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Association of low back pain with vitamin D deficiency and other common risk factors: A hospital based case-control study

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Abstract: Background: low back pain (LBP) is an extremely common health Problem in Asian communities. It is a major cause of activity limitation. Aim of this study was to identify the association of vitamin D and modifiable risk factors of low back pain among female patients in the childbearing period. Subject and methods: It was a hospital based case-control approach done at rheumatology and rehabilitation outpatient clinic of Arar hospital in Saudi Arabia during a period of 10 months from September 2010 to June 2011. The study population comprised Saudi female in the childbearing period (20-45years) (to exclude rickets in younger females and post menopausal osteoporosis in older ones). Cases were patients who had the complaints of chronic LBP (lasting more than three months) at the time of data collection. For each case, one control was selected from the same age group from patients with no LBP but attend the same units for other reasons. Data were collected with a semi-structured Check list and 174 participants were interviewed from which 87 had back pain (cases). Venous sampling 5 ml was done for both cases and control for serum calcium, phosphate, alkaline phosphatase, PTH and 25- hydroxy cholecalciferol (vitamin D3). Results: Univariate analysis showed that low back pain was significantly associated with age of the patients, low physical activity, body mass index (BMI) >25kg/m, prolonged sitting, history of back trauma (p < 0.05). Logistic regression revealed BMI >25kg/m and hypovitaminosis D as an independent risk factors for low back pain. Conclusion: Low back pain among Saudi female was associated with BMI, physical activity, sitting posture and hypovitaminosis D. All these risk factors could be regarded as the indicators of low back pain, and some relevant preventive measures should be taken to reduce low back pain risk.

Keywords: Chronic Low Back Pain (LBP), Low Physical Activity, Vitamin D, Risk Factors

1. Introduction

Low back pain (LBP) is one of the most frequent musculoskeletal disorders in daily practice [1]. It is defined as pain between the costal margins and inferior gluteal folds and is usually accompanied by painful limitation of movement; it is often influenced by physical activities and posture in most cases [2]. People with chronic LBP experience huge social, mental, physical and occupational disruptions [3]. The mental impact of LBP includes anxiety, depression and sleeplessness, whilst poor physical performance and deterioration in health status are the physical impacts. LBP results in an inability to carry out social activities and it decreases the capability to perform occupational activities since it mostly affects adults of working age [4]. Disability caused by LBP stems from the pain and/or loss of function inflicted on the sufferers. Chronic LBP is one of the four disabilities causing musculoskeletal conditions – the others being osteoarthritis, osteoporosis and rheumatoid arthritis [5].

More than 80% of the population will experience an

episode of LBP at some time during their lives. The clinical course is benign for most, with 95% of those afflicted recovering within a few months of onset. Some, however, will not recover and will develop chronic LBP, i.e. pain that lasts for three months or longer [6].

Risk factors for developing LBP could be immutable (non-modifiable) or mutable (modifiable). The immutable factors are age, parity, previous history of LBP, whilst the mutable factors include a sedentary lifestyle, obesity, tobacco smoking and drug dependence. Other mutable factors are occupation-related: poor posturing, prolonged sitting, twisting, bending, stooping and lifting of heavy loads [7].

Prolonged chronic vitamin D deficiency can result in osteomalacia; moreover mild vitamin D deficiency may produce a variety of musculoskeletal pains such as fibromyalgia-like pain, low back pain, and arthralgia [8].

This study was carried out to identify the association of vitamin D and modifiable risk factors of low back pain among female patients in the childbearing period in Saudi Arabia.

2. Subjects and Methods

Study design and settings: A hospital based case-control approach done at rheumatology and rehabilitation outpatient clinic of Arar Hospital in Saudi Arabia during a period of 10 months from September 2010 to June 2011.

Sampling technique

All Participants who met the study criteria and consented to take part in the study were consecutively selected

Participants and procedure: The study population comprised Saudi female in the childbearing period (20-45years) (to exclude rickets in younger females and post menopausal osteoporosis in older ones). Cases were patients who had the complaints of chronic LBP (lasting more than three months) [2] at the time of data collection. For each case, one control was selected from the same age group from patients with no LBP but attend the same units for other reasons (shoulder stiffness, ankle or knee pain or carpal tunnel syndrome, etc.). Total 87 patients were included as cases and 87 patients as controls.

Cases seen initially were assessed clinically for pain and the presence or absence of neurologic manifestation using plain radiograph of the lumbosacral spine. Both CT scanning and MRI of lower spine were performed to exclude disc prolapse, spinal stenosis, and degenerative disease of the spine. These patients were labeled as having idiopathic low back pain after the aforementioned assessment.

Patients who had a mechanical cause for the back pain congenital deformity of the spine, who had Patients clinical features suggestive of neurologic involvement or who had renal impairment or chronic liver disease were excluded from the study.

Venous sampling 5 ml was done for both cases and control for serum calcium, phosphate, alkaline phosphatase, PTH and 25- hydroxy cholecalciferol (vitamin D3). All tests are measured by immunoassay analyzer Cobas e411 and using kits supplied by Roch. Anthropometric measurements of height and weight were carried out for all respondents. The weight (in kilogram) was divided by the height (meter) and then squared to calculate the body mass index (BMI).

Informed consent was obtained from all patients and controls and questionnaire was used to interview the respondents. Information obtained from the respondents consisted of demographic, social, and health related factors; i.e., age, education, employment body mass index (BMI), sun exposure, daily physical activity (low or moderate level) [9], passive smoking (mixture of side stream smoke emitted by lit cigarettes and mainstream smoke exhaled by smokers) [10] and past history of back trauma.

3. Statistical Analysis

Data were analyzed by use of SPSS software, version 16.0 (SPSS Inc. Chicago, USA). Univariate analysis was used to compare variables for the outcomes of interest. Continuous data were compared using the Student's t test. Either $\chi2$ or Fisher's exact tests were used to compare categorical variables. A multivariate analysis was also performed using multiple logistic regressions with enter approach. All P values lower than 0.05 were considered statistically significant.

4. Results

During a 10-month period, Total 174 patients were included in this study 87as cases (had the complaints of LBP for 3 months or more) and 87 patients as controls (had no LBP) at the time of data collection.

Table (1) reveals socio- demographic characteristics of the study population:

The mean ± SD age of patients was 32.8 + 7.2 years for the control group and 37.3 + 5.3 years for the Cases. The study revealed statistically significant difference between cases and control groups regarding age of the participants (p < 0.001).

There was no significant difference between case and control group with respect to multiparity, education level, occupation, passive smoking, vitamin D rich food, multiparity and avoiding sun exposure (P = 0.2, 0.2, 0.34, 0.08, 0.06 and 0.07 respectively).

There was significant difference between case and control group regarding physical activity, prolonged sitting, history of back trauma and BMI >25 kg/m^2 (P = 0.001, 0.02, 0.003 and <0.001 respectively).

Table (2) reveals the means of laboratory markers in patients and control

There were no statistically significant differences in mean serum calcium or serum phosphorus between patients and controls (p>0.05)

On the other hand, mean serum ALP, PTH and serum 25 (OH) vitamin D levels were significantly difference in patients than controls (p<0.001).

Table (3) shows the logistic regression analysis of the risk

factors for LBP.

Selected risk factors were entered into a logistic regression model (stepwise) to perform the multivariate analysis which revealed that BMI and Serum 25 (OH) vitamin D were independent risk factors for LBP.

Table 1. Comparison of socio- demographic between patients and controls.

Variables	Cases (87) No. (%)	Control (87) No. (%)	OR	CI (95%)	P value
Age (mean ±SD yrs)	37.3+5.3	32.8+7.2	----	2.6-6.4	< 0.001
Education level					
Non educated	37	29	1.5	0.8-2.8	0.2
Below secondary	23	23			
Secondary or higher	27	35			
passive Smoking	61	53	1.5	0.8-3.0	0.2
Occupation					
House wife	72	67	1.4	0.6-3.2	0.34
employee	15	20			
vitamin D rich food	37	26	1.7	0.9-3.4	0.08
Multiparity	59	47	1.8	0.9-3.5	0.06
Avoiding sun exposure	52	40	1.8	0.9-3.3	0.07
physical activity					
low	74	52	3.8	1.8-8.5	< 0.001
Moderate	13	35			
prolonged sitting	64	49	2.2	1.1- 4.3	0.02
Previous back truama	43	24	2.6	1.3- 5.1	0.003
BMI >25 kg/m2	71	47	3.8	1.8-8.0	< 0.001

Table 2. Comparison of laboratory markers between patients and controls.

Variables	Cases (n=87)	Controls (n=87)	t	p
	Mean + SD	Mean + SD		
Serum Calcium (n8.2–10 mg/dl)	8.9±1.2	9.1±0.8	1.37	0.2
Phosphorus (n 2.5–4 mg/dl)	4±1.1	3.9±1.0	1.15	0.25
*ALP (n<136 U/l)	111.2±45.4	66.3±9.2	9.0	<0.001
**PTH (n<106 pg/ml)	147.7±39.6	20.3±7.4	29.5	<0.001
Vitamin D (n>25 ng/ml)	21.1 ±2.3	31.3 ±4.5	18.6	<0.001

*ALP = alkaline phosphatase, **PTH =Parathyroid hormone

Table 3. Logistic regression analysis of the risk factors for LBP.

Variables	Adjusted OR	CI (95%)	P value
BMI >25 kg/m^2	5.6	2.4 -17.6	0.01
Vitamin D	3.2	1.9 - 21.2	0.047

5. Discussion

Low back pain (LBP) is a common health problem with concomitant disability which has assumed a public health importance in our setting. This study revealed that age was demonstrated to have a significant association with LBP. These results are consistent with previous reports regarding an increased prevalence of LBP with age [11, 12]. In the elderly Thai population, BMI was identified as a predictive factor for spondylosis of the lower back [13].

Significant association was shown between BMI and LBP. Being overweight or obese causes an increase in the pressure on the structures of the lower back and that may lead to lumbar disc herniation and subsequent LBP. These in agreement with studies reported an association between being overweight and experiencing LBP [14, 15, 16]. But in contrast to Chung et al. 2005; Grimmer & Williams 2000 results[17,18]

There was no association between regular physical activity and LBP in contrast with previous studies which reported the association between a lack of physical activity and LBP [19, 20].

In this study, there was no apparent association between passive smoking and LBP while Miranda et al. (2008) [21] showed an association between smoking and LBP among subjects over 50 yr old.

There was a significant association between a history of back trauma and LBP. Hincapie et al. (2008) [22] showed that a history of work-related low back injury was positively associated with severe disability due to LBP

Prolonged sitting has been identified as a risk factor for LBP. O'Sullivan et al. 2011 [23] reported that, females and sitting posture was reported as related factors for LBP. The reported consequences of prolonged sitting are increased spinal compression load [24] and increased activity of paraspinal muscles [25]. As a result, LBP can occur due to tissue micro-damage and paraspinal muscle dysfunction [26].

Avoiding sunlight exposure was not significantly different among study groups. Sunlight exposure of the skin is known to be the most important source of vitamin D. Under exposure to sunlight is another cause of vitamin D deficiency but overexposure doesn't cause intoxication [27]. However, other studies showed that hypovitaminosis D is common

despite adequate sunshine [28,29].

Among the laboratory parameters, serum 25 OHD was significantly associated with LBP. In study conducted by. These in agreement with studies reported an association between vitamin D deficiency and LBP [30,31]. However a few studies have found no association between vitamin D deficiency and musculoskeletal pain [32, 33].

Vitamin D is essential for GI absorption of calcium. Vitamin D deficiency results in increased secretion of parathyroid hormone (PTH) which in turn leads to greater than before activity of osteoclasts in bone. Phosphaturic property of PTH with diminished absorption of calcium from GI may reduce calcium-phosphate interaction and consequently bone mineralization. Increased activity of osteoclasts and osteoblasts increases bone matrix with low mineralization. The resultant matrix would absorb water; as a result subperiosteal space becomes edematous. The event may produce bone pain [34].

Conclusion: Low back pain among Saudi female was associated with modifiable factors BMI, physical activity, prolonged sitting and hypovitaminosis D. All these risk factors could be regarded as the indicators of low back pain, and some relevant preventive measures should be taken to reduce low back pain risk.

The limitation of our study is that due to its case control design, so it is susceptible to recall bias. Also small response rate (174 participants) compared to large number of attendants.

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