Effects of suggested specific exercise program on pain and active range of motion in patients with nonspecific low back pain.

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Introduction

Low back pain (**LBP**) is a very common disorder (Woolf AD, Pfleger B, 2003) (Luo X, et al., 2004) with 84% of suffering from it at some point during their lifetimes (Goubert L, et al.,2004), (Luo X, et al., 2004). Among them, 7–10% will develop chronic low back pain (**CLBP**), and 1% will have physical disabilities (Nykänen M, Koivisto K., 2004). **LBP** is not only painful but also leads to loss of function, so this condition hampers a healthy lifestyle (JN., 2006). It is increasingly seen in patients in their 20s to 40s, especially due to the economic development of society and changing working environments (Puolakka K, et al. , 2008). Most cases (90%) are nonspecific and occur in all age groups (Krismer M, van Tulder M , 2007).

Patients with **LBP** suffer from deteriorated physical functions (Hwi-young Cho, et al., 2014), and may result in a reduced level of physical capacity due to weakened muscle strength in the lumbar region (Hwi-young Cho, et al., 2014) (Danneels LA, et al., 2000) (Rainville J, et al. , 2004), negative psychological effects (Manchikanti L, et. al. , 2002) (Carson JW, et al., 2007) and reduction in the quality of life (Yue Y-S, et al., 2014). it can be the result of many different things.

Low back pain can be the result of many different things. Pain can be triggered by some combination of overuse, muscle strain, and/or injuries to the muscles, ligaments, and

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discs that support the spine. Over time, a muscle injury that has not been managed correctly may lead to an overall imbalance in the spine. This can lead to constant tension on the muscles, ligaments, bones, making the back more prone to injury or re-injury. (D'Aoust, C., 2015).

Low back pain was defined also as pain and discomfort, localised below the costal margin and above the inferior gluteal folds, with or without leg pain (sciatica) (Omokhodion, 2002). **LBP** is caused by a degenerated or damaged facet joint or sacroiliac joint with soft tissue injury on the trunk or by lumbar instability from weakened muscle strength (Willson JD, et al., 2005). Lumbar instability restricts muscle strength, endurance, flexibility, and active range of motion (**AROM**) (Hwi-young Cho, et al., 2014). These changes increase lumbar instability and raise the recurrence of low back pain. Therefore, abdominal and spinal extensors are crucial in improving lumbar stability. Therefore, abdominal and spinal extensors are crucial in improving lumbar stability (Nicolas Olivier, et al., 2013) (Hwi-young Cho, et al., 2014) (Rainville J, , et al., 2004) .

LBP can be classified according to its duration (i.e. acute low back pain is usually defined as the duration of an episode of low back pain persisting for less than 6 weeks; sub-acute as **LBP** which lasts between 6 and 12 weeks and long-term **LBP** as persisting for 12 weeks or more; chronic **LBP** is defined as **LBP** persisting for 12 weeks or more) (van Tulder, et al., 2004).

Nonspecific - **LBP** is the most commonly reported by human beings. The human body has a center of gravity, which keeps the balance between muscles and bones to maintain the integrity of structures and protect them against injury, in any position whether standing, sitting or laying down. Which is the effort required for work and activities of daily living. (Daniele L. et al., 2012.). The characteristics of nonspecific LPB are heavy pain, worsening with exertion especially in the afternoon, relieved with rest, absence of neurological and muscle contraction, and antalgic posture, associated with inactivity and poor posture (Meleger AL, Krivickas LS , 2007).

Exercises that increase muscle strength and flexibility are very important for **LBP** patients not only to alleviate low back pain but also for continued self-care (Rainville J, et al., 2004). (Daniele L. at al., 2012).

Exercises are defined as a set of specific movements with the objective of developing and training the muscle and joints with the use of a practice routine or physical training in order to promote the physical health of the individual (Daniele L. at al., 2012).

Electronic databases MEDLINE, PUBMED and EMBASE (1992 to 2014) have been used. The auther used''Exercise program and nonspecific LBP'' as search terms. 54 studies have been found, that deal with the same topic. Some reviews have been published that evaluated different types of physical exercise interventions in the prevention of **LBP**. The reviews are essentially based on the same studies, although the most recent reviews also included some recent trials. Other reviews concluded that there are some evidences of effect of exercise. (Bell JA, Burnett A. , 2009) (Bigos SJ. et al. , 2009) (Gebhardt WA. 1994) (Lahad A. et al. , 1994) (Linton SJ, van Tulder MW. , 2001) (Maher, 2000) (Tveito TH, Hysing M, Eriksen HR., 2004) (van Poppel MN, et al., 1997)

One review concluded that there was contradictory evidence that various general exercise/physical fitness programs reduce future **LBP**. (Waddell G, Burton AK., 2001)

The most recent systematic reviews of randomized trials on exercises for prevention of **LBP** had somewhat different conclusions. One review on prevention at the workplace found strong evidence that exercise was effective in reducing the severity and activity interference from **LBP** and found limited evidence supporting the use of exercise to prevent **LBP** episodes (Bell JA, Burnett A. , 2009).

Another recent review included studies on prevention of back pain not only at the workplace but also in any other settings. The review found strong, consistent evidence to guide prevention of **LBP** episodes in working-age adults. The authors concluded that there is strong, consistent evidence that exercises are effective, while other interventions are not, including stress management, shoe inserts, back supports, ergonomic/back education and reduced lifting programs (Bigos SJ. et al., 2009). The studies included instructions for back extensor training followed by regular training sessions for 1 -12 months, training of trunk flexors, general aerobic exercise and aquatic exercises.

Some reviews concluded that most studies were of high quality and have a low risk of bias (Bigos SJ. et al. , 2009), while others concluded that there were various limitations and a high risk of bias in most studies (Bell JA, Burnett A. , 2009).

In conclusion, although exercise is widely used at the workplace to prevent **LBP**, the evidence is not yet consistent and convincing. Future trials are needed that should focus on identifying specific types and doses of exercise for specific populations. But such studies were not propagated in Kingdom of Saudi Arabia (KSA) before. Thus, the purpose of this study was to identify the effects of the exercise program on pain level and on daily active range of motion "**AROM**" in patients with nonspecific low back pain.

METHODS

Objective: To examine the effect of stretching and strength exercise for patients with nonspecific low back pain (**LBP**) in reducing pain and disability.

Design: Randomized controlled trial.

Setting: All participants have residence in "a compound" in Riyadh, Kingdom of Saudia Arabia. The program was parcticed in a sport hall. This study was held during the period from Nov. 2014 to Feb. 2015.

Participants

Twenty one subjects with nonspecific **LBP** participated in this study. The subjects were divided into two groups as follows: a control group consisting of 7 males, and an experimental group consisting of 12 males. Anyone with a known history of metabolic, cardiovascular, respiratory, back surgery, spinal stenosis, a herniated, ruptured or degenerated disk or neurologic disorders was excluded. All participants were nonsport and have persisting **LBP** for up to six weeks. They received verbal and written information about the study and all gave their written consent before entering the study.

All participants “the control group and the experimental group” were matched based on age, height and weight, which is presented in Table 1.

Table (1)
Means and Standard Deviations of Characteristics of subjects at the baseline.

Statistics / Parameters	Experimental Group (n=12)		Control Group (n=9)		Mean Difference	(T)	Sig. Level
	Mean	SD±	Mean	SD±			
Age (y)	45.17	2.04	44.67	2.12	0.50	0.55	0.59
Height (cm)	176.00	4.86	175.33	4.77	0.67	0.31	0.76
Wight (kg)	89.25	4.63	87.67	4.47	1.58	0.79	0.44
BMI	28.84	1.69	28.56	1.89	0.28	0.36	0.72

Values are expressed as the mean ± standard deviation (SD)

Main Outcome Measures:

All measurements were performed before and one day after the intervention. In order to reduce measurement errors, assessments were conducted by the same investigator in the same place before and after the intervention.

1- **Physical Fitness Measurements**

Physical fitness parameters included aerobic **walking multi-stages test**, abdominal muscular strength and endurance, and lower back and hamstring muscle flexibility.

Aerobic **walking multi-stages test** was performed according to the modified Klaus Bös protocol on the treadmill. The first stage were performed at 1.0 km/h for 2 min. every 2 min the speed will increase 0.5 km/h. The test should be stopped when the subject cannot continue due to fatigue or pain, or due to many other medical indications (Bös, K. 2000) (Bös, K. 2003). Abdominal muscular endurance was performed according to the **YMCA Half Sit-up (1 minute)** “number of repetitions in 60 sec” (Golding, 2000), and the flexibility was evaluated by **modified sit-and-reach test** (Chillon, P. et al., 2010) (Pedro A. et al., 2009).

2- Outcome Measures

To assess the degree of pain visual analogue scale (**VAS**) was used (Hwi-young Cho, et al., 2014) (Yoo, 2014). The Quebec Back Pain Disability Scale (**QBPDS**) was used to evaluate the general activities of daily living. The questionnaire has twenty questions representing six domains of activity of daily living, “sleep, sitting / standing, ambulation, general body movements, bending / stooping, handling large / heavy objects”. Items are scored from 0 – 5. Anchor points are zero or "no difficulty", and five – "unable to do" (Rob Smeets, et al., 2011).

Interventions:

The subjects in the experimental group conducted the exercise program for approx. 40- 45 minutes in total, 3 times a week, for 6 weeks. This program is divided into 3 categories: 5 min warm up, followed with a combination of abdominal strength and stretching exercises 25-30 min and cool down 5 min. The suggested exercises program was conducted individually for all subjects. The control group did not perform any exercise program. (Enclosure Nr. 6)

Low Intensity of Interval Training was used. The intensity of exercise used in this way no more than medium intensity 60% of the individual maximum level, repetition of each exercise for approx. 10 times for three sets, and the rest periods ranging from 60 seconds to 120 seconds (Erlangen, 2003).

Data Analyses

Statistical analyses were performed using SPSS v15.0. The independent t-test was performed to compare the differences in dependent variables between groups, and the paired t-test was used to evaluate the differences within groups. Values are presented as mean ± SD. The level of probability was set at $p < 0.05$.

RESULTS

Comparison of pain level “**VAS** scores”, general activities of daily living **"QBPDS** scores" (p<0.05). **Table 2.** After 6 weeks of exercises program significant differences were observed in **VAS** scores in the experimental group, from 5.33± 0.89 to 2.67± 0.65 (p>0.05), similarly for **QBPDS** scores, main effects analysis of time (at baseline and after 6 weeks) showed that there were significant differences from 54.50± 4.46 to 26.25± 7.07 (p>0.05), while the control group did not show a significant difference.

Table (2)

Means and Standard Deviations of VAS and QBPDS at the baseline and after 6 weeks.

Parameters \ Statistics		Experimental Group		Control Group		Mean Difference	(T)	Sig. Level
		Mean	SD±	Mean	SD±			
VAS scores	baseline	5.33	0.89	5.33	0.87	0.00	0.00	1.00
	After 6 weeks	2.67	0.65	5.22	0.67	-2.56	8.81	0.00
QBPDS scores	baseline	54.50	4.46	55.11	6.43	-0.61	0.26	0.80
	After 6 weeks	26.25	7.07	54.67	6.02	-28.42	9.69	0.00

Values are expressed as the mean ± standard deviation (SD)

Physical fitness parameters at the baseline showed no difference between two groups. After 6 weeks all physical fitness parameters has been detecting significant differences in the experimental group, but the control group showed no significant difference. **Table 3**.

Table (3)
Means and Standard Deviations of all physical fitness parameters at the baseline and after 6 weeks.

Parameters / Statistics		Experimental Group (n=12)		Control Group (n=9)		Mean Difference	(T)	Sig. level
		Mean	SD±	Mean	SD±			
sit and reach (cm)	baseline	-9.92	6.39	-13.89	4.40	3.97	1.60	0.13
	After 6 weeks	1.92	2.81	-10.00	6.26	11.92	5.88	0.00
YMCA Half Sit-up (number in 60 sec.)	baseline	20.17	4.26	22.11	3.55	-1.94	1.11	0.28
	After 6 weeks	36.00	4.31	26.00	3.35	10.00	5.77	0.00
Walking time (min)	baseline	12.08	1.31	11.33	1.41	0.75	1.25	0.22
	After 6 weeks	25.75	1.60	13.33	1.66	12.42	17.31	0.00
Walking distance (m)	baseline	457.09	83.56	412.19	87.36	44.90	1.20	0.25
	After 6 weeks	1704.87	190.97	541.46	109.36	1163.41	16.32	0.00

Values are expressed as the mean ± standard deviation (SD)

After the intervention. The Abdominal muscular strength increased significantly in the experimental group (from 20.17±4.26 to 36.00±4.31), but the significant increase was not found in the control group. In a similar way, the experimental group showed a significant increased flexibility (from -9.92±6.39 to 1.92±2.81), the control group, however, showed no significant increase in flexibility.

Correspondingly, significant differences were observed in walking time and distance, as was shown in the result that the experimental group achieved a significant increase in walking time (from 12.08± 1.31 to 25.75±1.60) and walking distance (from 457.09± 83.56 to 1704.87±190.97).**Table 2**.

For the experimental group, the **VAS** scores, the **QBPDS** scores, and all physical fitness parameters were significantly higher at **T2** (after 6 weeks exercises program) than **T1** (at baseline), while at **T1** and **T2** were not significantly different within the control group. In addition, significant differences were observed in all outcome measurements between the two groups ($p<0.05$).

DISCUSSION

Pain and less of general activities of daily living are the main symptoms of LBP; thus, their assessment is important to identify the efficiency of treatment. (Grönblad M, Hurri H, Kouri JP, 1997). This study applied stretching and strength exercises program to nonspecific **LBP** patients and showed that it is effective in reducing pain and improving the activity of daily living.

The **VAS** score measured the pain level for all subjects. The experimental group showed significant decreases in pain level compared with those in the control group. This is similar to the results of Goldby et al., Koumantakis et al., and Hwi-young Cho et al., which showed significant pain reduction in patients with low back pain. (Goldby LJ. Et al. 2006) (Koumantakis GA. et al., 2005) (Hwi-young Cho. et al., 2014).

Measuring functional improvement can be based on a self-report questionnaire "the **QBPDS** scores", the questionnaire is consisted of twenty questions relating to general activities of daily living. It showed significantly improvement after 6 weeks of exercise intervention in experimental group. This indicates that exercise program caused the changes in general activities of daily living of patients who had low back pain. This result was in agreement with previous studies (Rob Smeets. et al., 2011) (Tavafian SS. et al., 2014) (Pires D. et al.,2014).

The exercise program, which was suggested in this study, controls tension of the lumbo-pelvic-hip joint, which maintains lumbar stability to strengthen muscles. It includes also lower back and hamstring stretching, which can increase the flexibility of the hamstring, which relieves tension on the back. Such exercises showed similar effects in decreasing pain intensity. According to the results, in the experimental group increased significantly, while that in the control group did not. This result corresponds to the result of a study by (Hwi-young Cho. et al., 2014)

(Chillon, P. et al., 2010) (Koumantakis GA. et al., 2005) (Rainville J. et al., 2004).

This study measured walking distance, abdominal muscular strength and lower back and hamstring muscle flexibility after intervention in the experimental group increased significantly compared with those before treatment. The experimental group showed significant decreases walking time and distance, abdominal muscular strength and hamstring muscle flexibility compared with those in the control group. Based on the results, the suggested exercise program seems to be effective for the prevention of patients with **LBP** and promoting general activities of daily living.

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