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Original Article

Investigation of Factors Associated with Low Back Pain in Young Adults

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Abstract. [Purpose] The purpose of this study was to investigate the relationship between low back pain and generalized joint hypermobility, trunk muscle mass, lumbar kyphosis, and spinal mobility in young adults. [Subjects and Methods] A total of 201 healthcare students (125 women and 76 men; mean age, 20.9 ± 0.8 years) were interviewed using a questionnaire about their age, presence or absence of low back pain, and the effects of low back pain. General joint hypermobility was assessed using the Beighton score. BMI, the trunk muscle mass, the lumbar lordosis angle, and the spinal mobility were measured. Logistic regression analysis was performed to examine low back pain-related factors. [Results] Logistic regression analysis showed that the total spinal extension angle was a significant independent variable (odds ratio, 0.937; 95% CI, 0.893-0.982). [Conclusion] The generalized joint hypermobility, the trunk muscle mass, and the lumbar lordosis angle were not associated with low back pain, thus suggesting that an increase in the spinal extension range of motion may reduce low back pain.

Key Words: Low back pain, Spinal mobility, Joint Hypermobility

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1. INTRODUCTION

Low back pain is a major cause of disability incidence, and is a major cause of activity limitation and absenteeism in many places in the world[1)] . Low back pain (LBP) occurs in 5-10% of the young adult population of East Asia[2)]. The incidence of chronic low back pain (CLBP) also increases from adolescence to early adulthood[3)]. CLBP is associated with negative impact, defined as taking medication, health care seeking, modifying physical and daily life activities, and taking time off school[4)]. The impact of low back pain in the young population is an important social issue.

Several factors associated with low back pain, such as a decreased trunk muscle mass[5)] or sagittal plane spinal alignment[6)] have been reported, but it is unclear whether they apply to physical characteristics in young adults. In particular, young adults have a higher generalized joint hypermobility (GJH) [7)] and has been associated with trauma[8)] due to a period of high-stress activity. Joint hypermobility causes the joint bursae and the surrounding ligaments to overstretch, which can lead to musculoskeletal pain[9)]. However, there is no consistent view of low back pain and GJH in young adults. A previous study[10)] reported that young adults with LBP had more GJH and excessive lumbar segmental motion compared with those without LBP, whereas a recent study[11)] reported no association between LBP and GJH. One of the reasons of this discrepancy is due to the characteristics of an assessment tool of GJH[11)] . This tool (Beighton score) evaluates a total score of whole-body joint laxity including a trunk flexion task. If participants shows

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normal in the trunk flexion task and positive in other tasks, they may be judged to have GJH. Also, this tool assesses the trunk flexion combined with shoulder and hip flexion, and does not assess the spinal mobility alone. Therefore, investigating an effect of spinal mobility on the relationship between GJH and LBP is variable.

The purpose of this study was to investigate the relationship between LBP and the trunk muscle mass, the sagittal plane alignment of the spine, the spinal mobility, and the joint hypermobility in the young adults.

2. SUBJECTS AND METHODS

Subjects : The subjects, recruited from a university, were 201 healthcare students (125 women and 76 men, mean age 20.9 ± 0.8 years, mean height 158.0 ± 5.4cm, mean weight 52.2 ± 0.8kg, mean body mass index 20.9 ± 2.2kg/m^2). Exclusion criteria included any serious orthopedic disease, poor standing balance, and any injury within the past 30 days. Written consent was obtained from all the participants.

Patient characteristics such as age, gender, and the presence or absence of low back pain were recorded. The effect of LBP on daily life and GJH were scored using the Japanese version of the Oswestry Disability Index (ODI) score and the Beighton score, respectively. GJH was considered positive when the Beighton score was at least 5[11)]. The body mass index (BMI), the skeletal muscle mass, and the trunk muscle mass were measured using InBody270 (In Body Japan Inc., Tokyo, Japan). Spinal Mouse (Idiag Inc., Fehr Altdorf, Switzerland) was used to measure the lumbar lordosis angle, spinal flexion, and extension range of motion, due to it's are reliable[12)] and validated[13)] measurements of the spinal sagittal plane. In this study, three positions were measured: (1) standing upright, (2) maximum trunk flexion, and (3) maximum trunk extension. Spinal Mouse was placed on the paraspinal line of the spinal column from the 7th cervical vertebra to the 3rd sacral vertebra and was moved caudally. In measurements by Spinal Mouse, the positive values refer to the flexion direction of the spine and the negative values indicate the extension direction. Only one observer performed two measurements using this device and the maximum value was then used for statistical analysis.

The subjects were divided into two groups: an LBP group and a healthy group. Data were checked for normality using the Shapiro-Wilk test. Each endpoint between the two groups was obtained using the χ^2 test for the categorical variables and the Mann-Whitney test or t-test for the continuous variables. To examine the factors associated with LBP, logistic regression analysis was conducted with the presence or absence of LBP as the dependent variable and the measurement items as the independent variables. We used multivariable logistic regression to control for the potentially confounding roles of age, sex and BMI. The level of significance was set at 5%. This study was approved by the Ethics Committee of the International University of Health and Welfare (18-Ifh-091). There are no conflicting interests in this study.

3. RESULTS

In this study, the incidence of LBP was 10.0%, and the prevalence of GJH was 28.9%. The ODI scores, spinal extension range of motion and a sub-item of Beighton score (spine) were significantly different between the LBP groups and healthy groups (Table 1). We observed no statistically significant differences between the two groups in terms of age, sex, GJH ratio, the Beighton total score, BMI, the skeletal muscle mass, the trunk muscle mass, the spinal flexion range of motion and the lumbar lordosis angle. Logistic regression analysis showed that the main factor associated with LBP was the spinal extension range of motion. The odds ratio for the trunk extension range of motion was 0.937 (95% confidence interval, 0.893-0.982) and the Beighton score was 1.162 (95% confidence interval, 0.932-1.449).

Table 1. Comparison of evaluation values between the groups with low back pain and the healthy group

	Low back pain group (n=20)	Healthy group (n=181)	*p*
Age (year)	21.6 ± 0.8	20.9 ± 0.8	0.17
Women	11 (55.0%)	114 (63.0%)	0.32
GJH	4 (20.0%)	54 (29.8%)	0.26
Beighton total score	2.0 (0.0 - 4.0)	3.0 (1.0 - 5.0)	0.13
Sub-item			
Spine	3 (15.0%)	69 (38.1%)	0.03
Right knee	5 (25.0%)	39 (21.5%)	0.47
Left knee	5 (25.0%)	36 (19.9%)	0.40
Right little finger	5 (25.0%)	63 (34.8%)	0.27
Left little finger	5 (25.0%)	72 (39.8%)	0.15
Right thumb	4 (20.0%)	70 (38.7%)	0.08
Left thumb	4 (20.0%)	66 (36.5%)	0.11
Right elbow	7 (35.0%)	74 (40.9%)	0.39
Left elbow	7 (35.0%)	75 (41.4%)	0.39
ODI (score)	6.0 (4.3 - 10.8)	1.0 (0.0 - 2.0)	0.02
BMI (kg/m^2)	21.7 ± 2.2	21.3 ± 2.4	0.46
Skeletal muscle mass (kg)	25.2 ± 5.2	24.9 ± 14.5	0.93
Trunk muscle mass (kg)	17.9 (16.8 - 23.3)	17.0 (15.4 - 22.4)	0.13
Spinal range of motion (°)			
Flexion	99.0 (80.3 - 105.5)	97.0 (89.0 - 108.0)	0.56
Extension	-23.0 (-30.0 - -15.8)	-30.0 (-37.0 - -23.5)	0.01
Lumbar lordosis angle (°)	-25.0 (-32.6 - -19.0)	-27.0 (-34.0 - -20.0)	0.61

Values are mean ± SD or n(%) or Median(25% tile - 75%tile). A sub-item of the Beighton score indicated the number of positives for hypermobility (positive rate) in each joint. GJH, Generalized Joint Hypermobility. ODI, Oswestry Disability Index. BMI, Body mass index.

4. DISCUSSION

The ODI scores of the LBP group were significantly higher than those of the healthy group, and LBP had a significant impact on the daily life. The positive rate for the task of flexing the spine from the standing position, a sub-item of the Beighton score, was significantly lower in the LBP group, indicating a lower flexibility. The decreased range of motion of the spinal extension may be a risk factor for LBP in young adults.

The prevalence of GJH and the Beighton score were not significantly different between the two groups and were not associated with LBP, which is similar to the findings of earlier studies[11,14)] that there is no association between the chronic LBP and GJH. These studies[11,14)] examined LBP and the spinal hypermobility using the sub-items of the Beighton score to reflect spinal mobility, but not objectively. Our results also revealed a significant decrease in the entire spinal extension range of motion in the LBP group. Trunk flexibility with excessive joint mobility has been negatively correlated with CLBP and the facet joint osteoarthritis (FOA), suggesting that this may play a role in preventing CLBP and FOA[12)] as well as the importance of spinal flexibility for LBP. The lack of association between the spinal flexion range of motion and LBP was because the upper limbs were extended to the floor from a standing position, placing the upper limit on the spine flexion range of motion.

There were no significant differences in the trunk muscle mass or the lumbar lordosis angle between the two groups, and these factors were also not associated with LBP. Decreased muscle mass in the lower lumbar extensor group and in the lumbar major muscle is associated with the occurrence of LBP[15,16]. In addition, the mass of the extensor muscles of the lower lumbar spine is related to the size of the lumbar sagittal plane curvature [17]. As there was no significant difference in the lumbar lordosis angle between the healthy and the LBP groups, the lower lumbar extensor muscle mass associated with lumbar lordosis was also assumed to be similar. However, in the present study, the trunk muscle mass was not measured in a cohesive manner by the BIA method, and, therefore, no association between the trunk muscle mass and LBP has been observed.

A limitation of this study is that we were unable to measure the lower lumbar spine extensor muscle mass, which is associated with LBP, in a localized manner. Further studies are needed to clarify this association between the pain in the lumbar muscles and LBP in young adults using MRI and ultrasound. In this study, the presence of LBP was confirmed on a self-reporting basis, and the causes were not evaluated

In conclusion, based on our findings, LBP is associated with a reduced spinal extension range of motion in young adults, and not with the GJH, the trunk muscle mass, or the lumbar lordosis angle. For clinical implications, these findings may be useful for lifestyle advice (e.g. advising not to hyper extend trunk) combined with the general assessments for LBP (e.g. pain intensity or hip mobility). However, the details of low back pain and the measurement of the trunk muscle mass need to be examined further.

Funding and Conflict of interest

No funding was provided for this study. The author declares no conflict of interest.

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