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ORIGINAL ARTICLE

The effect of vitamin D on nonspecific low back pain

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Abstract

Background: Nonspecific low back pain is known as one of the most common reasons for chronic low back pain (CLBP) that burdens healthcare systems with high costs. According to a hypothesis, CLBP has been associated with vitamin D_3 deficiency, the goal of this study is to evaluate the effect of vitamin D_3 administration on improvements in CLBP.

Materials and Methods: This double blind randomized clinical trial included 53 patients aged between 18–40 years with nonspecific CLBP. Pain was measured using the pain visual analogue scale score (VAS), and serum 25-OH-vitamin D level was measured using an enzyme-linked immunosorbent assay kit. The patients were randomly divided into two groups based on sex and weight. Pearl of vitamin D_3 (50 000 IU) or placebo was administered orally every week for 8 weeks. Data were analyzed via SPSS 17th edition software using two-tailed paired *t*-test and chi-square test.

Results: There were 26 and 27 patients in drug and placebo groups respectively. Out of 53 subjects, 75.47% were female. There was no statistically significant difference in the mean age, sex, and mean weight between the two groups. The mean serum 25-OH-vitamin D level was 18.86 ± 9.24 nmol/L on the first visit. After 8 weeks of intervention, the mean serum 25-OH-vitamin D level changed from 17.88 ± 9.04 to 27.52 ± 9.04 ($P = 0.043$) and from 19.81 ± 9.60 to 18.91 ± 7.84 ($P = 0.248$) in drug and placebo groups, respectively. The mean VAS score for pain decreased from 5.42 ± 1.65 to 3.03 ± 3.14 ($P = 0.001$) and from 6.42 ± 1.62 to 3.11 ± 3.08 ($P = 0.001$) among drug and placebo groups, respectively. The mean changes in chronic pain were 2.38 ± 2.62, 95% confidence interval (CI) = 1.32–3.44 in the drug group and 3.33 ± 3.67, 95%CI = 0.61–2.55 in the placebo group. No significant statistical difference between the two groups was observed.

Conclusion: According to our results, both vitamin D_3 and placebo treatments improved CLBP and there was no significant difference between vitamin D_3 and placebo groups.

Key words: low back pain, pain, vitamin D_3.

INTRODUCTION

Low back pain (LBP) is one of the most common health problems associated with economic losses in society. Chronic LBP (CLBP, pain for more than 3 months) is a common cause of disability and absence from work.[1,2] Reported prevalence of LBP is variable from 12–33% to 11–84%.[3]

Annually, 40.2% of patients with LBP have persistent symptoms, 36.1% show some improvement, and 14.2% experience an aggravation of their symptoms.[4]

There are three diagnostic categories for LBP which include radiculopathy, specific LBP and nonspecific LBP. Nonspecific LBP is defined as symptoms without clear specific cause, for example, infection, malignancy,

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spondyloarthritis, spinal stenosis and fracture. More than 90% of patients complaining of LBP have nonspecific LBP.[5] Known associated factors with LBP are increased age, female sex, high body mass index, smoking, psychological factors and strenuous physical activity.[6]

Growing evidence suggests an association of chronic pain with low levels of vitamin D, latitude and season of the year.[7–10] Except pain due to osteomalacia, the association of vitamin D with chronic pain is unknown. Vitamin D plays an important role in the immune system.[11–13] Regulation of inflammatory cytokines by vitamin D may be correlated with chronic pain conditions. However, there are conflicting data about the association of low levels of vitamin D and chronic pain, for example, CLBP.[14–18]

Furthermore, the effect of vitamin D administration on improvement of chronic pain has been demonstrated in some studies.[19–28] But there is a disparity in the effect of treatment with vitamin D between randomized and double-blind clinical trials in comparison to studies of other designs.[29,30]

We aimed to evaluate the effect of vitamin D on improvement of LBP by conducting this randomized double-blind clinical trial, since there are a few studies based on this experimental design.

Methods

During the randomized double-blind clinical trial, patients who complained of LBP were recruited from the rheumatology clinic of Ali-Ebne-Abitaleb Hospital in Zahedan, Iran, during April to December 2012. After recording the medical history and systemic physical examination, laboratory and radiological investigations were performed to categorize diagnoses. This was performed by a rheumatologist. Patients with CLBP (> 3 months) within the age group of 18–40 years and living in urban areas were included in the study.

Patients who had specific low back pain, radiculopathy, addiction, pregnancy, taking medication (e.g., vitamin D_3), smoking, psychological disorders, systemic illness (sarcoidosis, tuberculosis, renal calculi, malignancy etc.), lumbar surgery, contraindications for non-steroidal anti-inflammatory drug (NSAID) use and serious occupational physical activity were excluded from the study.

Voluntary patients, irrespective of the serum vitamin D levels were randomly assigned to receive a vitamin D dosage of 50 000 IU or placebo, which was administered orally every week for 8 weeks. Permuted-block randomization was conducted by an independent study administrator and the subjects were blinded for intervention. Both, vitamin D_3 (drug) and placebo were packaged in a similar manner. Assessment was performed by an investigator who was unaware of the allocation groups.

The patients were advised to home-exercise and were given prescriptions of celecoxib up to 200 mg per day for back pain, when required. They were instructed to record the usage of drugs after 10 days from the first visit.

Serum 25-OH-vitamin D levels were measured by enzyme-linked immunosorbent assay (ELISA) and the severity of pain was assessed by the Visual Analogue Scale score (VAS) at the beginning and end of intervention. The primary end-point was the evaluation of changes in mean VAS score for pain.

All the patients consented for participation in the study, and this study was approved by the ethics committee of Zahedan University of Medical Sciences.

Statistical analysis

SPSS 17th edn. statistical software was used for analysis (SPSS Inc., Chicago, IL, USA). The changes in VAS score and serum levels of vitamin D from baseline to 8 weeks were calculated and results were expressed as mean and standard deviation (SD). Differences in variables before and after intervention were analyzed by two-tailed paired *t*-test. Statistical analysis of differences among the two groups was compared by *t*-test and chi-square tests. A level of $P < 0.05$ was considered as statisticall1y significant.

RESULTS

Fifty-three patients, including 13 (24.53%) males and 40 (75.47%) females were evaluated. Six patients were excluded from the study due to pregnancy, renal calculi and not taking correct medication during the study. Chi-square test showed no significant difference in sex between the two groups ($P = 0.81$). The characteristics of the patients are shown in Table 1.

At the beginning of the study, there was a significant difference in VAS score for pain between drug and placebo groups ($P = 0.028$), but no significant difference in serum levels of vitamin D_3 ($P = 0.45$) were observed.

As shown in Figure 1, mean value of VAS score of both groups was significantly decreased from the beginning to the end of the study ($P < 0.001$). The mean changes in chronic pain were 2.38 ± 2.62, 95% confidence interval (CI) = 1.32–3.44 in the drug group and 3.33 ± 3.67, 95%CI = 0.61–2.55 in the placebo group.

Table 1 The characteristics of the patients at first of study

Group variables	Drug	Placebo	*P*-value
Sex			
Male *n* (%)	6 (23.07)	7 (25.92)	0.81
Female *n* (%)	20 (76.92)	20 (74.07)	
Age (years)	33.19 ± 6.51†	33.29 ± 6.65†	0.43
Weight (kg)	70 ± 12.54†	71.1 ± 13.15†	0.51
Height (cm)	157.19 ± 15.52†	163.25 ± 7.32†	0.21
BMI (number of subjects)			
< 25	21	21	0.78
≥ 25	5	6	
VAS	5.42 ± 1.65†	6.44 ± 1.62†	0.028
25(OH)D	17.88 ± 9.04†	19.81 ± 9.60†	0.45

†Data is mean ± standard deviation; VAS, Visual Analogue Scale Score; 25(OH)D, 25 hydroxyvitamin D.

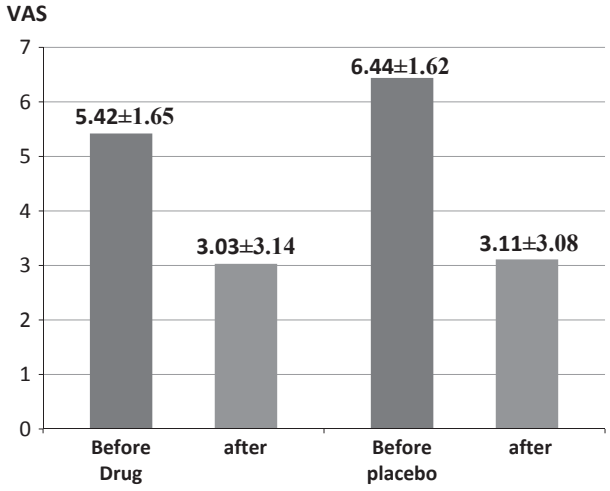

Figure 1 Mean and standard deviation (SD) of visual analogue scale score (VAS) before and after intervention.

Even after employing the covariance analysis to minimize the bias effect of baseline VAS score, there was no significant difference between the two groups ($P = 0.71$).

Mean serum 25-OH-vitamin D level was 18.86 ± 9.24 pg/mL. Mean variation of serum 25-OH-vitamin D level was significantly increased in the drug group from 17.88 ± 9.04 pg/mL to 27.52 ± 9.04 pg/mL in contrast to the placebo group, 19.81 ± 9.60 pg/mL to 18.91 ± 7.84 pg/mL, before and after intervention.

Vitamin D deficiency (serum 25-OH-vitamin D level < 20 ng/mL) was found in 11 patients out of 26 in the drug group (65.23%) and 14 out of 27 patients in the placebo group (62.96%). After 8 weeks of intervention, a decrease in the mean value of VAS score was observed in 61.11% and 82.35% of patients with vitamin D deficiency in the drug and placebo groups, respectively.

According to patients' records during the study, 19% (5/26) and 29% (8/27) of patients used celecoxib (200 mg) daily or for more than 5 days per week, in the drug and placebo groups, respectively. There was no statistically significant difference between the two groups ($P = 0.379$). Also, 7.69% (2/26) and 11.11% (3/27) of patients utilized 200 mg celecoxib less than 5 days per week in the drug and placebo groups.

DISCUSSION

There is a controversy regarding the correlation of hypovitaminosis D with LBP and the role of vitamin D in improvement of LBP. Both hypovitaminosis D and LBP are public health problems. In addition, there is some evidence indicating that the supplementation of vitamin D is safe and valuable for improvement of public health.[31] The present study was conducted from spring to autumn in Zahedan, southeastern Iran, which is an area receiving ample sunlight. The sun exposure is approximately the same in all seasons except winter. This city is located at an altitude of 1352 m above sea level at about 29°N latitude. Nevertheless, there is a high prevalence of hypovitaminosis D in this area,[32] which is comparable to other places in Iran.[33]

The results of the present study show an improvement in CLBP, both in the placebo and vitamin D_3 groups, and no statistically significant difference between the two groups was observed. Although there was no significant difference in the use of celecoxib among the two groups, it was used more frequently by the placebo group.

In this investigation, 50 000 IU per week dosage of vitamin D_3 was administered orally for 8 weeks. In previous studies, a vitamin D dosage of 1200–400 000 IU/monthly for a few days to 12 months was administered, but most studies lasted for 2 months or more.[29] Patients who consumed vitamin D supplementation were excluded from the study. Dietary history was not recorded since dietary intake of vitamin D without supplementation is a minor source of the body's requirement of vitamin D.[34,35] The major source of vitamin D is cutaneous synthesis upon exposure to ultraviolet light,[36] and the duration of sun exposure is more important than the size of sun contact area. In this study, all the patients were recruited from an urban area with similar duration of sun exposure.

Our finding is in concordance with the results of two studies that were performed on post-menopausal women with back pain; no significant difference was seen between placebo and vitamin D in improving back pain.[20,21] Moreover, Warner and coworkers showed, in comparison to placebo, ergocalciferol 200 000 IU/month for 3 months did not significantly decrease VAS score of musculoskeletal pain in a study involving 50 women with mean age of 56 years.[22]

In contrast to our results, Alfaraj and coworkers observed more than 50% improvement in low back pain in 100% and 69% of patients with low and normal serum vitamin D levels, respectively, after 3 months of cholecalciferol administration at 150 000 IU/month.[23] Also, more improvement was reported in old patients with back pain who received vitamin D in comparison to the placebo.[24,25] Abbasi and coworkers reported more than 60% decrease of VAS score in a majority of patients with musculoskeletal pain and vitamin D deficiency when treated with oral vitamin D_3.[26] However, two recent meta-analyses by Straube revealed contrasting outcomes between results of randomized clinical trials (RCTs) and other study designs. The effectiveness of vitamin D for chronic pain treatment was observed in 10% and 95% of RCTs and non-RCT or observational studies, respectively, although the meta-analyses were conducted on small and non-homogenous studies.[29,30]

In comparison to other investigations, the obvious difference in the present study is the lower mean age of the patients. Similar to the study by Warner and coworkers,[22] in the current study, the outcome was "decrease of pain VAS score." However, in some studies[23,26] showing a good effect of vitamin D_3 in alleviating chronic pain, the outcome was expressed as "percentage of patients with improvement of pain." Therefore, the methodology of reporting the outcome may be a contributing factor to the evaluation of the effectiveness of vitamin D in chronic pain.

There are several strengths to the present study. The serum level of vitamin D was measured before and after the study. A reduction of wide confounding factors such as psychological disorder, including patients aged between 18–40 years and an accurate diagnosis of nonspecific LBP was also performed.

Our subjects were selected only from an urban area of Zahedan and selection of the patients was conducted precisely and the patients did not receive other drugs concomitantly without observation which may have made our sample size too small. However, short duration and the small size of the present study as a preliminary investigation is a limitation since it is believed that 5–9 months are needed to assess the effectiveness of vitamin D_3 for chronic pain.[36] However, there was no possibility for us to follow up our patients longer than 2 months and there was a probability of missing them after this duration. Further, our patients were hardly likely to accept the use of vitamin D only for longer than 2 months. Another limitation is that we did not use any functional instrument specifically for LBP or quality of life at the end of study and did not evaluate the home exercise program.

Altogether, there is a need for more investigation to establish the effect of vitamin D on chronic pain. Studies with randomized controlled trial designs, longer duration, bigger sample size, different outcome assessment and different age groups are recommended.

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