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Original Article

Effectiveness of manual therapy for patients with low back pain from the perspective of physical and psychosocial factors

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Abstract. [Purpose] This study aimed to determine the effectiveness of the Arthrokinematic Approach (AKA)-Hakata method for patients with low back pain (LBP). [Participants and Methods] The participants were 39 patients with LBP who visited a medical facility between June 1, 2022, and November 30, 2022. The intervention period was 8 weeks, with five treatment sessions, and the patient assessments were performed using patient self-reported measures of LBP and motor function assessment. [Results] The AKA-Hakata method showed significant differences in all of the items evaluated in the longitudinal comparison of patients. Additionally, an interaction was observed only in the Roland-Morris Disability Questionnaire between the two groups classified using the Subgrouping for Targeted Treatment Back Screening Tool. [Conclusion] The results of this study showed that treatment with the AKA-Hakata method may have an early therapeutic effect on the physical and psychosocial risks in daily life. The results of this study indicated that the AKA-Hakata method is effective for the treatment of LBP. However, this study only evaluated a relatively short treatment period of five sessions. Further research on the long-term treatment effect is needed in order to optimize the treatment duration in detail and investigate the effectiveness of the AKA-Hakata method.

Key words: Low back pain, Arthrokinematic Approach Hakata Method, STarT Back Screening Tool

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INTRODUCTION

With reports that more than 70% of people in developed countries have low back pain and that at least 25% of physical therapy outpatients have low back pain as a primary complaint[1], low back pain is a condition that affects a large number of people. According to the Comprehensive Survey of Living Conditions in 2019[2], the prevalence of lower back pain in Japan was reported to be the highest among men and the second highest among women, following shoulder stiffness.

Low back pain is defined as pain localized between the 12th rib and the inferior edge of the gluteal groove, with or without pain in the lower extremities[3]. Almost all people who complain of low back pain have no identifiable cause for their pain and are classified as having so-called nonspecific low back pain. There are serious causes of persistent low back pain (malignancy, vertebral fracture, infection, inflammatory disease) that need to be identified and treated, but these causes

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are known to be responsible for only a small percentage of persistent low back pain[3–5]. Under such circumstance, a recent review by Gartenberg has shown that sacroiliac dysfunction is an unrecognized cause of low back pain worldwide. Sacroiliac dysfunction can arise from various clinical conditions as well as abnormal movements or misalignments of the joint[6]. Patients with sacroiliac dysfunction often have unilateral pain below L5, which is mostly localized to the distal and medial aspect of the ipsilateral posterior iliac crest. The pain can be described as sharp, dull, and may be misdiagnosed as radicular pain, as it can spread up to the S1 dermatome[7]. The diagnosis and evaluation of sacroiliac dysfunction are challenging and require provocation tests and image-guided anesthetic injections. There are various provocation tests, including Gaenslen's test, distraction test, thigh thrust test, compression test, FABER test, etc[8].

The treatment of sacroiliac dysfunction consists of conservative management, including physical therapy, chiropractic, and pharmacological therapy. If symptoms do not improve within six weeks of conservative management, other treatment options such as intra-articular injection, periarticular injection, or nerve blocks may be considered. Surgical intervention may be considered if all treatments fail to relieve pain, and sacroiliac joint fixation may be performed. However, long-term research is still required to determine the optimal treatment for sacroiliac dysfunction.

Furthermore, several other factors have also been shown to be associated with risk of low back pain, including personal factors (age, gender, general health), work-related factors, radiating or widespread pain, and psychosocial factors. Psychosocial factors have been shown to be important indicators of the chronicity and development of disability due to musculoskeletal pain[9].

The Subgrouping for Targeted Treatment (STarT) Back Screening Tool (SBST) was developed by Hill et al.[10] as a simple tool to assess the risk of chronic and refractory low back pain. The SBST consists of nine questions, four on physical factors and five on psychosocial factors, and classifies low back-pain as low risk, medium risk, or high risk according to the score. Patients with both low physical and psychosocial factors are classified in the low risk group, patients with strong psychosocial factors are classified in the high risk group, and patients who fall between the low and high risk groups are classified in the medium risk group.

Treatment of low back pain can be surgical or conservative. Conservative treatment includes medication, physical therapy, exercise therapy, and manual therapy. Manual therapy is a technique in which the therapist uses soft force to treat pain and joint abnormalities.

The Arthrokinematic Approach Hakata-Method (AKA-Hakata Method), developed by Setsuo Hakata, is a method for treating abnormal intra-articular motion and inducing motion of the joint surface based on joint kinematics and taking joint neurology into consideration. Hakata et al.[11] demonstrated the effectiveness of the AKA-Hakata method in the treatment of acute low back pain. Kogure et al.[12] reported that the AKA-Hakata method improved pain in-tensity and quality of life in patients with chronic nonspecific low back pain. However, there are no other studies on the effectiveness of the AKA-Hakata method, in particular those from the physical and psychological viewpoints.

Although various intervention methods have been used for low back pain, we believe that this study will help in selecting a treatment method for low back pain by verifying the intervention effects of the AKA-Hakata Method from the viewpoint of physical and psychosocial factors.

The purpose of this study is to clarify the therapeutic effect of AKA-Hakata method on patients with complaints of low back pain by comparing pre- and post-intervention effects after five outpatient interventions. Additionally, we aim to investigate the effect of AKA-Hakata method on each group classified by the SBST, and to clarify the therapeutic effect from physical and psychosocial factors.

PARTICIPANTS AND METHODS

This prospective intervention-control study was conducted with the approval of the N Clinic Ethics Committee (Approval No. 2022001). Participants were explained the research content by a written document and submitted written consent form. The study was designed based on the TIDieR checklist and registered in jRCT (Japan Registry of Clinical Trials) (registration number: jRCT1032220174).

The flowchart of this study is presented in Fig. 1. The inclusion criteria were patients who visited N Clinic and had a chief complaint of low back pain. The exclusion criteria were those who did not consent to participate in the study, those who had difficulty with modified independent stair climbing, those who had conditions such as ankylosing spondylitis, fractures, or spinal malignant tumors, those who had low back pain due to infections or tumors, those who had undergone spinal surgery in the past, and those who had not been prescribed manual therapy by a physician. After explaining the study, 39 individuals who provided their consent were included in this study. The intervention period for patients with low back pain was set at 8 weeks, with five interventions conducted every two weeks. All participants underwent interviews, questionnaires, and evaluations of their exercise function. Details are shown below.

As part of the initial assessment, we investigated medical history, physical function assessment, questionnaire evaluation, and exercise function assessment.

As part of the medical interview, we surveyed the following items using a questionnaire: age (years), gender, duration of lower back pain (months), history of lower back pain, and occupation. We also assessed awareness of the AKA-Hakata method. For the SBST, we used the Japanese version translated by Matsudaira et al[13]. As for physical function evaluation,

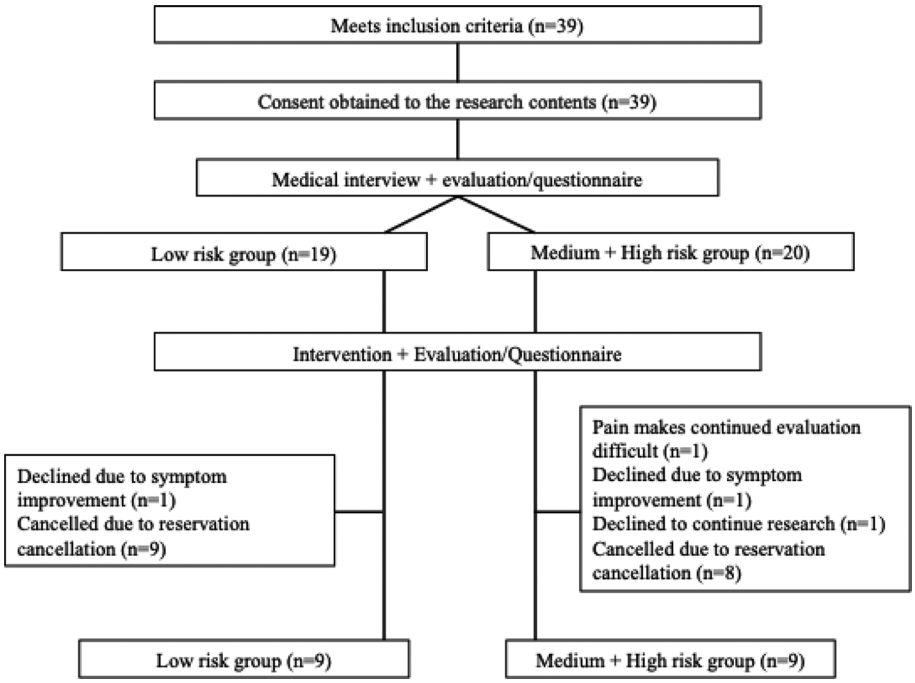

Fig. 1. Flowchart of the study.
Out of 39 eligible participants who met the inclusion criteria, 18 completed all evaluations and measurements.

we measured height (cm), weight (kg), BMI (kg/m^2), and the spinous process length on the side with lower back pain or greater pain.

The following four types of questionnaire evaluations were conducted. 1) The Roland–Morris Disability Questionnaire (RDQ)[14, 15], consisting of 24 items that ask "yes" or "no" questions about the degree to which low back pain interferes with daily activities, is scored from 0 to 24 with higher scores indicating greater disability. The Japanese version of the RDQ, translated by Suzukamo et al., was used for assessment. 2) The Visual Analogue Scale (VAS)[16] was used to assess pain intensity, with participants marking the level of pain on a 100 mm line with the left end indicating no pain and the right end indicating the worst possible pain. 3) The Fear-Avoidance Beliefs Questionnaire (FABQ)[17], translated into Japanese by Matsudaira et al., was used to evaluate the strength of fear-avoidance thoughts related to low back pain using 16 items, consisting of five items related to physical activity and 11 items related to work, with higher scores indicating stronger fear-avoidance beliefs. 4) The Pain Self-Efficacy Questionnaire (PSEQ)[18, 19], translated into Japanese by Adachi et al., was used to assess self-efficacy beliefs related to pain using 10 items scored on a 7-point scale from 0 to 6, with higher scores indicating greater self-efficacy.

The following two types of motor function were evaluated. The five-repetition sit-to-stand test (FRSTST), based on the measurement method of Bohannon et al.[20], was used. Participants were instructed to stand up and sit down from an armless chair with a height of 43 cm as quickly as possible for 5 repetitions. Participants were instructed to cross their arms in front of their chest, spread their legs shoulder-width apart, sit in the chair, stand up completely, and sit down firmly. The measurement began with a signal from the measurer and ended when the participant completed the fifth stand-up and seating. The Y-Balance Test (YBT), based on the measurement method of Alshehre et al.[21], was conducted using the Y-Balance Test Kit (Perform Better Japan). Participants performed the YBT barefoot to eliminate the influence of footwear. Participants stood on one leg with the painful or stronger leg on the weight-bearing side at the center plate as the starting position. The painless or weaker leg was used as the free leg and was instructed to slide the plate forward, backward, and to the posteromedial and posterolateral sides as much as possible while maintaining balance on one leg from the starting position (Fig. 2). If the participant met any of the following criteria, the trial was discarded and repeated: I) moved the weight-bearing leg from the center plate or crossed the line, II) pushed, kicked, or stepped on the plate, III) touched the floor with the free leg, IV) lost balance before returning the free leg to the starting position. After practicing all three directions, three measurements were taken in each of the three directions and recorded. During analysis, the average of three measurements for each of the three directions was calculated and normalized using the following formula (average of three measurements [cm]/spinous process length [cm] ×100[%]).

Six types of questionnaire and motor function assessments were surveyed at the initial assessment before the intervention and after each intervention, for a total of six times.

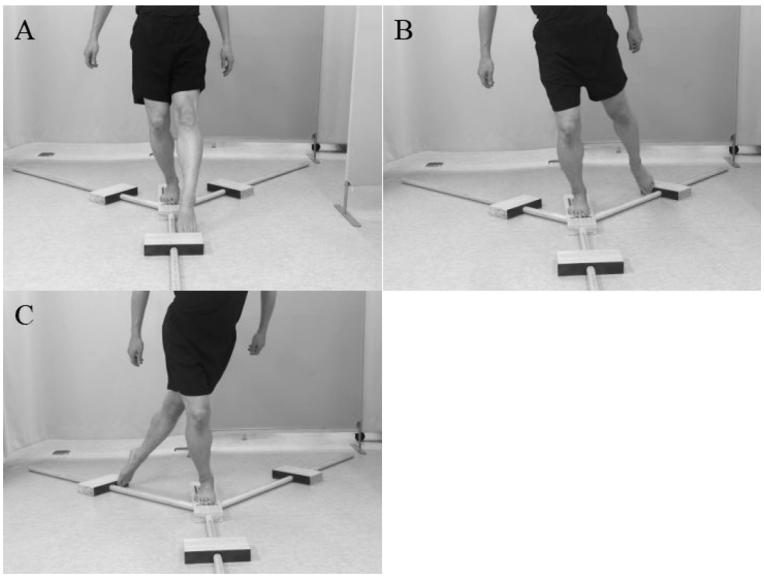

Fig. 2. Y-Balance Test. A. Anterior, B. Posteromedial, C. Posterolateral.
The participant stands on a central plate while maintaining a single-leg stance and is instructed to slide the opposite leg in three directions to reach as far as possible on each of the three plates.

The AKA-Hakata method induced the accessory movements of sliding and separation of the sacroiliac joint according to its manual technique. For the upward slide, the therapist placed the index finger of their cephalad hand on the first sacral segment and the thumb of their caudal hand on the iliac crest, while placing the ring finger on the posterior superior iliac spine. The therapist slid the ilium from the caudal side to the cephalad side with the caudal hand's ring finger and pushed the first sacral segment cephalad and ventrally with the cephalad hand's index finger to match the movement of the sacroiliac joint. For the superior separation, the therapist placed the thumb of their cephalad hand on the first sacral segment and the thumb of their caudal hand on the iliac crest, while placing the ring finger on the posterior superior iliac spine. The therapist operated the ilium from the cephalad to the caudal side, then separated it while keeping the caudal hand's thumb and ring finger attached to the iliac crest and posterior superior iliac spine, respectively. For the inferior separation, the therapist placed the thumb of their caudal hand on the third sacral segment, the thumb of their cephalad hand on the anterior superior iliac spine, and the ring finger on the posterior superior iliac spine. The therapist operated the ilium from the caudal to the cephalad side, then separated it while keeping the cephalad hand's thumb and ring finger attached to the anterior and posterior superior iliac spines, respectively. The downward slide was performed similarly to the upward slide, except that the therapist placed their index finger on the third sacral segment and pushed it caudally (Fig. 3). The intervention was performed a total of 5 times with a treatment interval of at least 2 weeks. The intervention was conducted by certified physical and occupational therapists designated by the Japan AKA Medical Society and Physical and Occupational Therapy Association.

Statistical analysis was conducted using IBM SPSS Statistics for Mac, Version 28.0 (Armonk, NY, USA: IBM Corp. Released 2020), with a significance level set at 5%. Basic information was checked for normality using the Shapiro–Wilk test, and then unpaired t-tests or Mann–Whitney U tests and χ^2 tests were performed accordingly. To compare the two groups over time using the SBST, the Shapiro–Wilk test was conducted to check for normality, and then a repeated measures ANOVA and post-hoc tests were conducted.

RESULTS

The completion rate of the study was 46%. According to the group assignment, there were 9 participants in the Low risk group, 7 in the Medium risk group, and 2 in the High risk group. As there were only 2 participants in the High risk group, the Medium + High risk group was combined, resulting in a total of 9 participants. Finally, 18 participants were included in the statistical analysis as they were eligible. There were no significant differences in the basic information between the groups (Table 1).

Regarding the results of the two-way repeated measures ANOVA, significant main effects were found in all evaluation items, including RDQ ($p<0.01$), VAS ($p<0.01$), FABQ ($p<0.01$), PSEQ ($p=0.01$), FRSTST ($p<0.01$), YBT anterior reach ($p=0.01$), YBT posteromedial reach ($p<0.01$), and YBT posterolateral reach ($p<0.01$), indicating improvement in all items from the first to the sixth measurement. However, there were no significant main effects in the comparison among the groups for all evaluation items. An interaction was found in RDQ ($p=0.04$), but not in other evaluation items (Table 2).

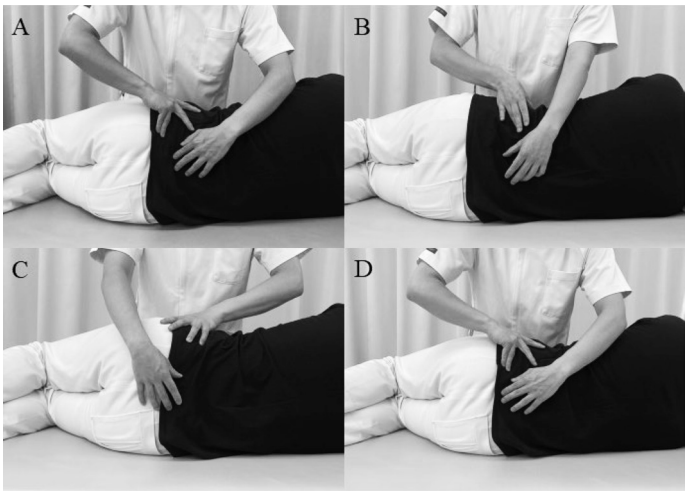

Fig. 3. AKA-Hakata Method.
A, upward gliding B, superior distraction C, inferior distraction D, downward gliding. The arrows in the figure indicate the direction of the manipulation of the ilium.

Table 1. Basic information for the Low risk group and the Medium + High risk group

Variable	Low (n=9)	Medium + High (n=9)
Sex, n; male/female	4/5	2/7
Age (years)	59.9 ± 18.6	51.8 ± 14.7
Height (cm)	160.5 ± 7.5	157.4 ± 8.9
Weight (kg)	52.4 ± 7.8	54.5 ± 9.6
BMI (kg/m^2)	20.3 ± 1.8	21.8 ± 2.4
Duration of low back pain (months)	58.5 ± 112.9	31.7 ± 74.0

BMI: body mass index.

Table 2. Comparison over time of two groups classified by subgrouping for targeted treatment (STarT) back screening tool (SBST)

		Base Line	1st (0week)	2nd (2week)	3rd (4week)	4th (6week)	5th (8week)	
RDQ (points)	Low	5.9 ± 3.3	4.7 ± 3.2	4.2 ± 2.6	3.4 ± 3.1	3.0 ± 2.7	2.4 ± 2.5	*†
	Medium+High	10.9 ± 5.0	9.1 ± 5.2	7.2 ± 3.4	5.2 ± 3.9	3.4 ± 2.9	2.4 ± 2.5	
VAS (mm)	Low	46.1 ± 27.6	19.6 ± 14.8	34.4 ± 23.7	19.7 ± 19.9	14.6 ± 11.2	14.6 ± 12.7	*
	Medium+High	51.4 ± 19.3	42.9 ± 26.6	36.8 ± 25.5	33.1 ± 21.4	20.0 ± 15.4	10.3 ± 8.1	
FABQ (points)	Low	36.7 ± 8.4	32.0 ± 12.7	34.0 ± 11.0	31.3 ± 12.0	29.4 ± 16.0	27.7 ± 16.4	*
	Medium+High	43.9 ± 16.7	41.1 ± 19.2	42.9 ± 11.7	40.9 ± 16.7	38.1 ± 17.0	33.2 ± 15.3	
PSEQ (points)	Low	40.7 ± 10.7	39.9 ± 11.9	43.2 ± 10.6	42.8 ± 10.1	40.9 ± 12.2	42.7 ± 11.6	*
	Medium+High	34.7 ± 12.3	34.0 ± 12.8	41.7 ± 9.3	45.1 ± 7.4	46.9 ± 6.5	46.6 ± 7.7	
FRSTST (s)	Low	9.5 ± 2.5	10.2 ± 2.8	9.5 ± 3.1	8.7 ± 3.0	8.3 ± 2.6	8.0 ± 2.2	*
	Medium+High	10.2 ± 1.8	9.7 ± 1.7	9.2 ± 1.8	8.5 ± 1.3	7.9 ± 0.7	7.5 ± 0.9	
YBT Anterior	Low	60.6 ± 6.0	62.9 ± 5.2	60.1 ± 8.1	63.1 ± 5.8	64.4 ± 6.5	64.8 ± 7.8	*
(cm)	Medium+High	59.1 ± 8.2	62.4 ± 8.4	63.0 ± 6.4	62.3 ± 6.1	62.7 ± 8.0	64.4 ± 5.9	
YBT posteromedial	Low	90.1 ± 15.1	92.1 ± 14.9	93.4 ± 15.2	99.0 ± 14.7	101.5 ± 14.6	104.4 ± 17.2	*
(cm)	Medium+High	93.0 ± 16.0	96.6 ± 17.8	100.4 ± 17.9	98.3 ± 16.5	100.0 ± 17.2	101.7 ± 16.8	
YBT posterolateral	Low	81.2 ± 14.9	86.0 ± 14.8	85.7 ± 14.0	92.5 ± 13.8	93.6 ± 15.4	95.8 ± 15.4	*
(cm)	Medium+High	90.0 ± 14.1	93.3 ± 16.8	99.2 ± 18.2	96.1 ± 13.7	98.7 ± 17.0	98.0 ± 18.3	

*ANOVA $p<0.05$, †Group effect $p<0.05$. RDQ: Roland-Morris disability questionnaire; VAS: visual analogue scale; FABQ: fear-avoidance beliefs questionnaire; FRSTST: five-repetition sit-to-stand test; YBT: Y-balance test; Low: low risk group; Medium + High: Medium + high risk group.

Post-hoc analysis for RDQ revealed significant differences in Low risk group be-tween the 1st measurement and the 5th ($p=0.02$) and 6th ($p<0.01$) measurements, and in Medium + High risk group between the 1st measurement and the 4th ($p<0.01$), 5th ($p<0.01$), and 6th ($p<0.01$) measurements. In the comparison among the groups, a significant difference was found between Low risk group and Medium + High risk group in the 1st measurement ($p=0.03$).

DISCUSSION

The aim of this study was to investigate the therapeutic effects of AKA-Hakata method intervention, which was performed five times, on patients complaining of lower back pain by comparing pre- and post-intervention results. The study also aimed to examine the effects of the AKA-Hakata method on each group classified by the SBST and to clarify the therapeutic effects from physical and psychosocial factors.

In the overall comparison of the participants, intervention effects were observed for all evaluation items. Kogure et al.[12] reported improvements in pain intensity and quality of life (QOL) in patients with chronic nonspecific low back pain who received intervention with AKA-Hakata method, and this study supported their findings. One reason for this could be that the cause of low back pain is considered to be the sacroiliac joint, and inducing its movement resulted in symptom improvement. Additionally, in a comprehensive review of sacroiliac joint pain by Cohen et al.[22] the sacroiliac joint was reported as one of the most common causes of chronic low back pain. The fact that the duration of low back pain in the participants of this study was 45.1 ± 96.4 suggests that many of them had chronic low back pain, which further supports the findings of previous studies. Therefore, it can be inferred that the improvement of sacroiliac joint movement through AKA-Hakata method intervention led to the improvement of low back pain symptoms.

Next, in the longitudinal comparison of the two groups by SBST, an interaction was observed only in RDQ between the Low risk group and the Medium + High risk group. Post hoc tests showed that in the Low risk group, improvement was observed from the 5th intervention compared to the 1st, and in the Medium + High risk group, improvement was observed from the 4th intervention compared to the 1st. In a study by Medeiros et al.[23] that stratified chronic low back pain patients by SBST and implemented exercise and manual therapy as physical therapy, patients in the High risk group showed significant improvement in RDQ compared to those in the Medium risk and Low risk groups when receiving the same treatment. In this study, there were only two participants in the High risk group who completed the final evaluation, and there were not enough samples for comparison with previous studies, which may have resulted in the lack of similar results as previous studies when analyzed together with the Medium risk group. Further re-search is needed to clarify this issue.

In terms of inter-group comparison, a significant difference was observed between the Low risk group and the Medium + High risk group at the first intervention. From this, it was suggested that the presence or absence of physical and psychosocial factors may have an impact on daily life disability even before the intervention.

The paragraph discusses the comparison of physical function between the low-risk group and the medium/high-risk group and how it did not show a significant difference. The authors were unable to find any studies that examined the relationship between SBST classification and physical function. The SBST classification system categorizes patients based on their physical and psychosocial factors, with the high-risk group being those with strong psychosocial factors and the low-risk group being those with fewer physical and psychosocial factors[24]. As such, the authors suggest that the lack of significant differences between the groups in this study indicates that physical factors may not play a significant role in SBST classification. Additionally, since the study was conducted in an outpatient clinic, it is possible that all patients recruited for the study had similar physical function levels, leading to the lack of differences between groups.

To the best of the knowledge of the present authors, there are no studies investigating the effects of the AKA-Hakata method on physical and psychosocial factors in patients with low back pain in Japan or other countries. Therefore, it was necessary to examine the status of the intervention effect of the AKA-Hakata method. In this study, the AKA-Hakata method was suggested to be effective in the treatment of low back pain patients, and there is a possibility that the treatment effect may be observed earlier in patients with physical and psychosocial factors.

In this study, patients who complained of low back pain were included without consideration of the specific cause of their pain, such as discogenic, facet joint, myofascial, sacroiliac joint, or stenosis related. Therefore, while the AKA-Hakata method showed therapeutic efficacy for low back pain in a broad sense, it will be necessary to investigate the therapeutic efficacy of this method for each specific cause in the future. This study only compared the intervention group over time without a control group, so the observed improvements might be attributed to natural recovery. In addition, since medication was pre-scribed by the physician's judgment, improvement due to medication should also be considered. Based on these factors, it is necessary to classify the intervention and control groups and conduct an RCT in the future. This study was conducted at an outpatient clinic, and the number of participants who completed the study was low, with a completion rate of 46%. Therefore, measures such as announcing the measurement date by email the day before to improve the completion rate were necessary.

This study examined the therapeutic effects of AKA-Hakata method on patients with low back pain, as well as the effects of the therapy on different risk groups as classified by the SBST. The results suggested that AKA-Hakata method may be effective in treating low back pain in the overall population. Additionally, the comparison of the two risk groups in the SBST indicated that the therapy may have a quicker effect on reducing disability in daily activities in patients with both physical and psychosocial risks. Importantly, this study also highlights the potential psychosocial benefits of AKA-Hakata therapy,

including reduced anxiety and depression symptoms among participants, which align with the improvements in physical symptoms. However, due to the small sample size in this study, further research with a larger sample size is necessary to confirm these findings.

Preprint publication

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Conflict of interest

None.

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