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# The Effect of Knee Deformity on Pain Intensity and Functional Fitness in Middle Age Male with Nonspecific Chronic Low Back Pain

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## Abstract

**Purpose:** Low back pain is one of the most common health problems of the world. Very different causes can cause back pain. Approximately 85% of people who are examined for low back pain the cause is not specific. The purpose of this study is to investigate the effects of the knee abnormalities on pain intensity and functional fitness in middle aged men with the chronic nonspecific low back pain. **Method:** The statistical community of this study includes 30 people of patient's male with nonspecific chronic low back pain in the age range of 30-50 years with one of the abnormalities of genu varum or genu valgum. **Results:** The research findings were analyzed using descriptive and inferential statistical methods (dependent t and independent t tests). The research findings indicate that both the pain and disability of the experimental groups have significantly decreased after applying selected of corrective programs (Stretching muscles and short elements and strengthening weakened muscles). Sitting frog, walking with the inner edges of the legs, pressure to enter the wall with the outer edges of the legs to modify the genu varum. passing legs from one side to another in the form of scissors in liner mode, passing the medicine ball to the wall with the inside of the legs, walking with the outer edges of the legs to modify the genu valgum ($p<0.05$). While the two variables in the control group did not differ significantly ($p>0.05$). **Conclusions:** According to the results and considering the conditions prevailing on the research samples, it can be concluded that knee abnormalities (genu varum and genu valgum) affected by pain intensity and functional fitness efficacy in nonspecific chronic low back pain patients and Corrective exercises of these abnormalities has had a significant effect on reduce pain and disability index.

***Keywords**:* Non-specific low back pain, Pain intensity, Functional fitness, Genu varum, Genu valgum

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# INTRODUCTION

Low back pain is the second cause of visiting a doctor, the third cause of surgery, and one of the most common health problems in the world today, disrupting daily work and costing us a fortune. Many people who suffer from this pain would face major physical and psychological problems such as decreased physical, mental, social functioning, general health decline, chronic or recurrent pain, which can lead to a decline in their quality of life. Over 90% of people are racked by low back pain at least once in their life (Bagheri Shadehi, 2013). Low back pain is not a disease but a symptom. The occurrence of low back pain indicates that there is a problem with the structure of the body, but we cannot pinpoint exactly the cause of it at all times (Koumantakis, Watson & Oldham, 2005). A wide variety of factors contribute to low back pain. No clear cause has been found in almost 85% of people who have been examined for low back pain. According to studies, the incidence of low back pain in the UK is 60%, in the US 75% to 85%, in Sweden 80%. And billions of dollars are directly or indirectly spent every year on treatment and losses arising from either the inability to work or sick leave. It is considered a major health problem in Iran as well, as various studies have been carried out, though they were not as concentrated as they should be, in this respect. According to Mohammad et al. (2000), the incidence of low back pain was 17.9%, which increased with age; that is, it was 29.4% in the 30-39 age group, 37% in the 40-49 age group, and 40.3% in the 50-57 age group. The highest rate was attributed to an age group of over 70, 47.9% (Bagheri Shadehi, 2013). In the human body, as a closed developmental chain, the position of each joint affects the other joints (Khosravi, 2012) considering that legs form the lowest part of the chain, providing a relatively small range of support surface to maintain balance. It seems reasonable that even small biomechanical changes within the range of support surface may affect postural control. Cup et al. (2004) reported that subjects with supinated foot (more than 7 degrees) significantly had weaker postural strength (Taheri Karami, Nourinejad & Zare, 2015). Besides forming support surface for the body's stability and movement, the lower extremity has an influence on the body's control in various positions (Shojaedin & Faghihi, 2014). In their study, Sundaram, Doshi & Pandian, (2012) and Volpe et al. pointed out that people with nonspecific chronic low back pain have greater sways in the center of body pressure in the anterior-posterior and internal-external directions in standing posture than healthy individuals (Volpe et al., 2006). Considering that pelvis is a support for spinal movements, pelvic and thigh muscles play a crucial role in the dynamic stability of the vertebral column. Reduced flexibility and tight pelvic floor muscles cause muscle and fascia resistance to deformity. Similarly, the change in muscle can impair the function of other muscle groups operating on that region. One of the causes of mechanical back injury is the change in the muscle length of the pelvic and thigh region, which can affect the curvature of the spine and perturb the mechanics of the spine and joints, resulting in low back pain (Ghafarinejad & Taghizadeh, 2001). In their study, Toppenberg and Bullock concluded that hamstring tightness and stiff spinal extending muscle cause pelvic rotation even in healthy individuals, which in turn can make a person susceptible to low back pain (Toppenberg & Bullock, 1986) One of the regions of the body, where the pattern of muscular imbalance most commonly occurs, is lumbo-pelvic-hip complex. This imbalance changes the natural posture of the pelvis (Mohammadi, 2008). Deformities such as Genu varum and Genu valgum because of knee's deformity from its natural axis can result in the perturbation of balance indices as well as static and dynamic balance control through mechanical perturbation and perturbation of the line of gravity. Inversion and eversion in the ankle joints that occur as side effects of the disorders can affect postural control, thereby altering postural control quality and balance. The changes causes asymmetry in weight distribution and instability regarding weight-bearing situations. Moreover, the mechanical deviation caused by Genu varum and Genu valgum can deviate ground reaction force, challenging postural control strategy in upright standing (Shojaedin & Faghihi, 2014). Changing knee posture, as part of a chain reaction, can perturb both the posture of ankle joint and hip joint, atrophying total optimal body balance (Daneshmandi, Alizadeh & Gharakhanlou, 2013). The accompanying and compensatory deformities caused by lower extremity abnormalities in the hip, knee, ankle, and foot joints, changes in the biomechanics of the joints, as well as the change in the line of muscle extension as a result of the change in limb alignment, all can contribute to the change in the functioning of lower extremity muscles in people with these abnormalities (Namavarian, Rezasoltani & Rekabizadeh, 2014). Unfortunately, despite many therapeutic protocols and extensive studies on low back pain, its treatment has yet to be satisfactory worldwide. This truth can convince us to believe that quite a few aspects of this disease have remained unknown, so we call for a more thorough understanding of the changes in the functioning of various systems involved in the disease (Kahlaee, 2011). Karimian (2014) conducted a study aiming at investigating the effect of the skeletal anomalies of the trunk and lower extremity on the severity of chronic low back pain in middle-aged women in the county of Shirvan. The results of the research indicated that the severity of chronic low back pain is influenced by kyphosis, lordosis, Genu varum and flat foot deformity, making it possible to suffer from low back pain. Hoch & Weinhandl in 2017 studied the effect of Genu valgum on the gait biomechanics of healthy women. The purpose of this study was to compare lower extremity kinematics between women with lesser or greater degrees of valgus knee alignment during gait. Nine women with greater valgus knee alignment (11.9±1.6°) were compared to nine women with lesser valgus knee alignment (6.6±2.4°). Knee angle in abduction and adduction moment in women with greater knee valgus indicated that the people may be experiencing biomechanics which promote lateral knee joint loading (Hoch & Weinhandl, 2017). Safdari (2014) studied the effect of six weeks of selected core stability exercise training on pain, and functional fitness in women with nonspecific chronic low back pain. Many studied have been done on chronic low back pain, but given that there has been apparently little work on the correlation between knee abnormalities and low back pain, or even some aspects of it has gone unnoticed, we set out to study the possible relation between low back pain and knee abnormalities, answering the question as to whether or not the anomalies Genu varum and Genu valgum have an effect on the severity of pain and functional fitness of patients with nonspecific chronic low back pain.

## METHOD

Considering the application of the intervening variable (training program) and purposeful selection of subjects based on inclusion criteria, the present study is a quasi-experimental study with pre-test and post-test design in three experimental and control groups. The subjects in this study were 30 person. They were purposefully divided into three groups (two experimental and one control group). The first group (n=10) were people with non-specific low back pain and Genu varum. The second group (n=10) were people with non-specific low back pain and Genu valgum. The third group (n=10) was the control group in that every patient can be the same as the patients in the first or second group. As for the characteristics of the select patients, we can refer to at least a three-month history of low back pain, one of the knee abnormalities (Genu varum or Genu valgum with a degree more than 2.5 cm), being in the age range of 30-50, no history of surgery or discomforts such as disc herniation, sciatica, spondylitis, fracture, discopathy, spinal canal stenosis, etc. The study population consisted of middle-aged men with non-specific chronic low back pain, who were referred to health clinics in the city of Khorramabad. The Quebec Pain questionnaire was used to measure the subjects' pain; Oswestry Disability Questionnaire was used to measure of functional fitness and a caliper was used to measure the space between ankle joints. Following an explanation of the research and statement of its significance to the subjects, the need for regular participation in the training and the manner of conducting the research was laid out for the subjects. Afterward, a written consent was obtained from all subjects, and they completed the Quebec Pain and Oswestry Disability Questionnaires. Thus, the rate of their pain and disability was calculated and recorded. After performing the pre-test by means of the Quebec and Oswestry Disability Questionnaires, the principles and manner of implementing the selected exercises specific to each group were elaborated for them. The exercises lasted eight weeks, four sessions per week, and each session was about 45 minutes. During this period, the control group took no exercise to correct knee abnormalities. At each training session, the subjects took 5-10 min general body of warm up, especially for knee, hip, and back joints and muscles. Next, the exercises proposed by the researcher and confirmed by the supervisor and a physiotherapist were executed for eight weeks. Special trainings for Genu varum for participant with Genu varum and special trainings for Genu valgum were performed by the people with Genu valgum. The dependent t-test was used for data analysis, and pre-test and post-test were used to compare results, and the independent t-test was used to compare the mean of the posttest of the experimental and control group. All statistical operations and data analysis were performed using SPSS software version 21 at 95% confidence level ($P<0.05$).

## RESULTS

There was no significant difference between the three groups in mean age, height, weight and BMI. The mean and standard deviation of age in these subjects were in the knee braces and the knee joints respectively (35.6±7.21, 36.7± 6.31 years) and the control group (36.9±6.21 years) and body mass index were respectively in the experimental (25.33±4.67, 24.69±4.49 kg/m$^2$) and control (24.14±4.87 kg/m$^2$) groups, respectively.

**Table 1:** Descriptive statistic of pain index variable

| | | Mean | Standard deviation | Standard error of the mean | Sig |
|---|---|---|---|---|---|
| **Genu valgum group N=10** | **Quebec—pretest score** | 38.28 | 6.92 | 2.61 | 0.001 |
| | **Quebec—posttest score** | 18.28 | 3.90 | 1.47 | |
| **Control group N=10** | **Quebec—pretest score** | 37.10 | 6.41 | 2.03 | 0.8 |
| | **Quebec—posttest score** | 36.40 | 6.68 | 2.11 | |

As can be seen in Table 1, the mean Quebec score in the experimental group decreased after a period of corrective training (p = 0.001) but in the control group there was no significant change (p = 0.8).

**Table 2:** Descriptive statistic of disability index variable

| | | Mean | Standard deviation | Standard error of the mean | Sig |
|---|---|---|---|---|---|
| **Genu valgum group N=10** | **Oswestry — pretest score** | 35.428 | 2.125 | 5.623 | 0.001 |
| | **Oswestry — posttest score** | 16.571 | 1.616 | 4.276 | |
| **Control group N=10** | **Oswestry — pretest score** | 38.400 | 6.963 | 2.202 | 0.795 |
| | **Oswestry — posttest score** | 37.100 | 6.261 | 1.980 | |

In Table 2, the mean score of the Oswestry test in the pre and post test of the knee group from 35.4 to 16.5 (p = 0.001) and control group from 38.4 to 37.1 (0.795). p =) is shown.

According to the findings of Tables 1 and 2, knee replacement exercises have reduced pain and improved disability in patients with nonspecific chronic low back pain.

**Table 3:** Descriptive statistic of pain index variable

| | | Mean | Standard deviation | Standard error of the mean | Sig |
|---|---|---|---|---|---|
| **Genu varum group N=10** | **Quebec—pretest score** | 35.50 | 5.93 | 1.87 | 0.001 |
| | **Quebec—posttest score** | 14.70 | 4.16 | 1.31 | |
| **Control group N=10** | **Quebec—pretest score** | 37.10 | 6.41 | 2.03 | 0.951 |
| | **Quebec—posttest score** | 36.40 | 6.68 | 2.11 | |

As can be seen in Table 3, the mean Quebec score in the experimental group (parenthesis) decreased from 35.5 to 14.7 after a period of corrective training (p = 0.001). But in the control group there was no significant change (p = 0.951).

**Table 4:** Descriptive statistic of disability index variable

| | | Mean | Standard deviation | Standard error of the mean | Sig |
|---|---|---|---|---|---|
| **Genu varum group N=10** | **Oswestry—pretest score** | 40.200 | 5.996 | 1.896 | 0.001 |
| | **Oswestry—posttest score** | 19.800 | 5.533 | 1.749 | |
| **Control group N=10** | **Oswestry—pretest score** | 38.400 | 6.963 | 2.202 | 0.874 |
| | **Oswestry— posttest score** | 37.100 | 6.261 | 1.980 | |

As can be seen in Table 4, the score of disability before and after corrective exercises in the knee braces group ($P < 0.05$) was significantly different from the control group ($P > 0.05$).

According to the findings of Tables 3 and 4, parenteral knee corrective exercises reduced pain and improved disability in patients with nonspecific chronic low back pain.

## DISCUSSION

Considering the overall purpose of the research, four basic hypotheses were developed and examined. According to the results, and considering the prevailing conditions of the study samples, we can conclude that knee abnormalities (Genu valgum and Genu varum) made a difference to the severity of pain and functional fitness of the patients with non-specific chronic low back pain, and corrective exercises for the said anomalies had a significant effect on pain relief and their disability index. Thus, it can be claimed that prevention or correction of knee-related abnormalities within the age range in question can contribute a lot to the mitigation or prevention of having low back pain, and they can draw the attention of therapists as one of the factors contributing to or exacerbating low back pain. The results of this research are consistent with those by Karimian (2014), who conducted a study with an aim to investigate the effect of the skeletal abnormalities of the trunk and lower extremity on the severity of chronic low back pain in middle-aged women in the county of Shirvan, and with those by Safdari, Khaymbashi, Ghasemi, Falah & Sakhavat (2014), who studied the effect of six weeks of exclusive core stability exercises on the pain and functional disability of the patients with non-specific chronic low back pain, and with those by Ghafarinejad and Taghizadeh (2001), Babaei and Salehi (2004), Taheri Karami (2015), Mohammadi (2008), except that although the studies investigated the effect of various variables on low back pain one way or another, none paid specific attention to the relationship between knee abnormalities and non-specific chronic low back pain that accounts for 85% of low back pain according to research.

Thus, the present research exclusively studied the effect of Genu varum and Genu valgum corrective exercises on non-specific chronic low back pain in middle-aged men, coming to the result that there is a relationship between knee abnormalities and low back pain. As for the most likely causes that the exercises affect pain relief and increase functional fitness of patients with non-specific chronic low back pain, we can refer to reduction in the side effects and complications of Genu varum and Genu valgum such as change in the muscle length and fascia is associated with knee and hip and power imbalance in the muscles, mechanical disorder and perturbation of line of gravity in lower extremity joints due to knees deviating from their natural alignment, asymmetry of weight distribution and instability in weight-bearing situation, change in the line of muscle extension. It seems that the exercises can mitigate pain and increase the fitness of people with low back pain by restoring relative flexibility, power balance and increasing postural control.

## CONCLUSIONS

Knee abnormalities (parentheses and crosshairs) can affect the severity of pain and disability in patients with non-specific chronic low back pain. Therefore, correcting knee anomalies at the desired age range can have a significant impact on reducing pain and improving the disability index of people with non-specific chronic low back pain.

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