

A Correlation between Low Back Pain and Associated Factors: A Study Involving 772 Patients who Had Undergone General Physical Examination

Many factors are associated with the development of low back pain. Among them, exercise, obesity, smoking, age, educational level and stress are the most common. This study examined the association of these factors with low back pain. An additional aim was to determine a procedure for preventing low back pain. This study analyzed the responses to a questionnaire sent to 772 individuals who had undergone a medical examination at this hospital in 2003 and excluded the individuals who had shown symptoms or their test results indicated a particular disease. Assuming that there were no variables, individuals who exercised regularly 3-4 times per week would have a lower chance of having low back pain than those who did not exercise regularly. The analysis revealed that individuals with a college degree or higher education have a lower chance of experiencing low back pain than those with only a high school education or even college drop-outs. When the other variables were constant, age, extent of obesity (body mass index), smoking and level of stress were not found to affect the development of low back pain. The level of education was associated with the development of low back pain. However, regular exercise 3-4 times per week or more would be most effective in reducing the incidence and duration of low back pain.

Key Words : *Body Mass Index; Patient Education; Exercise; Low Back Pain; Risk Factors*

Min A Kwon, Woo Seok Shim,
Myung Hee Kim, Mi Sook Gwak,
Tae Soo Hahm, Gaab Soo Kim,
Chung Su Kim, Yoon Ho Choi*,
Jeong Heon Park[†], Hyun Sung Cho,
Tae Hyeong Kim

Department of Anesthesiology and Pain Medicine,
Center for Health Promotion*, Samsung Medical Center,
Sungkyunkwan University School of Medicine, Seoul;
Department of Anesthesiology and Pain Medicine[†],
Seoul National University Bundang Hospital,
Seongnam, Korea

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Address for correspondence

Tae Hyeong Kim, M.D.
Department of Anesthesiology and Pain Medicine,
Sungkyunkwan University School of Medicine,
Samsung Medical Center, 50 Ilwon-dong,
Gangnam-gu, Seoul 135-710, Korea
Tel : +82.2-3410-2470, Fax : +82.2- 3410-0361
E-mail : bluecar@smc.samsung.co.kr

INTRODUCTION

Fifty to eighty-five percent of the population in a modern industrial society experience low back pain more than once in their lifetime. Low back pain is one of the common symptoms having a prevalence rate of 40-67.6% and a point prevalence of 20% (1-4). Approximately 50% of patients who experience low back pain show improvement within seven days and almost 90% are in remission within one month. Nevertheless, 4-15% of patients cannot return to their job for more than a month, and 1% will suffer chronic or recurring low back pain (5). In many cases, the symptoms may not coincide with the histologic and radiologic findings, resulting in a great deal of diagnostic and therapeutic medical expenses as well as leading to complementary and alternative medical therapies. Therefore, low back pain has become one of the greatest causes of manpower loss and escalating medical expenditure (6).

Extensive research has been carried out on the factors relevant to low back pain worldwide. Many of these studies have examined age, obesity, exercise, smoking, education and stress

as associated factors. In this study, a questionnaire was used to analyze the correlation between these factors and low back pain among 772 hospital-visiting male patients. The patients with a symptom or test result suspicious of a specific illness and those who were already diagnosed as having a vertebral disease were excluded. This study also examined which factors in ordinary life are most helpful in reducing and preventing low back pain.

MATERIALS AND METHOD

Of a total of 28,100 patients who underwent medical examination in this center, patients 19 yr old or younger, females, and people with symptoms or test results suspicious of a particular disease were excluded. Seven hundred and seventy two patients, who filled out the precision medical questionnaire, were used as subjects for retrospective analysis.

The precision medical questionnaire consisted of 13 general items and 9 questions for each system, as well as questions related to the level of stress. General items included the

presence of any particular motivation for health and medical examination, a history of previous medical examinations, marital status, extent of smoking, alcohol consumption, educational level, monthly income, previous medical history, previous surgical history, previous drug-taking history and previous familial medical history. The survey questions for each system included detailed items such as the general body state, digestive, respiratory, cardiovascular, endocrine, renal-urethral, nervous and dental questions. Of these questions, the item of the general body state included a question "Have you recently suffered low back pain?" Included in this study were the low back pain-related survey questions such as age, obesity, exercise, smoking, level of education and smoking. For each item, the number of people who had low lumbar pain and those that did not were compared and analyzed.

Using these survey questions, the following cases were excluded:

1) Cases where there were other factors relevant to low back pain in addition to a simple description of "I have low back pain," under the item "Recently, I felt something wrong regarding my health."

2) Cases where patients underwent any one of the following: gastric, duodenal, gallbladder, colonic or kidney surgery with respect to the item "Have you ever had surgery?"

3) Regarding the item "Up to now, have you ever been diagnosed by a doctor as having any of the following diseases?" any patient who checked any one of the following: cerebral infarct/paralysis, angina pectoris/myocardial infarct, acute hepatitis, chronic hepatitis/liver cirrhosis, renal disease, bladder disease, malignancy or trauma.

4) In the item, "Presently, are you continuously taking any drug twice or more weekly?", a patient who marked on any one or more of the the following: aspirin, NSAIDs, calcium, anti-anxiety drugs, sleeping pills, any other drugs which can modify back pain including herbal medicines or restorative drugs.

5) Finally, cases with the following symptoms:

"I lost body weight without any particular reason,"
 "I bruise easily or often have a nose bleed,"
 "I have difficulty swallowing and feel pain while swallowing,"
 "I often feel nausea or vomit, and the vomitus has a coffee or green color,"
 "I once had black-colored feces," "I once had a tight chest and pain radiating to the arm or the back,"
 "When I exercise, I feel tightness in the chest and become quite breathless,"
 "My heart suddenly throbs fast or irregularly,"
 "My face, hand or foot swells easily,"
 "I feel chest tightness and shortness of breath while lying down or sleeping but feel comfortable sitting down,"
 "I cough continuously for a long time,"
 "I have blood in my sputum or expectorated blood,"

"I have cold sweats during sleep,"
 "I have a hoarse breathing sound,"
 "I feel breathless even after slight activity,"
 "Recently, my urine volume has increased,"
 "I recently lost my appetite,"
 "My fingernails or toenails break easily,"
 "I have difficulty urinating and unsatisfactory feeling after urination,"
 "I cannot stand the urge of urination,"
 "I have red or cocoa colored urine,"
 "I have severe pain in the flank or lower abdomen,"
 "I often wake up to pass urine,"
 "I once passed urine without knowing,"
 "I often feel dizziness,"
 "I have an experience of passing out,"
 "I once had paralysis in the body,"
 "I have a symptom of slow movement or hand shaking" or
 "I have joint pain or swelling."

A total of 772 survey participants were divided into 4 groups according to age: 20-40 yr old, 40-50 yr old, 50-60 yr old and 60 yr or older. The body mass index (BMI, kg/m²) was used to indicate obesity. The participants were grouped according to the classification for Asians into normal (BMI less than 23), over weight (BMI 23-25) and obesity (25 or higher) (7). The extent of smoking in pack years (PY) was obtained by multiplying the average number of cigarettes smoked by the number of years smoked. They were classified into 5 groups: Individuals who never smoked, a smoker who stopped smoking in the past, smoker with 10 PY or less, smoker with 10-20 PY, smoker with 20 PY or more. With respect to the level of exercises, the respondents were grouped into 5 groups: Never exercised, exercised 2-3 times monthly, exercised 1-2 times weekly, exercised 3-4 times weekly and regularly exercised more than 5-6 times weekly. The participants were divided into 3 groups according to their educational levels: Less than high school graduation, high school graduation to college graduation, and higher than college education. Regarding the level of stress, the respondents were grouped into 4 groups: No stress at all, slight stress, moderate stress and a great deal of stress.

A chi-square test was used to examine each item for determining a correlation with the development of low back pain. A logistic regression test with a Bonferroni's correction was used for multivariate analysis. A *p*-value <0.05 was considered significant.

RESULTS

A total of 772 patients were included in this survey. Of these 772 patients, 80 (10.4%) responded as having low back pain (Table 1). Among the six factors examined, age, obesity, smoking, level of exercise, educational level and level

of stress, there was a statistically-significant correlation between low back pain and the educational level ($p=0.0029$, chi-square test), as well as level of exercise ($p=0.0409$, chi-square test). When the other variables were constant, multivariate analysis indicated that the development of low back pain is not dependent on age, obesity, smoking and level of stress. Nevertheless, when the other variables were constant, the development of low back pain was found to be associated with the level of exercise. The patients who exercised regularly 3-4 times a week ($p=0.028$, logistic regression test with Bonferroni' correction) and 5-6 times or more a week ($p=0.040$, logistic regression test with Bonferroni' correction) had a lower chance of developing low back pain than those who did not exercise at all.

When the other variables were constant, the educational level was found to be associated with the development of low back pain. The group with high school to college education ($p=0.006$, logistic regression test with Bonferroni's correction) had a higher chance of experiencing low back pain than the group with a higher than college education (Table 2).

Table 1. Description of the study population according to the socioeconomic and demographic characteristics

Predictor category	Total (%) n=772
Age (yr)	
<40	183 (23.7)
40-50	344 (44.6)
50-60	201 (26.0)
>60	44 (5.7)
Body mass index (kg/m ²)	
<23	198 (25.6)
23-25	254 (32.9)
>25	320 (41.5)
Exercise frequency	
None	125 (16.2)
2-3 times a month	119 (15.4)
1-2 times a week	218 (28.2)
3-4 times a week	181 (23.4)
5-6 times a week or more	129 (16.7)
Smoking	
Never	184 (23.8)
Ex-smoker	332 (43.0)
Current	
<10 pack-yrs	60 (7.8)
10-20 pack-yrs	85 (11.0)
>20 pack-yrs	111 (14.4)
Education	
<High school graduate	27 (3.5)
High school graduate-some college	123 (15.9)
≥College graduate	622 (80.6)
Stress	
None	99 (12.8)
Mild	347 (44.9)
Moderate	201 (26.0)
Severe	125 (16.2)

DISCUSSION

Statistically, there are many issues being considered as risk factors for low back pain. There are largely work-related factors, such as type of work and attitude to life, and individual factors such as gender, age, obesity, level of back muscle development, level of exercise, educational level, economic status, smoking and level of stress (8, 9). This is a retrospective study that analyzed results of a questionnaire at the Health & Physical Examination Center. Therefore, it was difficult to examine the cause and effect of the various risk factors on low back pain when only a correlation was observed. A sufficient number of samples were used to achieve good accuracy. This study excluded females in whom low back pain might be associated with various gynecologic conditions. By analyzing only male data, analytical errors, which could be brought on by gender differences, was minimized. This study also excluded the survey results with a check mark on various items that forecasted other disease, malignancies and metastatic disorders, and eliminating the causes of other disorders, which would have made it difficult to make differential diagnosis. In this investigation, after excluding the other variables, smoking, age and level of stress did not significantly increase the development of low back pain.

There have been many studies in which smoking had been associated with low back pain (10, 11). Intervertebral disc degeneration was the cause of low back pain in most of these studies. Although direct mechanical pressure following repeated coughing or osteoporosis can cause intervertebral disc degeneration, a blood circulation disorder due to vascular contraction, carboxyhemoglobin generation, atheroma formation and cellulose dissolution problems can also lead to intervertebral disc degeneration (12). Intervertebral discs receive their blood supply directly at a young age, but as people age, these discs instead receive their blood supply through diffusion from the adjacent cartilaginous end plate surrounding these discs (13). According to several animal experiments, a blood circulation impediment in the adjacent vasculature can occur, which affects the cellular uptake and solute exchange capacity. This can lead to a reduction in the collagen and proteoglycan level, which are the main constituents of the disc (12, 14, 15). However, many other studies argued that this is not be relevant (16). Nevertheless, in this study, there was no statistically significant correlation between smoking and the development of low back pain.

Age is one of many factors under consideration. Previous retrospective studies reported that the incidence of low back pain increased as people aged toward their 50-60s, with the incidence of low back pain decreased gradually thereafter (8, 17, 18). Several prospective studies have revealed that age is not a significant factor for low back pain (10, 19).

Although many studies on how mental stress induces low back pain have been carried out (2, 9), most stopped at verifying their correlation using retrospective studies (2, 9). How-

Table 2. Predictor categories associated with low back pain (LBP) in univariate analysis and multiple logistic regression

	LBP (%) n=80	Univariate analysis	Multivariate analysis			
		p value	B	p value	Exp (B)	95% Confidence interval
Age (yr)		0.2465		0.216		
40-<50	32 (40.0)		0.173	1.000	1.189	0.599 2.360
50-<60	28 (35.0)		0.694	0.198	2.002	0.954 4.200
≥60	5 (6.3)		0.312	1.000	1.366	0.416 4.485
<40	15 (18.8)		-	-	-	-
Body Mass Index (kg/m ²)		0.9142		0.870		
23-25	28 (35.0)		0.055	1.000	1.056	0.562 1.987
>25	32 (40.0)		0.095	1.000	0.910	0.492 1.682
<23	20 (25.0)		-	-	-	-
Exercise frequency		0.0409		<u>0.026</u>		
2-3 times a month	11 (13.8)		-0.673	0.428	0.510	0.225 1.157
1-2 times a week	26 (32.5)		-0.339	1.000	0.712	0.363 1.397
3-4 times a week	12 (15.0)		-1.086	<u>0.028</u>	0.338	0.152 0.748
≥5-6 times a week	10 (12.5)		-1.123	<u>0.040</u>	0.325	0.139 0.762
None	21 (26.3)		-	-	-	-
Smoking (Pack year)		0.5392		0.751		
Past	33 (41.3)		-0.113	1.000	0.893	0.493 1.620
Current <10	3 (3.8)		-0.884	0.708	0.413	0.115 1.490
Current 10-<20	8 (10.0)		-0.252	1.000	0.777	0.321 1.884
Current ≥20	14 (17.5)		-0.107	1.000	0.899	0.425 1.900
None	22 (27.5)		-	-	-	-
Education		0.0029		<u>0.006</u>		
<High school graduate	5 (18.5)		0.824	0.252	2.280	0.793 6.660
High school graduate- some college	22 (17.9)		0.877	<u>0.006</u>	2.403	1.357 4.253
≥College graduate	53 (8.5)		-	-	-	-
Stress		0.7427		0.770		
Mild	37 (10.7)		0.021	1.000	1.022	0.485 2.151
Moderate	17 (21.3)		-0.234	1.000	0.791	0.338 1.854
Severe	14 (17.5)		0.171	1.000	1.187	0.478 2.948
None	12 (15.0)		-	-	-	-

B, the coefficient of logistic regression; Exp (B), odds ratio.

ever, considering that mental symptoms such as depression concur with chronic diseases, there are some doubts that mental stress is a cause of low back pain. On the other hand, several retrospective studies demonstrated a correlation between the level of mental stress and low back pain (10, 20).

In this study, after excluding other variables, subjects with an educational level of high school graduation and up to less than college graduation had higher chance of developing low back pain than those with college graduation or higher educational levels. The proportion of blue collar workers having a lower socioeconomic status increases with decreasing education level. As the level of education increases, the proportion of white collar workers having to do less difficult work and physical labor increases (2, 21, 22). A correlation between the type of work and low back pain has been reported (23, 24). In these studies, hard manual work, heavy weight lifting, pushing and pulling jobs, jobs at which people are exposed to continuous whole body vibration (i.e., truck drivers) and work that requires sitting for long periods of time have been considered relevant risk factors (2, 4, 25, 26). There are

many reports asserting that physical labor causes low back pain (4, 23). However, there was a report showing that such hard labor did not specifically induce low back pain (20). Nevertheless, many studies concurred with the fact that hard physical labor leads to degenerative disc changes to the extent that they could be discovered radiographically (27). Furthermore, even without having done hard physical work, bending down or twisting the waist frequently while sitting for a long time increases the chance of experiencing low back pain (28). However, in this study, subjects with less than high school graduation did not have a high rate of low back pain compared with the college graduates. Most of the twenty-seven subjects with a level of education less than high school graduation were actually high income earners of 4 million won (about \$4,000) per month or higher (13). The reason behind the low rate of low back pain might be due to the fact many of them do not perform hard physical labour.

There was a significant correlation between the level of exercise and low back pain. However, there was no correlation between the BMI and low back pain. The mechanisms

by which exercises may prevent low back pain are believed to be: 1) they strengthen the back muscles and increase trunk flexibility; 2) they increase blood supply to the spine muscles and joints and intervertebral disks, minimizing injury and enhancing repair; and 3) they improve mood and thereby alter the perception of pain (5, 29-31). Many clinicians have recommended exercise for patients with low back pain. However, it has not clearly been determined what type and how much exercises one should carry out (31). Moreover, it is unclear if a reduction in body weight to a normal level is essential for its effectiveness or if long exercise is truly effective. In this study, excluding other variables, patients who exercised 3-4 times weekly or 5-6 times regularly every week were able to decrease the low back pain significantly compared to patients who did not exercise at all. This shows that the BMI is not related to low back pain. Many studies have examined the correlations between obesity and low back pain. Many have insisted that obesity might have been the cause of low back pain (10, 22, 32). However, recent studies carried out by excluding many variables showed otherwise (33, 34). Indeed, a regular exercise program performed 3-4 times weekly not to the extent of the reducing body mass index was found to be most effective in reducing low back pain.

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