrane Central Register of Controlled Trials) were searched from 1980 to 2014. Study Selection: Randomized and quasi-randomized controlled trials in adults with chronic LBP, fibromyalgia osteoarthritis comparing walking interventions to a non-walking exercise control group or non-exercise. Data were independently extracted employing a standardized form.	Results suggest that walking is related to significant improvements in outcome compared to regulate interventions but longer-term effectiveness is uncertain. Further work is additionally required examining effects on important health related outcomes during this population in robustly designed studies	Twenty-six studies (2384 participants) were included and suitable data from were pooled for meta-analysis with a random effects model used to calculate between group mean differences and 95% confidence intervals
29.	Carvalho *et al.* 2016	Effect of nonspecific chronic LBP on walking economy: An observational study[56]	An observational study, The sample calculation was performed using software Win Pepi 11:18 (PEPI for Windows). Considering possible losses, 18 individuals were recruited. (Eight for every group). Volunteers with chronic nonspecific LBP, of both genders, between 25 and 59-years-old, from the UNIOESTE physical restoration Center were recruited intentionally, not probabilistically, to compose the LG. The exclusion criteria for the LG were as follows: Smokers or ex-smokers (for both the groups) with osteomuscular injuries in other joints and neurological diseases; patients with histories of spinal surgery, pregnancy, cardiovascular, or lung diseases, or limitation of walking ability in reference to the well-liked self-selected speed (PS); and significant increase in pain during the tests.	Results revealed that, no differences between the CG and LG. It suggests that, those studies showing that chronic LBP does not reduce the physical conditioning are aligned, which might be a reason for the LG being less economical than the CG.	For the statistical analysis, we used the SPSS 20 software. Data normality was tested by the Shapiro-Wilk test. To measure oxygen consumption (VO_2)
30.	Saragiotto *et al*. 2016	MCE for chronic non-specific LBP[57]	Conducted electronic searches in CENTRAL, MEDLINE, EMBASE, five other database and two trials registers from their inception up to April 2015. Also performed citation tracking and searched the reference lists of reviews and eligible trial.	MCE is perhaps simpler than a minimal intervention for reducing pain, but probably does not have a crucial effect on disability, in patients with chronic LBP. There was no clinically important difference between MCE and other sorts of exercises or manual therapy for acute and chronic LBP.	CBN Review Group 12-item criteria.

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Table 1: *(Continued)*

S. No.	Author and Publication Year	Title	Methodology	Remark	Outcome measure
31.	Alghadir *et al.* 2016	Effect of retro and forward walking on quadriceps muscle strength, pain, function, and mobility in patients with knee osteoarthritis: a protocol for a randomized controlled trial[58]	Study was randomized controlled trial Respondents *n*=69, with knee OA are going to be recruited from the OPDs. The Respondents are randomly assigned to a particular groups; Retro-walking, Forward walking (control group). Duration of educational program=3 days/week for 6 weeks. An independent assessor blinded to group assignment will measure, knee pain intensity quadriceps muscle strength, mobility and functional disability at baseline and after training	Conclusion of the study, this study will help determine whether retro or forward-walking or both are effective within the rehabilitation of subjects with knee OA.	The primary outcome variables, 1. NPRS scores for pain 2. WOMAC index for function,
32.	Lee and Kang 2016	The effects of strength exercise and walking on lumbar function, pain level, and body composition in chronic back pain patients[59]	Respondents were randomly assigned to a particular 1.Strength exercise group (*n*=15) 2.Combined exercise group (*n*=15) 3.Control group (*n*=6). All subjects performed exercise twice per week, 50 min per session with knowledgeable instructors for 12 weeks.	In results, participating in strength and walking exercises were beneficial to enhance lumbar function. Also, the combined exercise program was simpler for reducing pain levels than the strength exercise. Finally, fat mass was reduced during this study and this might play a possible role within the improvement of lumbar function and reduction in LBP	1. VAS 2. RMDQ
33.	Ding *et al.* 2016	Backward-walking biological motion orients attention to moving away instead of moving toward[60]	Respondent was students *n*=20, from Zhejiang University (11F,9M with 19–25-years-old) The backward-walking PLDs were displayed on a 19inch screen (resolution: 1024×768; refresh rate: 60 Hz) using MATLAB (Math works, Inc.) with Psychophysics Toolbox extension	Concluded that, the shift triggered by walking direction isn't reflexive, thus providing support for the rich interpretation of those triggered effects	PLD were used to display walking
34.	Ganesan *et al.* 2017	Prevalence and risk Factors for non-specific LBP in 1,355 young adults: A cross-sectional study[61]	Respondents *n*=1,355 (741 M and 641 F) young, aged 18–35 years were enrolled within the study. The themes completed an in depth, semi-structured questionnaire that gathered data regarding their socio-demographic profile and factors associated with LBP. Anthropometric measurements, weight and height, were measured and body mass index	In results , Study indicated that the subsequent factors were related to LBP in young adults: legal status , strenuous exercise, monotony, job satisfaction, stress, previous history of spine problems, daily number of studying hours, and case history of spine problems	1. 1) Height and weight, and BMI 2. Pain was assigned a score of 0–100. 3. Questionnaire in the presence of an investigate
35.	Rose *et al.* 2018	A Retro-walking training program to improve balance and mobility in acute stroke: A pilot randomized controlled trial[62]	*n*=18 individuals, 1-week post stroke were randomized to eight, 30-min sessions of BWT or SBT additionally to scheduled therapy. Mobility were assessed pre- and post-intervention and at 3 months post stroke	Study concluded that, BWT resulted in greater improvements in both forward and Retro-walking speed than SBT. Retro-walking training may be a feasible important addition to acute stroke rehabilitation. Future areas of inquiry should examine BWT as a preventative modality for future fall incidence	1. Five-Meter Walk Test, 2. 3-Meter Backward Walk Test, 3. Activities-Specific Balance Confidence Scale, 4. Berg Balance Scale

(Contd...)

Table 1: *(Continued)*

S. No.	Author and Publication Year	Title	Methodology	Remark	Outcome measure
36.	Koch and Hänsel 2018	Chronic non-specific LBP and motor control during gait[63]	Author searched on Medline, Sport Discus, Psych Info, Psych Articles, EMBASE, and Scopus was performed. 29 articles comparing healthy adults and adults with chronic non-specific LBP in neuromuscular and/or biomechanical parameters during walking or running were examined. Data extraction and quality assessment were independently performed by two persons. Among others, we extracted population, conditions, outcome measures, and results	At the end of the study author concluded that , persons with and without non-specific LBP differed in several parameters of control , which was indicated by a low movement amplitude of the pelvis, more in-phase coordination, low ground reaction forces, higher stride-to-stride variability and a better activity in ES within the LBP group	NOS

VAS: Visual analog scale, RDA: Roland disability questionnaire, POMS-D: Profile of Mood States Depression, STAI: State Anxiety Inventory, DLW: Doubly-labeled water, HRM: Heart rate monitoring, NSAIDs: Non-steroidal anti-inflammatory drugs, TENS: Transcutaneous electrical nerve stimulation, OW: Over ground walking, DV: Dependent variables, RM: Repetition maximum, ODI: Oswestry Disability Index, WOMAC: Western Ontario and McMaster Universities Arthritis Index, ROM: Range of motion, MCE: Motor control exercise, CBN: Cochrane Back and Neck, RMDQ: Roland-Morris disability questionnaire, PLD: Point-light displays, NOS: Newcastle-Ottawa Scale, TSK: The Tampa scale

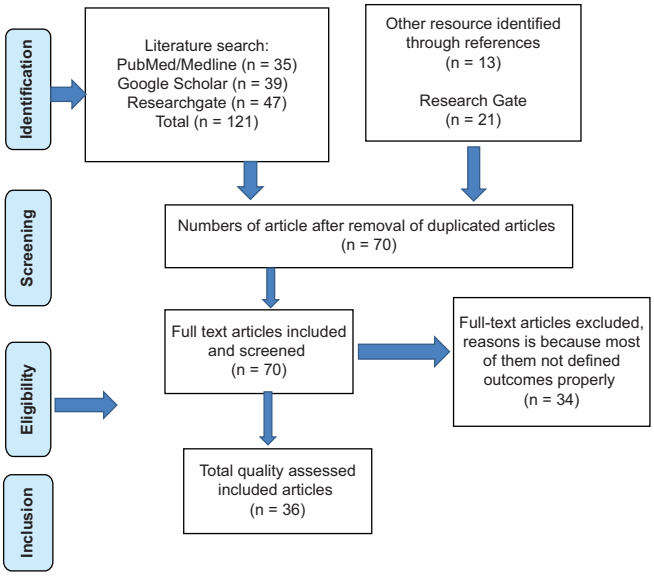

Figure 1: Flow chart of process of screening the articles

Discussion

The purpose of this systematic review was to determine the effect of retro-walking in non-specific LBP. After thorough reading of past studies on the effects of retro-walking in non-specific LBP, it was concluded that retro-walking shows different beneficial effects in different musculoskeletal and neurological condition, retro-walking gives multiple effects on condition. Retro-walking is effective in core strengthening, somewhere its improved balance and gait, reduced non-specific LBP (chronic and acute), with contributory effects on activation of paraspinal muscle and increases the ROM of lower back.[64]

Non-specific LBP presents a challenge for the clinician, and it's thought to be best managed by categorizing or matching treatments to particular symptomatology.[65] There was no plan to categorize specific LBP etiology or to regulate or maybe suspend other sorts of treatment modalities.[66] Walking exercise and stabilization with walking exercise significantly improved muscular endurance of back muscles.[67]

Incontrovertible evidence exists regarding the role of retro-walking in rehabilitation. Much dissimilarity has been stated between forward walking and backward walking.[68] There's scientific proof documenting the advantages of retro-walking in improving cardio respiratory fitness in injured athletes while decreasing joint compressive forces and increasing muscle strength.[69]

Some researchers found no differences between them and stated that retro-walking was almost a reflection of forward walking. They found that joint patterns were almost like forward walking but with simple temporal reversal. However, retro-walking differs from forward walking from biomechanical perspective. The results of preliminary study also suggested that retro-walking may positively influence hamstring flexibility for females. It shows whereas retro-walking when combined with conventional exercises has no additional effect in improving the flexion range of motion and reducing muscle fatigability.[70]

Conclusion

This systematic review concluded that retro-walking reduces non-specific LBP and increase low back range of motion with LBP and have high prevalence in females then male and some included review articles shows that retro-walking was effective in reducing pain at rest and activity, but it had been equally effective in increasing core strength having non-specific LBP and a few included review papers shows that retro-walking when added to standard exercises could also be helpful in reducing chronic mechanical LBP and improving core muscle strength.

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