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Advances in Exercise Prescription for Overweight and Obese Patients with Chronic Low Back Pain

Yadan Su[1], Bin Zhang[2], Xinzhou Huang[1], Wang Ying[1], Liu Mei[1], Xiaojing Li[1], Yao Wei[1,*]

[1]3201 Hospital, Hanzhong 723000, Shaanxi, China
[2]Ningqiang County Traditional Chinese Medicine Hospital, Hanzhong 724400, Shaanxi, China
**Correspondence Author*

Abstract: ***Chronic low back pain is one of the most common conditions encountered in spine surgery, orthopedics, and rehabilitation medicine. It is also a major contributor to activity limitation, impaired quality of life, and increased healthcare burden in adults. With the increasing prevalence of overweight and obesity, obesity-related low back pain has attracted growing clinical attention. Obesity may contribute to the onset and persistence of chronic low back pain through multiple mechanisms, including increased mechanical loading of the lumbar spine, impaired core muscle function, chronic low-grade inflammation, and accelerated intervertebral disc degeneration. Current clinical guidelines generally recommend exercise therapy, patient education, and non-pharmacological comprehensive management as first-line strategies for chronic low back pain. Meanwhile, exercise prescription is also a fundamental component of obesity management, with beneficial effects on body weight, body fat, cardiopulmonary function, and musculoskeletal performance. However, several challenges remain in clinical practice, including insufficient standardization of exercise prescriptions, limited individualization, poor long-term adherence, and inadequate integration between health management services and spine-specialty care. This review summarizes the current evidence regarding exercise prescription for overweight and obese patients with chronic low back pain from the perspectives of disease burden, the relationship between obesity and low back pain, exercise-based intervention, weight management, exercise adherence, and remote monitoring. Furthermore, this review proposes a feasible model integrating the Health Management Center and the Department of Spine Surgery for individualized exercise prescription, aiming to provide a theoretical basis for clinical intervention and future research on obesity-related chronic low back pain.***

Keywords: Overweight, Obesity, Chronic low back pain, Exercise prescription, Spine surgery, Health management, Remote monitoring, Adherence**.**

1. Disease Burden of Chronic Low Back Pain and Shifts in Management Strategies

Low back pain is one of the most common musculoskeletal symptoms worldwide and may occur across all age groups, including children, adults, and older individuals. Although most patients with acute low back pain experience symptom relief within a short period, a considerable proportion develop recurrent or persistent symptoms, eventually progressing to chronic low back pain. Chronic low back pain can lead to long-term pain, restricted mobility, reduced work capacity, and impaired quality of life [1]. Data from the Global Burden of Disease Study indicate that low back pain affects a large population worldwide, and its burden is expected to continue increasing due to population aging and lifestyle changes [2]. Therefore, chronic low back pain should not be regarded merely as an orthopedic symptom, but rather as a complex health problem with clinical, rehabilitative, and public health significance.

In recent years, the management of chronic low back pain has gradually shifted from a model dominated by imaging diagnosis and analgesic treatment toward a comprehensive approach emphasizing non-pharmacological intervention, functional improvement, and long-term self-management. The Lancet series on low back pain emphasized the need to avoid over-medicalization and highlighted the importance of patient education, exercise therapy, psychosocial assessment, and multidisciplinary management [3]. The clinical practice guideline issued by the American College of Physicians also recommends non-pharmacological treatments, including exercise, rehabilitation training, mindfulness-based approaches, and cognitive behavioral interventions, as preferred options for patients with chronic low back pain [4]. A recent global comparison of clinical practice guidelines further demonstrated that although recommendations vary across countries and regions, most guidelines consistently emphasize maintaining activity, avoiding prolonged bed rest, implementing exercise therapy, and providing patient education [5]. These findings provide an important evidence base for the application of exercise prescription in the management of chronic low back pain.

2. Association Between Obesity and Chronic Low Back Pain

Overweight and obesity are important factors associated with chronic low back pain. A meta-analysis by Shiri et al. showed that both overweight and obesity are associated with an increased risk of low back pain, and this association appears to be more pronounced in individuals with chronic low back pain and those seeking medical care for low back pain [6]. Similarly, a meta-analysis by Zhang et al. reported that overweight and obesity are common risk factors for low back pain in both men and women, suggesting that maintaining a healthy body weight may be an important strategy for the prevention and management of low back pain [7]. Population-based studies have further shown that elevated body mass index is associated with a higher prevalence of chronic low back pain, supporting the use of BMI as a basic indicator for screening the risk of obesity-related low back pain [8]. In a retrospective cohort study of Japanese men, Hashimoto et al. found that body composition indicators, including body fat percentage, were also associated with the risk of low back pain, indicating that body weight alone may not fully reflect the impact of obesity on lumbar spine health [9].

The mechanisms by which obesity contributes to low back pain are complex. First, increased body weight places greater axial load on the lumbar spine, thereby increasing stress on the intervertebral discs, facet joints, and paraspinal muscles. Second, obese individuals often present with abdominal obesity, reduced core muscle strength, impaired pelvic control, and decreased daily physical activity, all of which may compromise lumbar stability. Third, obesity is not only a mechanical loading problem but is also closely associated with chronic low-grade inflammation. da Cruz Fernandes et al. suggested that obesity-related inflammatory mediators may contribute to pain sensitization and the persistence of low back pain, while exercise may exert therapeutic effects by improving the inflammatory profile [10]. In addition, molecular interactions among obesity, inflammation, and intervertebral disc degeneration have been proposed. Ruiz-Fernández et al. suggested that adipokines may serve as a common link among obesity, inflammation, and disc degeneration, indicating that obesity-related low back pain may involve both mechanical and inflammatory-metabolic mechanisms [11].

Therefore, for overweight and obese patients with chronic low back pain, the goals of intervention should not be limited to pain relief. Instead, comprehensive management should simultaneously target body weight control, lumbar function, core stability, body composition, and long-term lifestyle modification.

3. Evidence Supporting Exercise Prescription for Chronic Low Back Pain

Exercise therapy is a core non-pharmacological intervention for chronic low back pain. The Cochrane review by Hayden et al. showed that exercise therapy provides beneficial effects on pain and functional improvement in patients with chronic low back pain compared with no treatment or usual care [12]. A systematic review on structured exercise programs by Verville et al. also suggested that structured exercise interventions may reduce pain and functional limitations in adults with chronic primary low back pain [13]. These findings indicate that transforming general exercise advice into a structured exercise prescription with clearly defined frequency, intensity, time, type, and progression has sound clinical rationale.

Regarding specific forms of exercise, core stability training is widely used in the management of chronic low back pain. A meta-analysis by Wang et al. showed that core stability exercise may be more effective than general exercise in improving pain and function in the short term among patients with chronic low back pain [14]. Smrcina et al. also reported that core stability exercises may be considered as a therapeutic option for patients with non-specific low back pain to reduce pain, improve function, and enhance core strength [15]. Motor control exercise is another approach with strong relevance to spine surgery and rehabilitation medicine, focusing on improving the activation and coordination of deep stabilizing muscles of the lumbar spine. The Cochrane review by Saragiotto et al. indicated that motor control exercise has certain benefits for chronic non-specific low back pain, although no single form of exercise is universally superior for all patients [16]. Therefore, clinical exercise prescription should avoid a “one-size-fits-all” approach and should instead be stratified according to age, BMI, pain intensity, lumbar mobility, core muscle strength, and baseline exercise capacity.

In addition to core stability and motor control training, Pilates, the McKenzie method, and walking exercise may also serve as important components of exercise prescription. A meta-analysis by Yu et al. suggested that Pilates may relieve pain and improve functional disability in patients with chronic low back pain [17]. A systematic review by Namnaqani et al. indicated that the McKenzie method has potential value in improving pain and function in chronic low back pain, particularly in patients with directional preference or posture-related symptoms [18]. A randomized controlled trial published in The Lancet by Pocovi et al. demonstrated that an individualized, progressive walking and education intervention reduced the risk of low back pain recurrence, suggesting that walking is a low-cost, easily implemented, and highly scalable aerobic exercise modality, particularly suitable for overweight and obese individuals [19].

Taken together, exercise prescription for overweight and obese patients with chronic low back pain may include four major components. The first is aerobic exercise, such as brisk walking, cycling, swimming, or elliptical training, aimed at weight control and cardiopulmonary improvement. The second is core stability training, including glute bridges, bird-dog exercises, dead bug exercises, and planks, aimed at enhancing lumbar stability. The third is strengthening exercise for the paraspinal, abdominal, and gluteal muscles to improve spinal support. The fourth is flexibility and postural control training to improve pelvic control, lower-limb flexibility, and posture-related problems associated with prolonged sitting.

4. Role of Exercise Prescription in Weight Management

For overweight and obese patients with chronic low back pain, weight management is essential for reducing lumbar mechanical loading, improving metabolic status, and enhancing exercise capacity. A systematic review by Chen et al. suggested that weight loss programs may improve pain, disability, and quality of life in patients with low back pain. However, the overall quality of evidence remains low, and adherence and long-term maintenance remain major challenges [20]. These findings indicate that further clinical studies are needed in the field of obesity-related low back pain, especially studies exploring standardized intervention models that can be implemented jointly by hospital-based Health Management Centers and spine-specialty departments. Roffey et al. conducted a pilot study of a multidisciplinary, medically supervised, non-surgical weight loss program in obese adults and found that such programs may reduce low back pain severity and disability burden [21]. This provides practical support for a collaborative model integrating health management and spine-specialty care.

The role of exercise prescription in weight management has been supported by multiple exercise medicine guidelines and systematic reviews. The American College of Sports Medicine position stand stated that physical activity is an

important component of preventing weight gain, promoting weight loss, and preventing weight regain, and recommended regular moderate-intensity physical activity for overweight and obese adults [22]. The guideline by Garber et al. on the quantity and quality of exercise for adults proposed that exercise prescription should integrate cardiorespiratory training, resistance training, flexibility exercise, and neuromotor training [23]. An overview of 12 systematic reviews and 149 studies by Bellicha et al. showed that exercise training can improve body weight, fat mass, and visceral adiposity in adults with overweight or obesity, while resistance training may help preserve lean mass during weight loss [24]. These findings suggest that exercise prescription for obese patients with chronic low back pain should not be limited to simply encouraging patients to "walk more" or "exercise more." Instead, it should integrate aerobic fat reduction, resistance training, core stability, and lumbar functional rehabilitation.

5. Necessity of Exercise Adherence and Remote Monitoring

The effectiveness of exercise prescription depends largely on patient adherence. Patients with chronic low back pain often discontinue exercise because of fear of pain, post-exercise discomfort, lack of supervision, insufficient time, excessive body weight, and negative emotional states. A systematic review by Burgess et al. on adherence to lifestyle interventions in adults with obesity showed that exercise adherence is influenced by multiple factors, including motivation, time availability, social support, physical limitations, emotional status, and knowledge level [25]. MacDonald et al. also emphasized that adherence to physical activity and exercise is a key determinant of intervention effectiveness in lifestyle programs and should be clearly recorded and evaluated in study design [26]. Therefore, it is necessary to include exercise check-in rate, prescription completion rate, follow-up completion rate, and patient satisfaction as outcome measures in future research.

Digital tools and remote monitoring provide new opportunities to improve exercise adherence. A randomized controlled trial by Weise et al. showed that an app-based home exercise program significantly reduced self-reported pain intensity in patients with non-specific and degenerative back pain [27]. Shebib et al. reported that a 12-week digital care program improved outcomes related to low back pain, suggesting that digital platforms can facilitate self-management and individualized rehabilitation [28]. Toelle et al. found that app-based multidisciplinary back pain treatment had clinical value in the management of chronic back pain, indicating that digital platforms can integrate exercise, education, and behavioral management [29]. Feng et al. further demonstrated that a telemedicine-supported structured exercise program improved disability, pain, and the physical health dimension of quality of life in patients with chronic low back pain [30].

These studies suggest that exercise prescription for overweight and obese patients with chronic low back pain should not remain a one-time paper-based instruction. Instead, a dynamic follow-up system should be established. For example, WeChat mini-programs, wearable devices, online questionnaires, or telephone follow-up may be used to record daily step counts, exercise frequency, pain scores, changes in lumbar function, and adverse events. Physicians or health managers may then adjust exercise intensity, training movements, and progression speed based on real-time feedback, thereby improving safety and long-term adherence.

6. Collaborative Intervention Model Between the Health Management Center and the Department of Spine Surgery

Existing evidence provides a relatively solid theoretical basis for exercise prescription in obesity-related chronic low back pain. However, three major limitations remain in clinical practice. First, Health Management Centers are usually strong in body weight screening and chronic disease management, but they often lack sufficient involvement in lumbar pain assessment, functional evaluation, and spine-specialty decision-making. Second, spine surgery departments often focus on imaging findings, pain control, and surgical indications, while paying relatively limited attention to obesity management, long-term exercise adherence, and lifestyle intervention. Third, exercise prescription often lacks stratification and dynamic adjustment, making it difficult to simultaneously achieve weight reduction and lumbar functional improvement.

Based on these limitations, a four-component collaborative model involving the Health Management Center, Department of Spine Surgery, rehabilitation or exercise guidance team, and remote follow-up system may be established. The proposed workflow includes the following steps. First, the Health Management Center screens overweight and obese individuals and collects baseline indicators such as BMI, waist circumference, body fat percentage, blood pressure, blood glucose, and blood lipids. Second, the Department of Spine Surgery evaluates chronic low back pain history, red flag signs, pain scores, Oswestry Disability Index, lumbar range of motion, and imaging findings. Third, risk stratification is performed according to age, BMI, pain severity, exercise capacity, and comorbidities. Fourth, individualized exercise prescriptions are developed, including aerobic exercise, core stability training, resistance training, flexibility training, and health education. Fifth, online check-ins, remote questionnaires, and regular follow-up visits are used for dynamic adjustment. Sixth, after 12 or 24 weeks of intervention, BMI, waist circumference, body fat percentage, pain score, Oswestry Disability Index, exercise capacity, and adherence are reassessed.

The core innovation of this model lies not merely in stating that "exercise is beneficial," but in integrating body weight management with lumbar functional rehabilitation. This model represents a shift from a weight-loss-oriented approach to a comprehensive intervention targeting body weight, pain, lumbar function, and adherence. For research proposal development, this model is consistent with the goals of chronic disease management and health promotion, while also highlighting the specialty characteristics of spine surgery. Therefore, it has favorable clinical feasibility and potential for broader implementation.

7. Conclusion and Future Perspectives

Chronic low back pain imposes a substantial disease burden, and overweight and obesity are important associated factors. Obesity may contribute to the development and progression of low back pain through increased mechanical loading, impaired core muscle function, chronic low-grade inflammation, and intervertebral disc degeneration. Exercise therapy is a core non-pharmacological intervention recommended by clinical guidelines for chronic low back pain and is also a fundamental strategy for weight management. Current evidence supports the application of aerobic exercise, core stability training, motor control exercise, Pilates, the McKenzie method, and progressive walking in the management of chronic low back pain. For overweight and obese patients with chronic low back pain, exercise prescription should simultaneously address weight reduction, pain control, lumbar functional improvement, and long-term adherence.

Future studies should focus on several key areas. First, stratified exercise prescriptions should be developed for patients with different BMI levels, age groups, and pain severities. Second, the comprehensive effects of exercise prescription on BMI, waist circumference, body fat percentage, pain score, and Oswestry Disability Index should be clarified. Third, the role of digital follow-up and remote monitoring in improving exercise adherence should be further explored. Fourth, an integrated management pathway linking Health Management Centers and Departments of Spine Surgery should be established. Based on the existing evidence, conducting a clinical study entitled “Exercise Prescription Developed Jointly by a Health Management Center and a Department of Spine Surgery for Improving BMI, Pain, and Lumbar Function in Overweight and Obese Patients with Chronic Low Back Pain” is theoretically justified, clinically necessary, and practically feasible.

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