Effects of an Individualized Educational Program for Korean Patients With Chronic Low Back Pain: A Randomized Controlled Trial

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ABSTRACT

Background: Most patients with low back pain prefer to ignore symptoms and avoid medical management because of incorrect perceptions about this condition. However, over 90% of patients with chronic low back pain are hardly able to perform daily activities, with 50% reporting that their daily activities have been severely impeded.

Purpose: In this study, an individualized educational program was developed and implemented in a sample of Korean patients with chronic low back pain, and the effectiveness of this program was evaluated.

Methods: This study was conducted as a randomized controlled trial with outpatients (n = 43) in an orthopedic clinic. The Analysis, Design, Development, Implementation, and Evaluation model was applied to develop the educational program. The experimental group was provided with an educational booklet and contacted via biweekly personalized telephone and face-to-face counseling sessions. The control group was provided the educational booklet only. SAS Version 9.4 was used to analyze collected data using the χ2 test, t test, Fisher’s exact test, Wilcoxon test, linear regression analysis, and Spearman partial correlation analysis.

Results: After 8 weeks, the experimental group demonstrated a significantly greater reduction in maximum, average, and current low back pain experienced within the immediately preceding 24 hours than the control group (p = .001, p = .002, and p = .014, respectively). In addition, daily living disability showed a greater reduction, and average back muscle strength showed a more significant improvement in the experimental group than in the control group (p = .001 and p = .035). The difference in medication adherence between the groups was not statistically significant (p = .089). The experimental group rated an average of 4.3 out of 5.0 points on the program satisfaction scale, indicating an 86% rate of satisfaction.

Conclusions/Implications for Practice: In this study, the individualized educational program was shown to be effective in helping alleviate symptoms in patients with chronic low back pain, decrease daily living disability, and improve average back muscle strength. It was further demonstrated that following up with expert medical staffs can motivate patients to incorporate the recommendations of the program into their daily routine, leading to higher patient satisfaction.

Key Words:
low back pain, individualized education, daily living disability, back muscle strength, medication adherence.

Introduction

Low back pain (LBP) has multiple possible causes (Samsung Medical Center, 2020), and a definitive cause is unable to be diagnosed in 85% of patients who present with idiopathic pain and are unable to be characterized anatomically or histologically (Deyo & Weinstein, 2001). Nearly 30% of patients with LBP do not seek medical treatment in a hospital despite severe pain, and only 70% eventually visit the hospital seeking pain relief (Ministry of Health and Welfare, 2019).

A previous study on the impact of chronic pain on the treatment-seeking behavior of Korean patients showed that the low back is the site most commonly affected by pain regardless of gender (Jeong et al., 2015). LBP is the leading cause of disability not only in Korea but also worldwide (Hartvigsen et al., 2018). Chronic LBP, defined as LBP that lasts more than 3 months, is a major cause of medical economic burden and daily living disability (Tegner et al., 2018). Although LBP may be attributable to structural causes, it is mostly triggered by the maintenance of incorrect body posture, which exerts extreme forces on the muscles, ligaments, and joints (Abbasi et al., 2018). As chronic LBP develops, the main purposes of treatment are to alleviate pain, prevent worsening of the condition, and help the patient perform activities of daily living (S. K. Kim et al., 2017).

Over 90% of patients with chronic LBP are hard to perform daily activities, with 50% reporting that their daily activities have been severely impeded by pain (S. K. Kim et al., 2017). This is because LBP is associated with an impaired ability to perform daily activities (Jan et al., 2018). Furthermore, the impairment of movement associated with chronic LBP may lead to other adverse effects, including weak low back muscles (Hyoung, 2008), increased pain intensity, and...
reduced quality of life (Husky et al., 2018). Muscle strength refers to the maximum force exerted by a muscle at a given time, which is influenced by the cross-sectional area of that muscle. Thick muscle fibers with a wider cross-sectional area indicate increased muscle strength (Muscle, 2020). However, the cross-sectional areas of the back muscles in patients with LBP diminish over time compared to those in healthy individuals, leading to a reduction in muscle strength (Goubert et al., 2016). Physical workouts are important for strengthening these muscles, and numerous patients with LBP have reported symptomatic improvement after back muscle strengthening exercises (Kumar et al., 2015). Workout therapy for LBP has focused mainly on the abdominal muscles located on the front and sides of the body, as related exercises help maintain the proper alignment of the spine in any posture and absorb the load applied on it (Bang, 2015). It is necessary to educate patients so that they are aware of relevant exercises and the importance of maintaining good posture to relieve LBP and are able to continue to practice these measures on their own.

The administration of oral analgesics (e.g., anti-inflammatory agents, analgesics, and muscle relaxants) for LBP is considered safe, as they have relatively few side effects and are easily accessible and cost-effective. However, because of the prevalent, groundless belief that withstanding pain is healthier than taking painkillers (S. K. Kim et al., 2017), patients are reluctant to use medicines prescribed for pain relief. Those who know more about medicine are more likely to adhere to medication (Min & Kim, 2012). Poor medication adherence has been shown to reduce the effectiveness of treatment and clinical outcomes (S. Lee et al., 2019). Thus, education aimed at improving compliance with medication is important in the treatment of chronic LBP.

As the number of patients with LBP increases, various treatments, including exercise (Zhang et al., 2014), injections (e.g., steroid injection; Vekaria et al., 2016), and Korean medicine therapies (J. H. Lee et al., 2017), are being utilized in the management of this problem. However, > 95% of chronic patients with LBP remain symptomatic despite receiving treatment, and only 8% receive education on LBP (S. K. Kim et al., 2017). According to the World Health Organization, therapeutic patient education can aid those with a chronic condition in acquiring or maintaining skills necessary to manage their own life in the best way possible (World Health Organization, 1998). Therefore, educating people with chronic LBP is vital, and LBP management is an important first step in treatment.

Patients with chronic disease may limit worsening symptoms by understanding the related principles of management and learning to undertake simple interventions (Wonngom et al., 2019). Imparting knowledge in the form of individualized counseling requires more time and effort but has the advantage of being able to motivate individuals to implement relatively permanent behavioral changes and meet their own expectations with respect to treatment outcomes. There is also evidence that individualized counseling has resulted in behavioral changes (Lancaster & Stead, 2017). Thus, it is important to tailor the information provided to patients using individualized education to ensure that they are able to identify and manage their own particular symptoms and subsequently improve self-care efficacy. The Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model (Dick et al., 2011) is widely used in educational program development. This model is particularly useful if the focus of the program is targeted on changing participant behaviors and improving performance (Sapana et al., 2018). It has also been effectively used to change behaviors in the management of various healthy conditions (Malan et al., 2015; Sapana et al., 2018).

Previous studies of LBP have focused on interventions such as exercise (Kumar et al., 2015; Kwak & Kim, 2016) and Korean medicine therapies (J. H. Lee et al., 2017) to improve depression (Kuvačić et al., 2018) or quality of life (Husky et al., 2018). Furthermore, studies on the management and education of patients with LBP focused on specific groups such as pregnant women (Shiri et al., 2018), caregivers (Kamioka et al., 2011), and nurses (Járomi et al., 2018). However, few studies have examined the effect of individualized educational programs on ordinary patients with chronic LBP.

The purpose of this study was to develop and apply an individualized educational program based on the ADDIE model with content that could be easily accessed and applied to daily living activities for chronic patients with LBP. In this study, pain, daily living disability, back muscle strength, and medication adherence were hypothesized to differ in patients with chronic LBP according to the individualized educational program.

**Methods**

**Study Design**

This randomized controlled trial was designed to investigate effectiveness of a newly created, individualized educational program for patients with LBP. The independent variable was the individualized, 8-week educational program, and the dependent variables were LBP, daily living disability, back muscle strength, and medication adherence.

**Study Participants**

Participants were recruited from adult patients (≥ 18 years of age) who visited the outpatient orthopedic clinic at the Samsung Medical Center in Seoul from November 2017 to June 2018. The inclusion criteria included patients who (a) had been suffering from LBP for ≥ 3 months, (b) had been radiologically diagnosed with lumbar vertebral dislocation or spinal instability on radiography during an outpatient visit, (c) agreed to participate in an individualized educational program, (d) had been prescribed the similar ingredient drugs, and (e) could communicate without difficulty and understood the study purpose and its attendant instructions. Otherwise, eligible patients who (a) had been diagnosed with neurological conditions such as stroke or Parkinson’s disease, (b) had a cognitive functional disorder or a psychiatric illness, (c) had undergone a spinal surgery within the previous 12 months, (d) had already participated in an educational program related
to LBP; or (e) scored ≥ 8 points on the numerical rating scale for the current LBP based on a previous report (Zhang et al., 2014) were excluded from the trial. Finally, participants who withdrew before completing the study were those who (a) received an injection or an alternative, traditional Eastern alternative treatment over the low back area during program participation; (b) self-reported < 80% adherence with the program; (c) did not participate in the program for ≥ 2 weeks; or (d) expressed the desire to withdraw from the program.

The sample size required to obtain a valid assessment of the change in the extent of LBP after completion of the program was determined using nQuery nTerim Version 4.0 (Statistical Solutions Ltd, Cork, Ireland). Based on a previous study (Shin & Cho, 2014), considering a pre- and postprogram exposure difference of 2 ± 1.6 points in the LBP score, a significance level of .05 and a power of 90% in the two-tailed test were used to calculate the required sample size. The optimal sample size was estimated at 30, and a sample of 54 participants was recruited to account for the estimated potential dropout rate. After ensuring that the participants satisfied the inclusion and exclusion criteria, they were allocated to either the experimental or control group based on the order in which they had registered based on a randomization table that was created using a randomized block design created using SAS software Version 9.4 (SAS Institute, Inc., Cary, NC, USA) to evenly divide the participants between the groups.

Six and five participants from the experimental and control groups, respectively, withdrew from the study, as they self-reported less than 80% of the program performance rate, did not participate for 2 weeks or longer in the 8-week program because of flu treatment or other reasons, or did not respond to a posttest and wanted to drop out of the study. Thus, data from 21 and 22 experimental and control group participants, respectively, were available for analysis.

Before initiating the trial, the two groups’ general baseline data and other characteristics related to LBP were tested for homogeneity. The number of participants who exercised regularly before participating in the study differed significantly between the groups. After performing the necessary adjustment for this variable across the two groups, the effects of the program were analyzed (Table 1 and Table 2).

**Intervention**

The program was developed based on the ADDIE model, an instructional systems design model created by the Center for Educational Technology at Florida State University. The model includes analysis, design, development, implementation, and evaluation phases for the development and application of any individualized educational program.

**Analysis**

The research design, subjects, interventions, educational methods, duration of education, and other dependent variables of the program adopted from a previous Korean study (S. K. Kim et al., 2017) were analyzed. Based on the findings, the level of knowledge and educational needs of the participants were analyzed. Their frequently asked questions were also collected and organized. The selected educational areas in the program were the spinal structure, causes of LBP, diagnostic inspection, posture of daily living, exercise, and medical and surgical treatment.

**Design**

The objectives, assessment tools, and educational method of this program were framed based on the results of the above-mentioned analysis.

The program aimed to improve LBP scores by ≥ 2 points on average in the participants who self-reported ≥ 80% adherence to the program or participated for ≥ 6 weeks of the 8-week program. The Korean version of the Brief Pain Inventory, the Korean version of the Oswestry disability index, Med-X for measuring muscle strength, and the Korean version of a self-report questionnaire were utilized to assess the outcomes of the program. It was decided to educate the participants individually and to provide the necessary information using an educational brochure on LBP.

**Development**

The relevance and applicability of this program were verified by nine experts, including five orthopedic specialists specializing in spinal disease, two nurses in charge of spinal disease treatment, one spinal disease coordinator, and one professor of nursing. The validity coefficients used to assess the appropriateness (six items) and applicability (two items) of the program were calculated using the content validity index in accordance with the criteria described by Lynn (1986). The content validity index of all items included in the program was ≥ .8, thus aiding in the decision to use the entire program. The educational brochure included an explanation of the pathophysiology of LBP, diagnostic inspections, body postures to be used in daily activities, targeted exercises, and the various medical and surgical treatment alternatives (Figure 1). The contents of the program and the brochure were explained to five patients with LBP as part of a user group evaluation. The terms that were reportedly difficult to understand were revised to improve general-patient comprehension.

**Implementation**

The newly developed, individualized educational program was implemented by the researcher in the outpatient counseling room of our medical center. The researcher was a doctoral student in the Graduate School of Nursing who had been responsible for spinal disease in the hospital for over 5 years. Each patient in the experimental group was provided with the educational brochure on LBP and was educated individually for 30 minutes, in line with a previous study (Kwak & Kim, 2016) that had conducted domestic research on exercise therapy for middle-aged women suffering from chronic LBP. All participant questions were resolved in detail in individualized educational sessions. The experimental group received...
Table 1
General and Back-Pain-Related Characteristics of the Participants

| Variable                        | Experimental Group (n = 21) | Control Group (n = 22) | $\chi^2/z/t$ | $p$  |
|---------------------------------|----------------------------|------------------------|--------------|------|
| **General characteristics**     |                            |                        |              |      |
| Age (years), $M$ and $SD$       | $61.3 \pm 11.5$            | $54.5 \pm 12.8$        | 1.84         | .073 |
| < 65                            | 13 (61.9)                  | 17 (77.3)              | 1.20         | .273 |
| ≥ 65                            | 8 (38.1)                   | 5 (22.7)               | 0.19         | .661 |
| Gender                          |                            |                        |              |      |
| Male                            | 6 (28.6)                   | 5 (22.7)               |              |      |
| Female                          | 15 (71.4)                  | 17 (77.3)              |              |      |
| Height (cm), $M$ and $SD$       | $160.2 \pm 8.9$            | $160.2 \pm 9.3$        | -0.03        | .973 |
| Weight (kg), $M$ and $SD$       | $63.9 \pm 10.7$            | $62.1 \pm 11.6$        | 0.53         | .601 |
| Education                       |                            |                        |              |      |
| ≤ Elementary school             | 3 (14.3)                   | 2 (9.1)                |              |      |
| Middle and high school          | 8 (38.1)                   | 12 (54.5)              |              |      |
| ≥ College                       | 10 (47.6)                  | 8 (36.4)               |              |      |
| Smoking                         |                            |                        |              |      |
| Nonsmoking                      | 18 (85.7)                  | 17 (77.3)              |              |      |
| Smoking                         | 0 (0.0)                    | 4 (18.2)               |              |      |
| Smoking cessation               | 3 (14.3)                   | 1 (4.5)                |              |      |
| Sleeping time (hours), $M$ and $SD$ | $6.6 \pm 1.4$            | $6.3 \pm 1.4$          | 0.71         | .483 |
| < 8                             | 16 (76.2)                  | 18 (81.8)              |              |      |
| ≥ 8                             | 5 (23.8)                   | 4 (18.2)               |              |      |
| Sleeping place                  |                            |                        | 0.30         | .586 |
| Bed                             | 15 (71.4)                  | 14 (63.6)              |              |      |
| On the floor                    | 6 (28.6)                   | 8 (36.4)               |              |      |
| **Back pain-related characteristics** |                        |                        |              |      |
| Duration of disease (years), median [1st, 3rd] | 5 [1.5, 10]          | 6.5 [3, 20]            | 0.84         | .401 |
| < 1                             | 4 (19.1)                   | 1 (4.6)                |              | .333 |
| 1–5                             | 7 (33.3)                   | 10 (45.5)              |              |      |
| > 5                             | 10 (47.6)                  | 11 (50.0)              |              |      |
| Frequency of LBP (per week)     |                            |                        | 1.00         | .000 |
| ≤ 2                             | 1 (4.8)                    | 2 (9.1)                |              |      |
| 3–4                             | 3 (14.3)                   | 3 (13.6)               |              |      |
| ≥ 5                             | 17 (80.9)                  | 17 (77.3)              |              |      |
| Degree of disturbance of daily life |                            |                        | 0.689        | .568 |
| None                            | 0 (0.0)                    | 2 (9.1)                |              |      |
| Slightly                        | 10 (47.6)                  | 10 (45.5)              |              |      |
| Much                            | 11 (52.4)                  | 10 (45.4)              |              |      |
| LBP treatment                   |                            |                        | 1.00         | .000 |
| Yes                             | 20 (95.2)                  | 20 (90.9)              |              |      |
| No                              | 1 (4.8)                    | 2 (9.1)                |              |      |
| Duration of treatment (months)  |                            |                        | 0.248        | .123 |
| ≤ 3                             | 4 (20.0)                   | 1 (5.0)                |              |      |
| 4–11                            | 5 (25.0)                   | 9 (45.0)               |              |      |
| ≥ 12                            | 11 (55.0)                  | 10 (50.0)              |              |      |
| Treatment method b              |                            |                        |              |      |
| Steroid injection               | 14 (66.7)                  | 12 (54.6)              | 0.66         | .416 |
| Oral medication                 | 17 (81.0)                  | 16 (72.7)              | 0.30         | .586 |
| Physiotherapy                   | 15 (71.4)                  | 14 (63.6)              |              |      |
| Exercise therapy                | 4 (19.1)                   | 11 (50.0)              | 4.53         | .033 |
| Oriental medical therapy        | 11 (52.4)                  | 11 (50.0)              | 0.02         | .876 |
| Use of analgesics               |                            |                        | 3.79         | .052 |
| Yes                             | 18 (85.7)                  | 13 (59.1)              |              |      |
| No                              | 3 (14.3)                   | 9 (40.9)               |              |      |
biweekly personalized telephone and face-to-face education for 8 weeks and was trained to check the self-checklist every day. Conversely, the control group was offered only the brochure, and a single individualized education was performed after 8 weeks. The outcome of implementing the program was examined after 8 weeks based on the results of a previous study (Hyoung, 2008) that investigated a low-back-strengthening program (applied for 8 weeks) in elderly women suffering from chronic LBP.

Evaluation

The effects of the program were evaluated by measuring LBP, daily living disability, back muscle strength, and medication adherence in the experimental and control groups before and after implementation of the program. The experimental group was evaluated for program satisfaction after 8 weeks.

Outcome Measures

The Korean version of the Brief Pain Inventory, originally developed by Duat et al. (1983) and translated into Korean by Yun et al. (2004), was used to measure the extent of LBP, with higher scores indicating more severe pain.

The level of daily living disability was measured using the Korean version of the Oswestry disability index, which was originally developed by Fairbank and Pynsent (2000) and translated into Korean by Jeon et al. (2006). The total possible index score is generally 50 points and 45 points for respondents for whom items regarding sexual activity are not applicable. A higher score on this index indicates greater functional disability. The disability index (%) was calculated using the following equation: (total score measured/total possible score [50 or 45]) × 100.

Back muscle strength was measured using a Med-X lumbar extension machine (Med-X, Ocala, FL, USA). The assessor (an exercise prescriber) was blinded to the group allocation of each patient to ensure measurement reliability. Relative values of the maximal isometric muscular strength for lumbar extension were calculated considering each patient’s age, gender, and weight. The relative values measured at each lumbar flexion angle were distributed from −100% to 100%, with a mean of 0%. Values closer to 100% indicate

Table 1
General and Back-Pain-Related Characteristics of the Participants, Continued

| Variable                          | Experimental Group (n = 21) | Control Group (n = 22) | $\chi^2$/z/t | p    |
|----------------------------------|----------------------------|------------------------|--------------|------|
| Education about LBP             |                            |                        |              |      |
| Yes                              | 0 (0.0)                    | 1 (4.6)                |              | 1.000^a |
| No                               | 21 (100.0)                 | 21 (95.4)              |              |      |
| Willingness to join education about LBP |                    |                        |              |      |
| Yes                              | 20 (95.2)                  | 21 (95.4)              |              | 1.000^a |
| No                               | 1 (4.8)                    | 1 (4.6)                |              |      |

Note. LBP = low back pain.

^a Fisher’s exact test; ^b Multiple response method, for those who answered “yes.”

Table 2
Homogeneity of Dependent Variables Between the Experimental and Control Groups at Baseline

| Variable                        | Experimental Group (n = 21) | Control Group (n = 22) | t/z   | p    |
|---------------------------------|-----------------------------|------------------------|-------|------|
| LBP for 24 hours                |                             |                        |       |      |
| Maximum                         | 6.6 ± 1.9                   | 6.1 ± 1.9              | 0.99  | .328 |
| Average                         | 5.2 ± 1.7                   | 4.5 ± 1.9              | 1.36  | .181 |
| Current                         | 4.1 ± 1.9                   | 3.4 ± 2.2              | 1.00  | .324 |
| Minimum                         | 1.7 ± 1.6                   | 1.6 ± 1.5              | 0.10  | .920 |
| Daily living disability (%)     | 37.9 ± 15.5                 | 33.0 ± 14.1            | 1.10  | .278 |
| Average back muscle strength (%)| 5.3 ± 36.7                  | −9.6 ± 45.0            | 1.19  | .242 |
| Medication adherence ^a         | 2.5 ± 1.3                   | 1.9 ± 1.5              | 1.46  | .145 |

Note. LBP = low back pain.

^a Score (0–4): The lower the score, the higher the medication adherence.
greater muscular strength. The average of relative values measured at each lumbar flexion angle was calculated to produce the mean values.

To test medication adherence, a self-reporting tool, originally created by Morisky et al. (1986) and translated into Korean by S. W. Kim et al. (1995), was used after obtaining approval from its developers. A lower score on this tool indicates stricter adherence to the drug regimen for LBP.

Finally, level of satisfaction with the program was measured using a score constituting seven items, each graded on a 5-point scale, that were developed by the researchers of this study. The content validity of the tool was tested by five orthopedic specialists in spinal disease and three professors of nursing. A higher score indicated greater satisfaction with the program.

**Data Analysis**

The collected data were analyzed using SAS software Version 9.4 (SAS Institute, Cary, NC, USA). All of the participants’ general and LBP-related characteristics recorded at baseline were presented as frequency, percentage, mean with standard deviation, and median (quartile). Homogeneity between the groups was tested using $\chi^2$ test, $t$ test, Fisher’s exact test, and Wilcoxon rank sum test.

A comparison between the pre- and postexperimental changes in all assessed variables, including LBP values, level of daily living disability, back muscle strength, and medication adherence were examined using $t$ test and Wilcoxon signed-rank test. Prior to conducting this analysis, the exercise therapy received by the patients in both groups before undertaking this study program was used as an adjustment variable, and linear regression analysis and Spearman partial correlation analysis were conducted based on the assumption of normality. Finally, the experimental group’s satisfaction with the educational program was presented in terms of the mean with standard deviation.

**Ethical Consideration**

This study was approved by the institutional review board of Samsung Medical Center in Seoul, Korea (IRB No. SMC 2017-10-015). During recruitment, the researcher provided detailed explanations of the aims and procedures involved in the study to all participants. The participants provided written informed consent prior to participation, and their anonymity was preserved.

**Results**

**Low Back Pain**

To test the effect of the program on LBP, the participants were asked to score the level of maximum pain they had experienced during the preceding 24 hours. The experimental group demonstrated a 2.7-point reduction from a mean score of 6.6 pretest to 3.9 posttest, showing a significant difference compared to the difference observed in the control group, which declined by 1.0 point only (mean score of 6.1 pretest to 5.1 posttest, $p = .001$). The average intensity of LBP experienced by the experimental group within the preceding 24 hours dropped by 2.6 points, from a median score of 5.2 to 2.7, showing a significant difference with the control group, which dropped by 0.9 points (from 4.5 to 3.6, $p = .002$). As for the intensity of the current LBP, the level of pain in the experimental group dropped by 2.3 points, from a mean of 4.1 pretest to 1.8 posttest, which was significantly different from the control group, which declined by 0.9 points (from 3.4 to 2.6, $p = .014$; Table 3).

**Daily Living Disability**

The daily living disability index score for the experimental group dropped 19.8%, from 37.9% to 18.1%, between pretest and posttest, whereas the score for the control group
dropped 6.4%, from 33.0% to 26.6%, showing a significant difference between the two groups \((p = .001; \text{Table 3})\).

**Back Muscle Strength**

Following the program, the back muscle strength of the experimental group improved by 14.7% (from 5.3% to 20.0%), whereas that of the control group improved by 6.0% (from −9.6% to −3.6%), indicating a significant difference between the two groups \((p = .035; \text{Table 3})\).

**Medication Adherence**

The experimental group’s self-assessment score with respect to medication adherence dropped by 1.5 points from 2.5 pretest to 1.1 posttest, whereas the control group’s score dropped by 0.4 point from 1.9 to 1.5. The intergroup difference in medication adherence was not statistically significant \((p = .089; \text{Table 3})\).

**Program Satisfaction**

The experimental group rated the program an average 4.3 out of 5.0 points on the satisfaction assessment scale \((\text{Table 4})\). The item on the scale that earned the highest satisfaction score was “The educational program was professional and systematic,” followed by “I am satisfied with the contents of the educational program,” “I’d like to recommend the educational program to others,” and “I’d like to participate in the educational program again if necessary.” By contrast, the items that the participants expressed the lowest satisfaction included “I am satisfied with the duration of the educational program,” “I think I have improved my low back pain through the educational program,” and “I apply what I learned from the educational program to daily living.”

**Discussion**

Following the implementation of the individualized educational program, the experimental group experienced a significantly greater reduction in the intensity of the maximum, average, and current LBP experienced within the preceding 24 hours than the control group. This finding is consistent with the results of a previous study, which offered education for 8 weeks on a lumbar stabilizing exercise program and LBP management to female seniors \((S. K. Kim et al., 2017)\), and the results of another study in which patients with LBP with herniated discs were similarly informed using an educational program \((Shin & Cho, 2014)\). In this study, it was presumed that the individualized education based on the ADDIE

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**Table 3**

*Effect of the Back Pain Education Intervention*

| Variable                  | Baseline  | 8 Weeks       | t/s     | p   | Difference a (Baseline–8 Weeks) | t/p   | p   |
|---------------------------|-----------|---------------|---------|-----|---------------------------------|-------|-----|
|                           | Mean ± SD | Mean ± SD     |         |     | Mean ± SD                       |       |     |
| LBP for 24 hours          |           |               |         |     |                                  |       |     |
| Maximum                   |           |               |         |     |                                  |       |     |
| Exp.                      | 6.6 ± 1.9 | 3.9 ± 1.7     | −83.50  | .001| −2.7 ± 2.2                      | 4.47  | .001|
| Con.                      | 6.1 ± 1.9 | 5.1 ± 2.0     | −60.00  | .011| −1.0 ± 1.7                      | 1.07  | .318|
| Average                   |           |               |         |     |                                  |       |     |
| Exp.                      | 5.2 ± 1.7 | 2.7 ± 1.1     | −108.50 | .001| −2.6 ± 1.8                      | 4.60  | .002|
| Con.                      | 4.5 ± 1.9 | 3.6 ± 1.6     | −45.00  | .046| −0.9 ± 1.9                      | 0.96  | .340|
| Current                   |           |               |         |     |                                  |       |     |
| Exp.                      | 4.1 ± 1.9 | 1.8 ± 1.3     | −78.50  | .001| −2.2 ± 2.0                      | 2.56  | .014|
| Con.                      | 3.4 ± 2.2 | 2.6 ± 1.6     | −36.50  | .078| −0.9 ± 2.2                      | 0.97  | .336|
| Minimum                   |           |               |         |     |                                  |       |     |
| Exp.                      | 1.7 ± 1.6 | 0.9 ± 1.1     | −33.50  | .061| −0.9 ± 2.0                      | 1.67  | .102|
| Con.                      | 1.6 ± 1.5 | 1.8 ± 1.6     | 5.50    | .657| 0.2 ± 1.9                       | 0.2   | .699|
| Daily living disability (%)|          |               |         |     |                                  |       |     |
| Exp.                      | 37.9 ± 15.5 | 18.1 ± 8.2  | −114.00 | .001| −19.8 ± 14.5                    | 3.70  | .001|
| Con.                      | 33.0 ± 14.1 | 26.6 ± 11.4 | −66.00  | .010| −6.4 ± 10.6                     | 6.4   | .262|
| Back muscle strength (%)  |           |               |         |     |                                  | 0.33  | .035|
| Exp.                      | 5.3 ± 36.7 | 20.0 ± 29.8  | 92.00   | .002| 14.7 ± 18.3                     | 14.7  | .001|
| Con.                      | −9.6 ± 45.0 | −3.6 ± 33.5  | 18.50   | .283| 6.0 ± 25.3                      | 6.0   | .253|
| Medication adherence b    |           |               |         |     |                                  | −0.27 | .089|
| Exp.                      | 2.5 ± 1.3 | 1.1 ± 1.3     | −84.00  | .001| −1.5 ± 1.4                      | 1.5   | .132|
| Con.                      | 1.9 ± 1.5 | 1.5 ± 1.3     | −19.50  | .390| −0.4 ± 2.0                      | 0.4   | .670|

Note. LBP = low back pain; Exp. = experimental group \((n = 21)\); Con. = control group \((n = 22)\); \(\rho\) = Spearman partial correlation coefficient.

a Linear regression analysis or Spearman partial correlation analysis with adjustment of whether exercise treatment; b Score (0–4): The lower the score, the higher the medication adherence.
The educational program was professional and systematic. The participants in this study were able to reduce LBP as well by strengthening the muscles in this region. Patients with unstable low back struggle with a greater disturbance in their daily living activities. Consequently, it is important to secure and increase postural stability to improve (Kumar et al., 2015). As an unstable low back not only causes pain but also makes range of motion difficult, it is important to secure and increase postural stability by strengthening the muscles in this region. Patients with LBP are less likely to continue exercising on their own without supervision from medical staff (Saner et al., 2018). The individualized program developed in this study proved to be an effective intervention in patients with LBP, as it was highly accessible, applicable to daily life, and composed of workouts that patients could easily perform themselves.

Oral analgesic drugs must be administered stepwise upward according to the cause and intensity of pain; for patients requiring constant pain management, it is better to receive the analgesic dosage on a regular basis at certain fixed intervals to maintain blood concentration (Hospital Nurses Association, 2019). After the program, it was found that, despite the minimal intergroup difference in medication adherence, the values in the experimental group had increased significantly between pretest and posttest. The authors believe that this is attributable to the repeated explanations (of the treatment) and individualized education/counseling provided. Considering that correct knowledge of medications improves adherence by increasing self-efficacy (Min & Kim, 2012), the information provided to the experimental group regarding the importance of drug therapy enhanced medication adherence during the treatment regimen, which helped decrease LBP and improve daily living functions and back muscle strength.

In this study, the experimental group’s satisfaction score was 4.3 out of 5.0 points, indicating a satisfaction rate of 86%. In particular, this group reported that the educational program was conducted professionally and systematically and that they were satisfied with its contents, which included relevant information that they would like to recommend to others. The high level of satisfaction may be attributed to the fact that this program may be easily implemented for each patient. Furthermore, we believe that regular phone calls and personal meetings with program experts enhanced the effectiveness of the program. This is consistent with the results of another study, which showed that, rather than impersonal information delivery using automated and clustered messages, individualized intervention by experts is effective in transforming the subject health behaviors through continued feedback and interactions (Spark et al., 2015). The lowest level of satisfaction was given to program duration. Therefore, future investigation into the effects of long-term educational programs is recommended.

The findings of this study support that an individualized educational program applied to patients with chronic LBP reduces pain and daily living disability while improving back muscle strength. The participants expressed a high level of satisfaction with the program, confirming that it was implemented.

### Table 4
**Program Satisfaction in the Experimental Group (N = 21)**

| Variable                                      | Mean ± SD  |
|-----------------------------------------------|------------|
| The educational program was professional and  | 4.6 ± 0.5  |
| systematic.                                   |            |
| I am satisfied with the contents of the       | 4.4 ± 0.7  |
| educational program.                          |            |
| I would like to recommend the educational     | 4.4 ± 0.6  |
| program to others.                            |            |
| I would like to participate in the educational| 4.3 ± 0.8  |
| program again if necessary.                   |            |
| I apply what I learned from the educational   | 4.2 ± 0.9  |
| program to daily living.                      |            |
| I think I have improved my low back pain      | 4.1 ± 0.9  |
| through the educational program.              |            |
| I am satisfied with the duration of the       | 4.1 ± 1.0  |
| educational program.                          |            |
| Total score                                   | 4.3 ± 0.6  |

**Note.** Score (1—5): The higher the score, the higher the program satisfaction.

model, which included posture correction and exercise, was effective in reducing LBP. The ADDIE model is particularly useful when the program focus is on changing participant behavior (Sapana et al., 2018).

The experimental group showed a greater reduction in the level of daily living disability than the control group, which is similar to the results of another study where young patients with chronic LBP experienced a lower degree of daily living disability after performing guided, back-strengthening exercises and receiving health education for 12 weeks (Zhang et al., 2014). Daily living activities such as walking, sitting, standing, sleeping, sexual activity, socializing, traveling, maintenance of personal hygiene (e.g., washing), and dressing are all basic necessary tasks of living. Considering that patients who struggle with a greater disturbance in their daily living activities experience greater LBP (S. K. Kim et al., 2017), it appears that the participants in this study were able to reduce LBP as well by reducing the difficulties experienced in performing daily activities. Consequently, it is important for patients with chronic LBP to obtain and apply correct knowledge during the individualized program, cultivate positive habits, and perform healthier exercises for the low back.

In this study, the experimental group experienced a greater increase in the relative strength of back muscles than the control group. Similar to a previous study in which the comprehensively supervised group showed a higher compliance with performing back-strengthening exercises than the control group (Lacroix et al., 2017), the experimental group in this study demonstrated a significant improvement in back muscle strength, perhaps because its members were more motivated to practice what they were taught in the individualized program. Consequently, it appears that, as LBP decreased, patients were able to perform exercises more actively, further enhancing their muscle strength. Regardless of the cause, most patients with LBP have a restricted range of motion in their back and lower limb joints that is attributable to reduced muscle strength, endurance, and flexibility, which requires regular, systematic workouts to improve (Kumar et al., 2015). As an unstable low back not only causes pain but also makes range of motion difficult, it is important to secure and increase postural stability by strengthening the muscles in this region.

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professionally and systematically. Moreover, the program content was satisfying, and the participants expressed a willingness to recommend the program to others. These findings indicate that an individualized, accessible educational program that is conducted regularly with continued support and encouragement from experts is able to motivate patients to implement behavioral changes and to adopt better treatment measures that may alleviate their symptoms and help them achieve a better quality of life.

Limitations
This study has a number of limitations. First, the participants in this study were patients who had visited the orthopedic outpatient clinic of an advanced general hospital’s spine center, which indicates that most were currently suffering from chronic/intense LBP. Thus, generalization of the results of this study to other populations of patients with LBP should be done with caution. Second, as this study implemented an individualized educational program and examined its effect after a short duration (8 weeks), a follow-up study investigating the long-term effects of the program by monitoring whether the participants continued to practice what they had learned from the program over a longer period of time (e.g., ≥ 3 months) is necessary. Finally, as this study only included patients visiting a single hospital, a multicenter study covering a wider group of people in a variety of social environments will be necessary to confirm the efficacy of this program.

Conclusions
The findings of this study confirmed the effectiveness of an individualized educational program in reducing pain and daily living disability and improving back muscle strength in patients with chronic LBP. The participants expressed a high level of satisfaction with the program, confirming that it was implemented professionally and systematically and noted that the program contents were satisfying and they would be willing to recommend the program to others. These findings indicate that an individualized, accessible educational program that is implemented regularly and with continued support and encouragement from experts may be effective in motivating patients to implement behavioral changes and adopt better treatment measures that alleviate symptoms and promote a better quality of life.

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Author Contributions
Study conception and design: All authors
Data collection: SKK, SSC
Data analysis and interpretation: SKK, HSK
Drafting of the article: All authors
Critical revision of the article: SKK, HSK

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