ORIGINAL PAPER
ORYGINALNY ARTYKUŁ NAUKOWY

Health Prob Civil. 2023, Volume 17, Issue 4
ISSN 2353-6942

THE EFFECT OF "BACK SCHOOL" INTERVENTION ON CHINESE PATIENTS WITH CHRONIC LOW BACK PAIN

WPŁYW DZIAŁANIA PROGRAMU „BACK SCHOOL" NA CHIŃSKICH PACJENTÓW Z PRZEWLEKŁYM BÓLEM DOLNEGO ODCINKA KRĘGOSŁUPA

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D. Data interpretation
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zebranie funduszy

Summary

Background. The Back School program has been recommended in many countries around the world for patients with low back pain (LBP) to help improve self-efficacy to enhance their prognosis. However, few studies have reported on the application of the Back School in East Asia, including China. This study aimed to explore the Back School's effect on Chinese adults with chronic LBP based on four areas: posture, knowledge of LBP, physical activity and body performance.
Material and methods. There were 10 participants in the intervention group and 11 in the control group. Baseline data was collected prior to the intervention, including upper body physical examination, core and lower limb muscle examination, Roland-Morris Disability Questionnaire, LBP Knowledge Questionnaire and Global Physical Activity Questionnaire. Physical indicators and questionnaires were retaken after the 8-week Back School intervention. The differences between the two groups were compared before and after the intervention.
Results. There was a statistically significant increase in McGill trunk flexion test results and knowledge of LBP (especially basic knowledge and treatment sections) in the intervention group.
Conclusions. The Back School-based intervention model has a positive impact on muscle performance in the core area and knowledge acquisition of LBP in Chinese patients with chronic LBP.

Keywords: Back School, low back pain, chronic pain, China, knowledge

Streszczenie

Wprowadzenie. Program „Back School" jest zalecany w wielu krajach na całym świecie w przypadku pacjentów z bólem dolnego odcinka kręgosłupa (LBP) w celu poprawy skuteczności i polepszenia rokowań. Jednak niewiele badań dotyczyło zastosowania programu „Back School" w Azji Wschodniej, w tym w Chinach. Niniejsze badanie miało na celu określenie wpływu działania programu „Back School" na dorosłych Chińczyków z przewlekłym LBP w oparciu o cztery obszary: postawę, wiedzę na temat LBP, aktywność fizyczną i wydolność organizmu.
Materiał i metody. W grupie interwencyjnej było 10 uczestników, a w grupie kontrolnej 11. Przed rozpoczęciem interwencji zebrano dane wyjściowe, w tym badanie fizykalne górnej części ciała, badanie mięśni tułowia i kończyn dolnych, kwestionariusz niepełnosprawności Rolanda-Morrisa, kwestionariusz wiedzy na temat LBP i globalny kwestionariusz aktywności fizycznej. Wskaźniki fizyczne i kwestionariusze zostały wypełnione ponownie po trwającym 8-tygodni programie „Back School". Różnice między obiema grupami porównano przed i po interwencji.
Wyniki. W grupie interwencyjnej odnotowano istotny statystycznie wzrost wyników testu zgięcia tułowia McGilla i wiedzy na temat LBP (zwłaszcza w części wiedzy podstawowej i dotyczącej leczenia).
Wnioski. Model interwencji oparty na programie „Back School" ma pozytywny wpływ na wydajność mięśni w obszarze rdzenia i zdobywanie wiedzy na temat LBP u chińskich pacjentów z przewlekłym LBP.

Słowa kluczowe: Back School, ból dolnego odcinka kręgosłupa, przewlekły ból, Chiny, wiedza

Tables: 4
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Submitted: 2023 Jul 17
Accepted: 2023 Oct 4

Wang Z, Makai A, Czakó DE, Tumpek NI, Bogdán K, Járomi M. The effect of "Back School" intervention on Chinese patients with chronic low back pain. Health Prob Civil. 2023; 17(4): 368-387. https://doi.org/10.5114/hpc.2023.131868

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Introduction

Low back pain (LBP) is a condition that affects all age groups [1]. It has been one of the main factors impacting the years lived with disability throughout the world for the past three decades, and it has a significant negative impact on public health [2-4]. Meanwhile, LBP was recognized as the top disease causing a loss of life years due to disability from 2005 to 2016 in the Disease Burden Report of China and Provincial Administrative Regions from 1990 to 2016 [5]. The long duration and lower level of pain associated with chronic LBP make it less noticeable but can affect the quality of daily life. Physical activity is defined as any bodily movement produced by skeletal muscles that requires energy expenditure [6]. It is one of the factors that influence the incidence of LBP [7]. The massive worldwide epidemic of COVID-19 over the past three years has added social isolation in life [8]. Lifestyle changes have reduced physical activity and increased sedentary behavior, which affects the incidence of LBP [9].

The Back School program is a concept that originated in Sweden in the 1960s [10]. It was later refined by rehabilitation practitioners and medical teams to provide education and rehabilitation services for people with LBP in order to improve their function and reduce the risk of future attacks [11]. This idea is consistent with European clinical guidelines that emphasize the prevention and treatment of LBP by means of exercise and education [12]. It has been more than half a century since the Back School was proposed, but studies in different countries and populations continue to proliferate [13-15]. However, there are no studies related to the Chinese Back School.

The purpose of this study was to evaluate the overall situation of Chinese students before and after participating in Back School intervention in the post-COVID-19 era, with four dimensions: physical activity, knowledge of LBP, body performance and LBP disability. It was hypothesized that after the 8-week Chinese Back School intervention, participants' performance on all four of these dimensions would be improved and enhanced.

Material and methods

Study design and participants

This interventional controlled study was conducted at the Faculty of Health Sciences at the University of Pécs in Hungary between July 11, 2022, and November 25, 2022. It was approved by the Institutional Review Board of the Regional Research Committee of the Clinical Center in Pécs (No. 8342-PTE 2020).

Participants were recruited through the WeChat social platform through online files. The whole process of sample selection can be found in Figure 1. The following inclusion criteria were applied for the participants: (1) reported chronic LBP within the past three months; (2) Chinese living in Pécs and older than 18 years of age; (3) not taking medication or presenting any other musculoskeletal, rheumatic, metabolic, cardiological or neurological disorders; (4) voluntary participation in this study and signing the informed consent. The following exclusion criteria were applied: (1) missing more than two Back School sessions; (2) missing the measurement sessions; (3) taking medication or showing any other musculoskeletal, rheumatic, metabolic, cardiological or neurological disorder during the study. Participants chose to join the intervention or control group according to their schedules. There were 25 volunteers at the beginning, 4 of which dropped out. The final number of participants was 21: 11 in the Intervention Group (IG) and 10 in the Control Group (CG). All the participants signed informed consent before the start of the study and were aware of all the possible risks of the study.

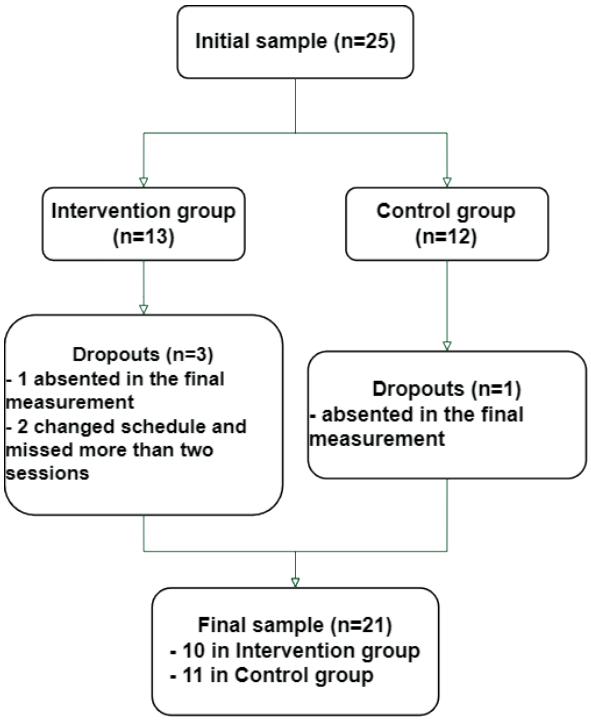

Figure 1. Flowchart of sample selection

Intervention

The study consisted of an intervention based on the Back School program, which lasted 8 weeks, with one session per week lasting 90 minutes. The physiotherapists reminded the participants to perform the exercises at home on their own 2 times a week. The Back School program contains both education and exercise. Additionally, assessments of the variables were made during the original meeting and the final event of the intervention. Table 1 provides an overview of the Back School program used in this research, and the specific movements can be found in the Appendix.

Table 1. Summary of Back School intervention

No.	Theory	Practice
1.	Informed consent and anatomy of the spine	Initial measurements
2.	Spine biomechanics, musculoskeletal system, muscle balance, spinal protection	Correct standing position, correct sitting position, feeling the body position
3.	Causes of spinal disease, pathomechanism	Flexibility training, muscle strengthening exercises in the correct posture; isometric, isotonic concentric exercise learning
4.	Prevention of spine diseases (within physiotherapy, emphasize active, passive, alternative forms of movement); application of Back School: child, adults	Correct sitting position posture training; muscle strengthening exercises in the correct posture and stretching
5.	Therapeutic options and their short/long-term effectiveness	Correct four-legged position, posture, training; muscle strengthening exercises in the correct posture and stretching
6.	Spine-friendly lifestyle, ergonomics	Resistance training of trunk muscles and stretching exercises
7.	Spine protection in daily life; spine protection rules; spine-friendly lifestyle	Resistance training – trunk muscles; stretching exercises
8.	Spine protection in the workplace, rules of spine protection, ergonomics, spine-friendly workplace, spine-friendly workstation, and spine-friendly sports leisure activities	Obtain participants' measurements at the end of the intervention

For the CG, all participants were given a knowledge booklet and exercise advice, which contained the same contents as the IG after the first measurement. Their second measurements were also taken in the 8th week.

Instruments

Two LBP-specific questionnaires, one demographic questionnaire and a physical activity questionnaire were used in this study.

Low Back Pain Knowledge Questionnaire (LKQ)

The Low Back Pain Knowledge Questionnaire (LKQ) is a standardized assessment tool that consists of 16 questions. It is designed to evaluate knowledge pertaining to three key dimensions of LBP, which are general knowledge, concepts and treatment [16]. The questionnaire has a total score of 24 points. The 16 questions are a combination of 8 single-choice and 8 double-choice questions, each with 5 options. Correct responses are scored 1 point, and a higher overall score on the LKQ is indicative of a greater knowledge regarding LBP.

Roland-Morris Disability Questionnaire (RMDQ)

The Roland-Morris Disability Questionnaire (RMDQ) was first created in 1983 by Roland and Morris as a self-administered questionnaire for back pain assessment. It was developed from the Sickness Impact Profile and contains 24 items to evaluate the impact of pain on daily life [17]. The scoring system ranges from 0, indicating no disability, to 24, indicating maximum disability.

Global Physical Activity Questionnaire (GPAQ)

The Global Physical Activity Questionnaire (GPAQ) is a standardized survey developed by the World Health Organization (WHO) to assess physical activity levels across different populations and countries [18]. The

GPAQ has been widely used in research and public health initiatives to estimate physical activity levels and to identify patterns of physical activity within populations. The questionnaire assesses physical activity across three domains: work-related, transportation-related and leisure-time physical activity.

Measurements

All subjects underwent posture measurements on a voluntary basis and with privacy protection, including the line of gravity, a sideline of gravity, stature triangle, shoulder symmetry and hip symmetry, before the intervention. There were five manual physical examinations used to test the physical fitness of all participants before and after the study, including the McGill trunk flexor test, the Biering-Sorensen test, the Pectoralis flexibility test, the Thomas test and the Straight Leg Raise test.

The participants' core endurance was evaluated using the McGill trunk flexor test and Biering-Sorensen test. These two tests assessed the muscular endurance of the deep flexor and extensor in the core muscles, respectively [19-20]. The Pectoralis flexibility test aimed to measure the balance of the upper back, which affected the position sometimes [21], with the Thomas test to determine whether hip joint or knee joint muscles were tighter by measuring the length of hip flexors. Other disorders involving psoas syndrome, patellofemoral pain syndrome, LBP, osteoarthritis and rheumatoid arthritis may have a hip condition that limits the range of motion [22]. The Straight Leg Raise test was used to detect the flexibility of hamstrings [23].

Statistic analysis

Statistical analysis was performed using SPSS 25.0 software. The Shapiro-Wilk test was used to verify the normal distribution of the data. Independent samples t-tests were used for between-group comparisons, and paired samples t-tests were used for within-group comparisons. Mann-Whitney U tests were used to assess the results of the intervention and control groups. The relationship between all the variables among two quantitative physical examinations scores of three questionnaires were assessed by Spearman correlation analysis. The results were considered significant at a $p<0.05$ level.

Results

Baseline data

Demographic

Out of the 25 participants included in the study, 2 were excluded for having missed more than 2 sessions of Back School in IG. Another 2 participants were absent from the final measurement session due to personal reasons (1 in IG, 1 in CG). Finally, 21 participants in total were recruited for the study. All participants were in tertiary education (undergraduate and above). The demographic data is shown in Table 2. There were no significant differences between the IG and CG.

Table 2. Demographic data of participants

Variable	All (n=21)		IG (n=10)		CG (n=11)		*p*-value
	$\bar{x}\pm SD$	Median	$\bar{x}\pm SD$	Median	$\bar{x}\pm SD$	Median	
Age (years)	24.43±2.181	24.00	25.20±2.098	25.00	23.73±	24.00	0.125
Height (cm)	171.10±8.871	172.00	168.80±8.470	170.00	173.18±9.097	172.00	0.269
Body weight (kg)	66.95±13.151	68.00	61.50±12.394	60.00	71.91±12.284	74.00	0.069
BMI (kg/m^2)	22.742±3.409	22.833	21.445±3.112	20.963	23.922±3.363	22.840	0.097

Posture examination

In the basic body measurements, all participants confirmed physiologically normal performance in the line of gravity. In the other four morphometry measures, imbalance and asymmetry were observed in both the intervention and control groups. Figure 2 shows the number of participants in the two groups with unbalanced and asymmetrical body morphometry as a percentage of the total number of participants in the group individually. Shoulder asymmetry was the most frequently seen abnormal body posture (IG: 40.0%, CG: 63.6%), followed by stature triangle and hip asymmetry, respectively (stature triangle: IG: 30.0%, CG: 27.3%; hip: IG: 10.0%, CG:27.3%). Only 10.0% in the IG and 18.2% in the CG showed impaired position in the sideline of gravity. The results of the Mann-Whitney U test showed no statistical difference in the distribution of their postural morphology levels between the two groups of subjects (Z=-1.102, p=0.270).

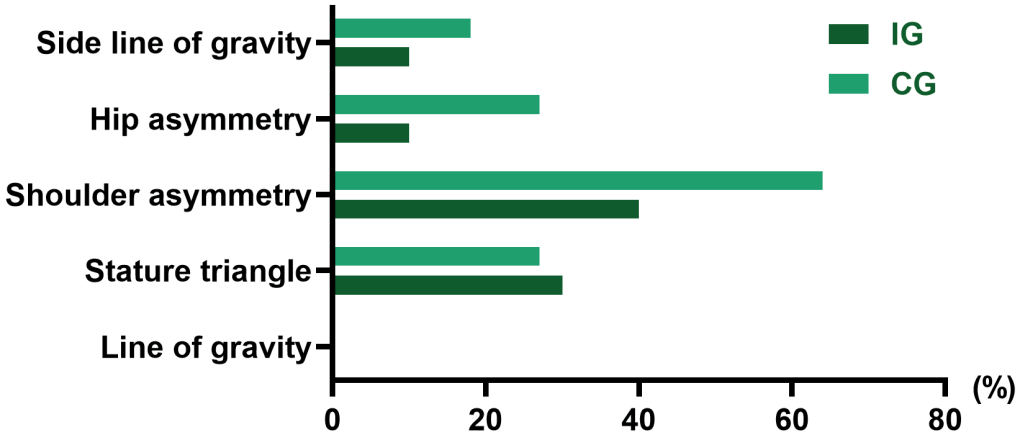

Figure 2. Percentage of participants with impaired posture

Physical examinations

According to the baseline assessment, all the participants in the CG were evaluated as positive for the Pectoralis flexibility test, while none of the patients in the IG were positive. The frequency of positive evaluation for the Thomas test was 81.8% for the CG and 40.0% for the IG. In the Straight Leg Raise test, all the participants in the CG and half in the IG were observed to have a positive performance. After the intervention, 90.9% of participants in the CG and 30.0% in the IG reported positive results in the Pectoralis flexibility test. As for the Thomas test, 81.8% of the participants in the CG and 10.0% from the IG showed positive signs. All the participants in the CG showed positive signs in the Straight Leg Raise test, but only 20.0% in the IG obtained positive results. The results of the physical examination are shown in Table 3. Statistical differences in pre- and post-intervention outcomes were found in the IG for the McGill trunk flexor test (p=0.034).

Table 3. Results of physical examination and questionnaires before and after the intervention

Variable	Group	Pre-test		Post-test		*p*-value	95% CI
		Mean	SD	Mean	SD		
MTFT	IG	168.50	74.848	224.70	30.383	0.034 *	[-107.062, -5.338]
	CG	160.82	89.149	158.55	99.333	0.753	[-13.405, 17.951]
BST	IG	86.40	50.136	102.20	48.074	0.054	[-31.954, 0.354]
	CG	64.09	20.671	71.45	23.062	0.232	[-20.270, 5.542]
RMDQ	IG	4.40	4.061	2.80	4.392	0.104	[-0.401, 3.601]
	CG	4.36	3.802	5.91	7.981	0.521	[-6.718, 3.627]
LKQ	IG	15.90	3.604	19.30	1.703	0.001 *	[-5.024, -1.776]
	CG	15.91	4.826	16.00	2.449	0.961	[-4.104, 3.923]
LKQ-GK	IG	6.10	1.912	7.50	1.179	0.007 *	[-2.305, -0.495]
	CG	5.82	1.401	5.82	1.250	1.000	[-1.502, 1.502]
LKQ-C	IG	2.30	1.059	2.60	0.843	0.279	[-0.889, 0.289]
	CG	2.18	1.328	2.27	0.647	0.846	[-1.108, 0.926]
LKQ-T	IG	7.50	1.780	9.20	1.135	0.003 *	[-2.657, -0.743]
	CG	7.91	2.737	7.91	1.300	1.000	[-2.124, 2.124]
GPAQ	IG	2764.00	2375.463	2900.00	2916.253	0.905	[-2642.956, 2370.956]
	CG	2695.27	3977.234	2646.18	5218.317	0.918	[-985.026, 1083.208]

Notes: IG – intervention group; CG – control group; CI – confidence interval; SD – standard deviation; MTFT – McGill trunk flexor test; BST – Biering-Sorensen test; RMDQ – Roland-Morris Disability Questionnaire; LKQ – Low Back Pain Knowledge Questionnaire; LKQ-GK – general knowledge part in LKQ; LKQ-C – concept part in LKQ; LKQ-T– treatment part in LKQ; GPAQ – Global Physical Activity Questionnaire.

Questionnaires

In RMDQ, the mean score of the IG was 4.40±4.061 and 4.36±3.802 in the CG. Repeated measurements showed that the IG decreased to 2.80±4.392, and the CG increased to 5.91±7.981.

All the subjects obtained around 15.9 points (IG: 15.90±3.064, CG: 15.91±4.826) before the Back School intervention in LKQ. After the intervention, there were significant differences between the two groups in the LKQ sum score (p=0.001) and two subcomponents: basic knowledge (p=0.007) and treatment (p=0.003). The IG obtained higher scores than the CG. As can be seen from Figure 3(d), the differences were shown between the IG and the CG reported in LKQ score (p=0.002), subparts of LKQ about general knowledge (p=0.005) and treatment (p=0.026) after the intervention.

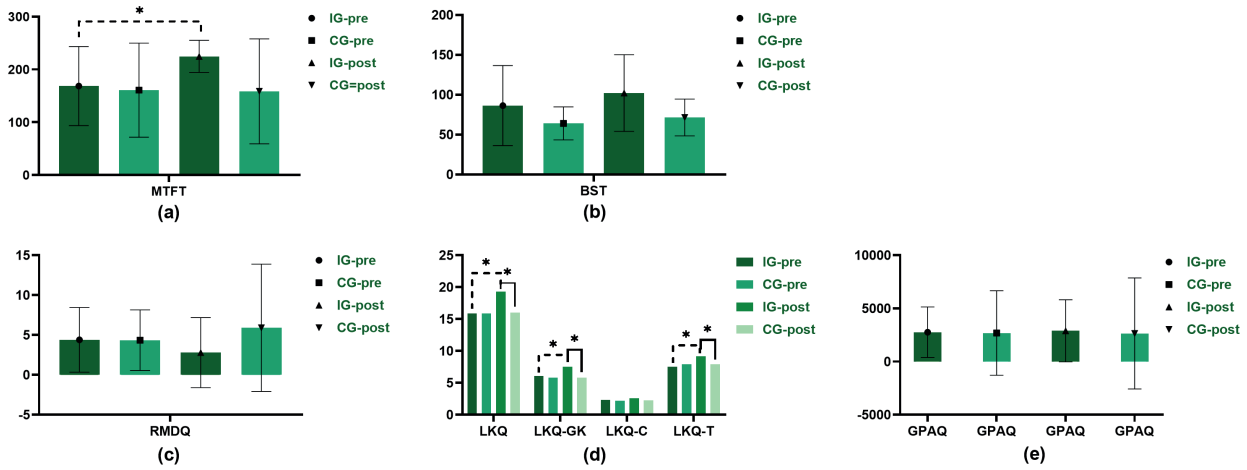

Figure 3. Results and changes within and between groups in different examinations

In the physical activity component from GPAQ, all subjects showed no statistically significant differences in physical activity intensity after the Mann-Whitney U test results (p>0.05), including before and after the intervention (Table 4).

Table 4. Physical activity patterns of participants in different groups

Variable		IG (n=10)		CG (n=11)		Z value	*p*-value
		Mean	SD	Mean	SD		
VW (min/week)	Pre	21.00	49.092	0.00	0.00	-1.520	0.129
	Post	18.00	56.921	65.45	217.088	0.000	1.000
MW (min/week)	Pre	43.00	92.141	76.36	216.484	-0.103	0.918
	Post	58.00	122.366	65.45	217.088	-0.578	0.563
Transportation (min/week)	Pre	124.00	96.056	155.64	189.342	-0.284	0.776
	Post	104.00	80.132	152.27	107.107	-1.136	0.256
VR (min/week)	Pre	154.00	217.010	152.73	227.072	-0.152	0.879
	Post	178.00	200.100	94.00	226.124	-1.179	0.238
MR (min/week)	Pre	174.00	209.083	136.36	234.063	-0.761	0.447
	Post	171.00	179.471	124.91	222.641	-0.624	0.533
Sitting (min/day)	Pre	247.00	154.995	372.73	210.385	-1.421	0.155
	Post	234.00	163.041	410.00	283.796	-1.418	0.156

Notes: IG – intervention group; CG – control group; VW – vigorous intensity work; MW – moderate intensity work; VR – vigorous intensity recreation; MR – moderate intensity recreation.

Correlations

In the results of the Spearman correlation analysis, the Biering-Sorensen test was found to be associated with the McGill trunk flexor test (r=0.710, p<0.001), vigorous-intensity (r=0.480, p=0.028) and moderate-intensity (r=0.484, p=0.026) work hours per week.

Discussion

The purpose of this study was to determine the effects of a Chinese Back School-based intervention on low back function in patients with chronic LBP. The results of this study showed positive effects, including improvements in core muscle strength and flexibility of the hip flexors and hamstrings. Another significant change in the intervention group was reflected in the scores of the LBP knowledge questionnaire, which indicated improvement in participants' understanding of LBP.

In general awareness, patients, clinicians and researchers believe that movement and posture are associated with LBP [24-26]. This is also reflected in our study. All subjects were patients with chronic LBP and showed impaired posture upon examination.

Trunk muscle strength is one of the factors that influence the incidence of LBP [27,28]. Strengthening the muscles in the core area is often part of the effective treatment plan adopted by physiotherapists for patients with LBP in clinical practice. In our study, the increase in trunk flexor strength in the IG demonstrated the effectiveness of the Back School program. This result is consistent with the results of the Back School intervention study published in 2021 by Hernandez-Lucas et al. [29]. Coincidentally, trunk extensor strength was also found to be improved in their study but did not show a statistically significant change in ours, although the overall results of the Biering-Sorensen test in the IG group showed a trend towards enhancement. This phenomenon may be due to the small sample size of our study, and individual differences cannot be avoided, affecting the statistical outcomes. The results remind us that not only the core muscles of the lower back but also the hamstrings are noteworthy for their improvement before and after the Back School intervention. This significant change was also reported by Hernandez-Lucas et al. [29]. It suggests the embodiment of the kinetic chain in bodywork, especially in musculoskeletal problems, requires attention to the potential influence of tissues adjacent to joints [30].

Self-efficacy is a competency that is applicable in many chronic conditions, including LBP [31]. Patients with high self-efficacy performed better in disease prognosis [32]. According to the International Association for the Study of Pain, LBP is an emotional experience that may be impacted by other emotions, such as worry or fear, in addition to being a sensory awareness of physical damage [33]. Thus, it is important to teach patients about the causes and sources of LBP in order to prevent suffering. The results of the LKQ connect and present these two points very well. After a combination of theory and exercise training, the IG showed a significant increase in LBP knowledge. This phenomenon demonstrated that the participants were more knowledgeable about LBP disorders, specifically in terms of basic knowledge and treatment. The lack of significant difference in the concept section may be due to confusion in the common perception of the medical terms.

For patients with acute LBP, avoidance of strenuous exercise is a sensible form of care. However, in patients with chronic LBP, lack of physical activity may have the opposite effect. According to the physical activity guidelines for the Chinese population published in 2022 [34], our subjects met the basic physical activity requirements of 150-300 minutes of moderate intensity physical activity or 75-150 minutes of vigorous intensity physical activity per week for Chinese individuals 18 years of age and older. Interestingly, the physical activity data embodied in the population in our study differed from that of a previous Hungarian study, and they found an increase in physical activity among the people after Back School [13]. A possible explanation for this might be due to differences in lifestyle habits considering the culture and age groups of the participants. Our study did not show significant differences before and after the intervention due to the smaller sample size and shorter duration of the intervention.

The aim of rehabilitation is to reduce symptoms and pain to improve function and quality of life. The Back School, a professional program focusing on self-management skills, exercise and education, has shown promise in a number of previous studies to improve the prognosis of back pain patients in many countries. The results

of this study found an increase in core muscle strength and low back pain knowledge improvement among the Chinese participants. This is the first attempt at a systematic Chinese Back School, and it makes a lot of sense.

This study also has some limitations. The results cannot be generalized because of the small sample size, while further study is needed with a larger sample size. Secondly, the 8-week intervention and weekly frequency of the intervention were not sufficient for participants' persistence in the exercise. A longer intervention period would be more informative for the promotion of the Chinese Back School with chronic LBP. The Self-assessment scale relied on the subject's own report. Bias is difficult to avoid. It would have been more clinically practicable to follow up on this study.

Conclusions

The 8-week Back School intervention was effective in Chinese patients with chronic LBP and facilitated the recovery of low back function. It greatly enhanced the strength and performance of the participants' core muscles, as well as led to increased awareness of the disease-specific aspects of low back knowledge. The Chinese Back School program can be scaled up for use as resources and circumstances permit. Other effects will need to be explored in follow-up studies with large samples.

Disclosures and acknowledgments

The authors would like to thank all the participants in this research. The authors declare no conflicts of interest with respect to the research, authorship, and/or publication of this article. The research was funded by the authors.

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Appendix

Back School movement training diagram

Phase 1

Movements	Notes
	**Sitting position** Keep your eyes flat in front of you and control your neck not to go too far forward or backward. Keep your shoulders naturally down and place your hands on your thighs. Spread your legs about a thigh's width apart. The torso is naturally at a 90° angle to the thighs, and the thighs are at a 90° angle to the calves.
	**Standing position** Stand upright, eyes flat in front of you, and control your neck so that it is not excessively tilted forward and retracted. Try to keep your earlobes in the same plane as your shoulder blades. Open your shoulders and lower your arms, palms inward. Spread your legs naturally and visualize a line above your head, lifting your torso vertically upwards. Practice the movement: In place before and after the center of gravity: standing position, feet do not tiptoe or tiptoe, to complete the center of gravity from the forefoot slowly moving to the heel and then to the forefoot of the process, the torso can be changed with the center of gravity slightly before and after the backward movement, to maintain the front and back side of the abdominal muscles (core area) tightened.
	**Supine core isometric contraction training (1)** Lie on your back, bend the hip and knee of one side of the lower limb, and place your arms naturally on both sides of your body, palms up. Exercise to keep the lower lumbar (core area) muscles toward the ground forces so that the core area, shoulders, and the back of the hand are close to the ground. Keep exerting force for 8-10 seconds at a time. Right and left side lower limbs are flexed separately for the exercise.
	**Supine core isometric contraction training (2)** Lie on your back with both lower limbs flexed at the hip and knee, about a hip's width between the feet and knees, arms on both sides of the body, arms, and head in a downward V-shape, palms up. Keep the lower back (core area), shoulders, and back of the hands close to the ground during the exercise, and continue to exert yourself for 8-10 seconds at a time.
	**Supine core isometric contraction training (3)** Lie on your back with both lower limbs flexed at the hips and knees, arms straight, and torso at 90°, palms up. Exercise to keep the lower back (core area), shoulders, and back of the hands close to the ground, with continuous force for 8-10 seconds for once.
	**Supine core isometric contraction training (4)** Lie on your back, bend both lower limbs at the hips and knees, straighten your arms at 90° to your torso, and stand with your palms vertically on the ground (with the side of your little thumbs on the ground). Exercise to keep the lower back (core area), shoulders, and palm side edge close to the ground, with continuous force for 8-10 seconds for once.

Movements	Notes
	**Supine core isometric contraction training (5)** Lie on your back with both lower limbs flexed at the hips and knees, arms straight, and torso at 90°, palms down. Exercise to keep the lower back (core area), shoulders, and palms close to the ground, with continuous force for 8-10 seconds once.
	**Supine core isometric contraction training (6)** Lie on your back, bend your knees at the hip with both lower limbs, arms at 90 ° to the torso and lower arms at 90° to the upper arms (i.e., a W-like movement), palms up. Exercise to keep the lower back (core area), shoulders, and the back of the hands close to the ground, with continuous force for 8-10 seconds for once.
	**Supine core isometric contraction training (7)** Lie on your back with both lower limbs flexed at the hips and knees, arms up in a V-shape, palms up. Keep the lower back (core area), shoulders, and back of the hands close to the ground during the exercise, and continue to exert yourself for 8-10 seconds at a time.
	**Supine core isometric contraction training (8)** Lie on your back with both lower limbs flexed at the hips and knees, arms straight upward as close as possible to both ears, palms up. Exercise to keep the lower back (core area), shoulders, and the back of the hands close to the ground, and continue to exert force for 8-10 seconds once.
	**Supine core isometric contraction training (9)** Lie on your back with both lower limbs flexed at the hips and knees, and place your hands approximately below the back of your head. Keep your lower back (core area), shoulders, and elbows close to the floor during the exercise, and continue to exert yourself for 8-10 seconds at a time.
	**Supine core isometric contraction training (10)** Lie on your back with both lower limbs flexed at the hips and knees and hands placed above the top of the skull. Keep the lower back (core area), shoulders, and elbows close to the ground during the exercise, and continue to exert force for 8-10 seconds once.

Phase 2

Movements	Notes
	**Supine straight leg raise** Lie on your back with your palms facing up on either side of your body and bend one leg at the hip and knee. Slowly lift the other leg straight up to the height of the foot approximately equal to the opposite knee, hold for 3-5 seconds, and then lower. With continued force behind the lower back and shoulders, try to maintain a slightly retracted jaw (double chin) position with the back side of the head on the ground.
	**Supine bent knee leg raise** Lie on your back with your hands up (as shown, call it baby position). Bend one leg at the hip and knee. With the other leg straight, slowly raise the leg and bend the knee to the level of the opposite knee, then straighten the raised leg in the air and slowly lower it.

Movements	Notes
	**Prone leg raise** Lie prone, keeping your forehead on the floor as much as possible, place your hands on either side of your body, and slowly lift each lower leg (e.g., right leg up-down, left leg up-down).
	**Prone alternating limb raises** Lie prone with your arms stretched forward over your head on the floor. Movement one: Raise right hand - Raise left hand - Raise right leg - Raise left leg - Lower right hand - Lower left hand - Lower right leg - Lower left leg Movement two: Raise right hand - Raise left leg - Raise left hand - Raise right leg - Lower right hand - Lower left leg - Lower left hand - Lower right leg
	**Prone baby position lifting** Lie prone with the elbow flexed (baby position). As with the previous set, you can lift the upper limb and then the lower limb, or you can alternate lifting.
	**Lying on your back with your hands on your head and lifting your limbs** Lie prone, hands on the back of the head, elbows on the floor, and as before, lift the unilateral upper limb - contralateral lower limb - contralateral upper limb - ipsilateral lower limb, and then lower them one by one.
	**Back stretching** In a kneeling position, sit on your calves and feet. Gradually lie your torso and upper limbs on the floor, reaching your arms as far forward and as far away as possible, and hold static for 30 seconds.
	**Pectoral stretching** Stand on the side of the door frame/wall. With the upper arm and elbow joint of one hand on the corner side of the plane, take a step forward with the lower leg on the same side of the reaching hand, and with the elbow joint, the corner of the reaching forward, as the fulcrum of the body, slowly rotate the torso to the opposite side and feel the pull on the pectoral muscles on the side of the lifting hand. Change the angle of the arm to the wall (palm up, down), the same action, respectively, pulling the upper and lower bundles of the pectoral muscles.

Phase 3

Movements	Notes
	**Supine straight leg raise** Lie on your back on the floor with your hands naturally down on either side of your body. Bend one leg at the hip and knee, slowly lift the other leg to about 90°, hold for 3-5 seconds, then slowly lower and switch to the other side. Maintain control of the torso during the movement, with continuous force from the core, shoulders, and elbows toward the ground.

Movements	Notes
 	**Lying on your back and pushing your arms against the ground** Lying on your back, bend your hips and knees to raise your arms to the ground (baby position). Keep your upper arms level with your shoulders and tighten your core and the back of your shoulders toward the ground. Slowly push your arms upward until they are fully extended, then slowly return them to the starting position. (Imagine yourself standing in front of a wall and feeling your body pushing as you complete the arms push.)
	**Prone alternating leg raises** Lie down on the ground with your hands on either side of your body. Without moving your thighs, slowly lift your calf on one side, hold for 3-5 seconds, slowly lower, switch to the other side, and continue. Feel the sustained exertion in the core and thigh area.
	**Lie on your back with your feet facing each other in the air** This movement is the starting movement for a series of exercises. Lie on your back with your hands on either side of your body. Raise each leg into the air, keeping the feet opposite each other. During the movement, make sure that your lower back and core are completely on the ground, avoiding the formation of a "bridge" gap in the lower back.
	**Supine raising feet in the air variation 1** Start the movement by lying on your back with your feet facing each other in the air. The upper body is in baby position, feeling the pelvis open, the core hard, the back and shoulder blades hard, and the arms hard.
	**Supine raising feet in the air variation 2** Start the movement with Supine raising feet in the air variation 1. One lower limb stays in the starting position while the other attempts to slowly straighten without touching the floor, retract, and continue on the opposite side.
	**Supine raising feet in the air variation 3** The lower limbs are supine in the air with the feet opposite each other and the arms straightened into the air. Slowly lower one side of the upper limb at the same time, and slowly straighten the opposite side of the lower limb (for example, the right hand slowly lowered to the ground, the left leg at the same time slowly straighten but do not touch the ground), slowly retracted, change the opposite side. During the movement, pay attention to the waist close to the ground force.

Movements	Notes
	**Correct four-point brace** It is called the "four-point brace" because both palms and knees play a key supporting function. The four-point brace is one of the basic movements for maintaining and measuring the balance of the muscles of the core and the muscles on both sides of the body. The movement is shown in the picture. It is important to note that in a correct four-point brace, the calves are at 90° to the thighs, the thighs are at 90° to the torso, and the arms are at 90° to the body. The head and neck should not be hyper-flexed (i.e., don't tilt your head back or raise your head), and try to keep the cervical spine in a straight line with the torso.
	**Primary balance training with four-point support** In a four-point brace, reduce the number of support points by one to a „three-point brace," keeping the rest of the body in the same movement pattern. Starting with a four-point brace, lift one arm and extend it forward so that it is flush with your torso and in the same plane. Hold for about 5 seconds, slowly lower, and switch to the opposite side. Maintain control of the core during the movement.
	**Core area muscle stretching** Lie prone on the ground. Place your hands on either side of your body. Place your hands on your shoulders and brace your torso. Force the entire upper body backward, stacking the head back for progression, and open the shoulders back to feel the pull on the muscles of the lower back and abdomen, the front of the shoulders, and the front side of the neck. The movement can be held for about 20 seconds and repeated several times as needed.
	**Back stretching** In a kneeling position, sit on your calves and feet. Gradually lie your torso and upper limbs on the floor, reaching your arms as far forward and as far away as possible, and hold static for 30 seconds.

Phase 4

Movements	Notes
 	**Kneeling three-point brace** Kneeling four-point support as the starting action, slowly raise one arm, change to three-point support, and hand touches the same side of the shoulder. Touch the shoulder without moving, slowly expand the shoulder joint outward so that the upper arm and the back of the shoulder are at the same height, and touch the shoulder side of the shoulder blade near the muscles to have a sense of tightening, hold, close the arm to the chest, and then back to the kneeling four-point support position.

Movements	Notes
	**Kneeling two-point support workout 1** One hand touching the shoulder, elbow on the chest of the three points of support for the starting movement. Open the shoulder joint so that the upper arm and the back of the shoulder at the same time lift the opposite side of the lower limbs to the same height as the buttocks, hold for 3-5 seconds, and close the arm, hand leg, repeat five times, change the other side.
	**Kneeling two-point support workout 2** With one hand touching the shoulder, the elbow is placed in front of the chest as a three-point support for the starting movement. Slowly open the shoulder joint to the upper arm and the back of the shoulder at the same height, close the shoulder joint, and close the opposite side of the leg, as far as possible, so that the elbow touches the knee (as shown in the picture, the right elbow joint is placed approximately in front of the chest, close the left leg, as far as possible, so that the left knee touches the right elbow), repeated a number of times, and change to the other side.
	**Plank** This movement is a progression of the kneeling four-point brace (bridge brace). The elbows are bent and supported on the ground, the toes are on tiptoe, the lower arms are at approximately 90° to the upper arms, the upper arms are at approximately 90° to the torso, and the body is off the ground. Head, shoulders, back, hips, and legs try to be at the same height, approximately parallel to the ground. Exert pressure on the abdomen and hips, hold the posture, and look at the ground with your eyes.
	**Plank support advanced – three-point support** Use plank support as the starting position. Lift one arm and touch the same shoulder, hold for 3-5 seconds, and switch to the other side. You can also perform a dynamic rhythmic workout, switching arms once per second. Pay attention to the core and glutes during the movement, keeping the rest of the body except the arms balanced.
	**Plank support advanced – two-point support** Use the plank support as the starting position. Try to lift one arm, straighten it forward to the same height as your ear, and while stretching your arm, lift the opposite leg to the same height as your hip (e.g., left hand, right leg), hold for 3-5 seconds, and repeat a few times before switching to the opposite side. You can also alternate the exercise bilaterally.
	**Kneeling four point brace progression – knee lift** Use the bridge kneeling four-point brace as the starting position. Keeping your torso balanced, lift one knee off the ground and lift the other knee. Lower one at a time. Repeat several times. The course of the movement is: kneeling four-point support - lift right knee - lift left knee - lower right knee - lower left knee.
	**Core area muscle stretching** Lie prone on the ground. Place your hands on either side of your body. Place your hands on your shoulders and brace your torso. Force the entire upper body backward, stacking the head back for progression, and open the shoulders back to feel the pull on the muscles of the lower back and abdomen, the front of the shoulders, and the front side of the neck. The movement can be held for about 20 seconds and repeated several times as needed.

Movements	Notes
	**Back stretching** In a kneeling position, sit on your calves and feet. Gradually lie your torso and upper extremities on the floor, reaching your hands as far forward as possible, and hold statically for 30 seconds. Once the front is completed, the hands can gradually move to the left and right to complete the left front and right front (i.e., right side muscles, left side muscles) pulls.
	**Pectoral stretching** Stand on the side of the door frame/wall. With the upper arm and elbow joint of one hand on the corner side of the plane, take a step forward with the lower leg on the same side of the reaching hand, and with the elbow joint, the corner of the reaching forward, as the fulcrum of the body, slowly rotate the torso to the opposite side and feel the pull on the pectoral muscles on the side of the lifting hand. Change the angle of the arm to the wall (palm up, down), the same action, respectively, pulling the upper and lower bundles of the pectoral muscles.

Phase 5

Movements	Notes
	**Lie on your back with your feet facing each other in the air** This movement is the starting movement for a series of exercises. Lie on your back with your hands on either side of your body. Raise each leg into the air, keeping the feet opposite each other. During the movement, make sure that your lower back and core are completely on the ground, avoiding the formation of a "bridge" gap in the lower back.
	**Supine raising feet in the air variation 1** Start the movement by lying on your back with your feet facing each other in the air. Place your hands on either side of your body in a static holding position, with the side of the pinky of your hand standing on the ground. During the movement, tighten the core and gluteal muscles and press the side of the palms toward the ground.
	**Supine raising feet in the air variation 2** Start the movement by lying on your back with your feet facing each other in the air. Place your hands on the side of your ears. Slowly lower the left foot without touching the floor, keeping the knee flexed. At the same time, slowly open your right arm away from your ear to a „plank position" (as shown). Bring the right hand and left leg back to the starting position, switch to the left arm and right leg, and repeat.
 	**Prone knee lift variation** Hold the movement in a prone position with your elbows on the floor and your toes on the ground, with your feet braced on your knees. During the movement, tighten the core and tighten the back (prone four-point brace at this point). Keeping your knees lifted, slowly lift your right arm and extend it until it is at the same height as your ear, gradually flatten your right arm to the side and open it up as shown, then return it to the same height as your ear, return your right arm to the floor for support and switch to the left side. Repeat several times.

Movements	Notes
	**Crouch down and climb** Start the movement in a plank position. Alternate bending the hips and knees on the left and right sides, feeling the thighs close to the abdomen. Activate the dynamic contraction of the abdominal muscles. Exert your hips during the movement to maintain the balance of your torso.
	**Yoga ball assisted balance training 1** Keep the yoga ball on your upper back (shoulder blade area). Brace your feet on the ground and thrust your hips upward as far as you can. Keep the ball stable by controlling it through your core and shoulder, and back strength. Once stabilized, try to step backward with both feet so that the ball moves back and forth regularly over the entire range of your back. During the movement, try to keep your core muscles stable so that the movement is controlled and smooth.
	**Yoga ball assisted balance training 2** Place the ball underneath the front of the calf, or in more advanced positions, underneath the ankle (i.e., to minimize contact between the body and the ball). Keep your body and torso balanced with your elbows on the ground, and use your body's strength to find a "stabilizing point" to keep the ball in control and keep it from moving. After stabilizing, increase the difficulty and try to use your core strength to flex your hips and knees to move the ball forward (i.e., contract your rectus abdominis muscles), then go back to the starting movement and repeat several times. This type of training is dynamic balance training with increased instability and requires more control and strength in the core area.
	**Back stretching** In a kneeling position, sit on your calves and feet. Gradually lie your torso and upper limbs on the ground and reach your hands as far forward as possible, holding static for 30 seconds. Upon completion, crawl and move to the left front and right front with both hands, respectively, holding for about 30 seconds on each side, which can be repeated.
	**Kneeling deltoid stretching** The feet and knees are supported, and the hips sit on the calves. The right deltoid pull is shown. With your right hand straight out in front of you diagonally, place your left hand on the outside of your right forearm and apply a slow, sustained force from your right arm to your left forearm (using the principle of leverage to make the most effective pull with the least amount of force). Hold for 20 seconds and switch to the other side.
	**External abdominal obliques and somatic muscle stretching** The feet and knees are supported, and the buttocks sit on the calves. The arm on the side being pulled is extended above the head. Slowly tilt the torso and feel the pull on the large muscle group on the lower side of the arm on the side of the torso.