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Research article

Comparison of saddles in hippotherapy for patients with chronic low back pain

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Abstract

Chronic low back pain (CLBP) significantly impacts daily life. Currently, hippotherapy on a robotic horse has been shown to decrease pain and disability in low back pain. However, live horses and different types of saddles used during hippotherapy may have various therapeutic effects. Therefore, the purpose of this study was to compare the standard all- purpose saddle and the pad saddle used in live horse hippotherapy for individuals with CLBP. Ten participants with CLBP (mean age 36.6±6.02 years) were assessed pain level using the visual analog scale (VAS) and lumbopelvic mobility using the Schober test and inertia measurement unit (IMU) before and after each saddle, with a one-week interval between saddles and a 20-minute hippotherapy session. The dependent t-test, with a significance level of 0.05, was conducted to compare the percentage change of each variable between two saddles. The result showed that the standard saddles significantly reduced pain levels ($p < 0.001$) and increased pelvic range ($p<0.05$) greater than pad saddles in participants with CLBP. Therefore, the standard saddle is more beneficial than the pad saddle for individuals with CLBP undergoing hippotherapy

Keywords: CLBP, Hippotherapy, Lumbopelvic mobility, Saddle, VAS

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INTRODUCTION

Chronic low back pain (CLBP) is a common health problem that results in significant medical visits and missed workdays (National institute for health and care excellence, 2020), causing serious medical and economic consequences with regards to mobility and physical disability (Laird et al., 2014; Untimanon, 2016; Social Statistics Division National Statistical office, 2017; National institute for health and care excellence, 2020; Lieveld Jean Yves et al., 2021). Guidelines for managing CLBP recommend promoting movement and daily activities while avoiding inactivity and reducing physical activity (Untimanon et al., 2016). Therefore, physical therapy for patients with CLBP focuses on therapeutic activities such as improving flexibility, strengthening core muscles, increasing mobility, and promoting proper posture, with the specific exercises varying according to the patient's condition (Laird et al., 2014). However, it remains unclear which exercise therapy is more effective compared to others (O'Connell et al., 2016).

Hippotherapy is an alternative therapeutic exercise that can increase muscular flexibility, decrease pain (Janura et al., 2009; Yılmaz et al., 2020), improve disability scores (Aldridge et al., 2016), promote movement coordination, help alleviate spasticity and pain in patients with hemiplegia (Adams, 2000) and improve balance and quality of life in elderly (Angoules et al., 2015). This is because the horse's gait pattern can induce movement in all three planes of the rider's pelvis and encourages the muscles to operate continuously (Adams, 2000; Janura et al., 2009; Angoules et al., 2015). In the frontal plane, the horse's movement activates the anteroposterior muscle group of the rider, promoting the activation of opposing muscle groups, which improves muscular strength and spinal stability (Janura et al., 2009; Janura et al., 2015). In the sagittal plane, as the horse lifts its legs, the rider's center of gravity shifts in the direction of mediolateral stimulation to expand the range of motion of the hip joint, spine, and the activity of the lateral muscles for equine balance (Janura et al., 2009; Janura et al., 2015). Lastly, in the transverse plane, when the horse walks, the horse's torso is curved in a convex or concave manner, which causes the human's body to curve when it sits on the horse's back. However, there are few studies on patients with CLBP (Janura et al., 2015; Aldridge et al., 2016).

Even though hippotherapy may offer benefits for patients with CLBP (Janura et al., 2015), horseback riding (HR) must take into account the equipment used, particularly the saddle. The saddle's primary purposes in horseback riding are to provide comfort for both the horse and rider, facilitate proper balance for the rider, and enable the rider to become more self-sufficient (Janura et al., 2015; Aldridge et al., 2016; Yılmaz et al., 2020). The closer the rider is to the horse, the more they can feel and respond to the horse's movement, which can engage muscles not typically used, such as the core and those used in walking. Therefore, thinner equipment like the pad saddle support can enhance the rider's ability to transmit movement from the horse and maintain a closer connection with their mount which only applies to children riders. However, since the pad saddle can transmit warmth from the horse to the rider by adding a direct touch point, it may enhance the rider's ability to greater move and balance from the pad saddle's support than the standard saddle (Janura et al., 2009). Previous research (Janura et al., 2015) on adults with CLBP has been conducted using standard all- purpose saddle that might lessen the movement from transmitting by their thickness. Consequently, it is interesting to determine, if a specific type of saddle is required for providing hippotherapy for CLBP, which type of saddle will provide the greatest therapeutic benefit. The selection of saddle type should be made based on the rider's movements and the pressure exerted on the horse's back, which are influenced by the horse's gait and direction of movement. However, the study of saddles used in hippotherapy is limited. Therefore, this study attempted to compare the effects of two saddle styles during hippotherapy on pain and lumbopelvic mobility in individuals with CLBP.

MATERIALS AND METHODS

Participants

Ten male and female participants, aged between 20 and 60 years (mean age=36.62±6.02 years), with a history of non-specific low back pain (LBP) and without any symptoms of limb pain for more than 12 weeks, were recruited for the study. Using the sample size calculation by G-power (F tests ANOVA: repeated measures, within factors (2X2), a priori: compute required sample size-give effect size, α, and power) on VAS variable from Janura et al. (2015), eight participants were required. Therefore, the study added 2 more participants to prevent drop-out from the study. The mean pain score was 3.89±1.02 cm and the mean body weight was 68.75±16.67 kg. Participants with specific causes of back pain, such as infection, rheumatoid arthritis, or fractures with significant pain, were excluded from the study. Additionally, individuals with other discomforts, such as intervertebral disc abnormalities, collapsed or fractured vertebrae, scoliosis, or those who were unable to sit or balance on a horse were also excluded. The study procedures were thoroughly explained to the participants and informed consent was obtained prior to their enrollment in the study. The study was approved by the ethics committee of the Human Research Ethics Unit, Faculty of Associated Medical Sciences, Chiang Mai University (Ethical approval number AMSEC-64EX-101).

Hippotherapy

Horseback riding (HR) was performed on a flat 30 x 70 -meter riding ground for 20 minutes riding with the horse walking at a rate of 100 steps per minute. The horse selected was healthy 16-hand-height thoroughbred horse with no history of illness in the previous 6 months and not lame, based on the results of a subjective lameness evaluation performed before the study. The horse had previous equine assisted therapy (EAT) experience. During horseback riding, the horse was accompanied by a professional hippotherapy team and handlers to manage the horse's direction and pace and to provide the participants with proper riding posture.

Outcome measures

Visual Analogue Scale (VAS)

Pain intensity was determined using VAS. A 100-mm line with two endpoints—"no discomfort" and "worst pain imaginable"—is used. It is a simple and widely used technique to evaluate pain variations. VAS Cronbach's alpha was 0.9117 (National institute for health and care excellence, 2020). Participants will mark a week's estimated pain level on the line. A ruler measured the distance from the "no pain" endpoint to determine a pain score out of 10.

Lumbopelvic mobility

The Schober test

The Schober test is a method for measuring the amount of flexion in the lumbar spine. To perform the test, participant is standing, examiner marks the L5 spinous process by marking a horizontal line across the patients back. A second line is marked 10 cm above the first line (Figure 1). Patients were instructed to bend forward to obtain an accurate measurement of the distance between the markings. After the flexion movement, the distance between the markings is measured. The test-retest reliability of the Schober test on participants with CLBP prior to conducting this study was found to be excellent (ICC = 0.91, $p < 0.001$) (Bauer, 2016).

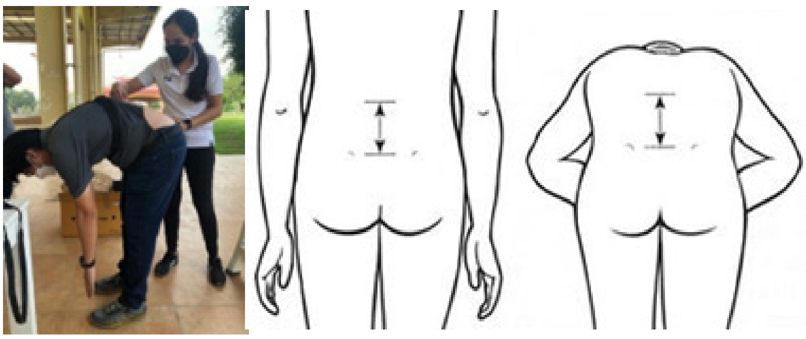

Figure 1 Schober test.

Inertia measurement unit (IMU)

The angular displacement of the rider's pelvis and back in the sagittal plane during HR, including pelvic range and femurs to back flexion, was measured using IMU (STT system, San Sebastian, Spain). Eight sensors were attached to the participant at the dorsal, sacrum, and thighs. A portable personal computer with the iSen 3.0 system® Research software was connected to the sensors via WIFI (2.4 GHz – 5 GHz). Each sensor (56 x 38 x 18 mm, 46 g.) included a 3-axis gyroscope, 3-axis accelerometer, and 3-axis magnetometer, with tri-axial data collected at 400 Hz. This IMU has previously been shown to have excellent concurrent validity with a motion analysis system (Vicon 370) and a 3D optoelectronic system, with correlations ranging from 0.829 to 0.998 (Zhang,2022).

Procedure

All participants completed a personal data collection form providing information on age, gender, weight, and height, as well as the Thai version of the Oswestry questionnaire index (ODI) to screen and identify how back pain impacted routine activities.

This study was quasi-experimental trial with 2-way repeated measures design. Prior to the hippotherapy session, all outcome measures were assessed. Afterwards, participants were randomly assigned either a standard saddle or a constructed pad saddle in a counter-balanced design (Figure 2). The standard saddle included a saddle, back sheet, bracing, stirrup, and rein, while the constructed pad saddle consisted of a back sheet measuring width 120 cm, length 70 cm, and thickness 2 cm, a pad saddle measuring width 72 cm, length 80 cm, and thickness 1 cm, solid bracing, solid straps, a harness, a stirrup mounting kit, and stirrups.

For the hippotherapy session, the horse trainer and physical therapist assisted participants in adjusting their postures while seated. Participants were given instructions on walking, holding the reins, and handling the horse, as well as safety precautions, including not pulling, striking, or pinching the animal's legs or body. Participants could immediately withdraw from the study if they experienced unusual symptoms such as increased pain or pain greater than their original discomfort, or other symptoms such as numbness, dizziness, panic, or loss of balance. However, the horse's pace was regulated by the handler who guided the horse along the training ground in a straight line. After walking at a typical pace for 20 minutes and dismounting, participants were reassessed using all outcome measures as a post-study assessment.

One week later, participants returned for a second horseback riding session, using the other saddle from their first session to eliminate any potential carry-over effects, and all outcome measures were remeasured.

Figure 2 Standard all purpose (A) and Pad saddle (B).

Statistical analysis

Descriptive statistics for categorical data were used to determine characteristics of participants. The Shapiro-Wilk test was performed to assess the general distribution of the data, and the two-way repeated measures analysis of variance (ANOVA) was used to determine group interaction between two saddles across all variables, with a significance level of 0.05. The effect size calculation was performed using partial eta squared. The data were statistically analyzed using version 26 of the SPSS program (IBM Corp, 2019).

RESULTS

Ten participants, five males and five females were recruited in this study. The participant's characteristics were shown in Table 1.

Table 1 Characteristic of participants (n=10; male=5, female=5)

Variables	Min	Max	Mean	SD
Age (years)	27.00	45.00	36.60	6.02
Body Mass Index (kg/m^2)	19.31	30.93	24.42	3.53
Oswestry Disability Index (point)	0.00	20.00	7.10	5.82
Visual Analogue Scale (cm)	3.10	6.00	3.89	1.02

The results in participants with CLBP showed that, compared to the pad saddle, the standard saddle resulted in a statistically significant decrease in pain level ($p<0.001$) and an increase all variables in lumbopelvic mobility ($p<0.05$) (Table 2).

Table 2 Comparison of pain level and lumbopelvic mobility between pad and standard saddles (N=10)

	Pre-hippotherapy Mean (SD)		Post-hippotherapy Mean (SD)			
	Pad	Standard	Pad	Standard	p-value*	η_p^2
VAS (cm)	3.89 (1.02)	3.73 (0.85)	3.78 (1.07)	2.13 (0.79)	<0.001	0.681
Lumbopelvic mobility						
Schober's test (cm)	14.85 (1.51)	14.80 (0.79)	15.10 (1.47)	15.85 (0.97)	0.024	0.254
IMU (degrees)						
- pelvic range	39.25 (11.75)	34.15 (10.52)	36.39 (9.61) 134.49	40.31 (11.41)	0.018	0.273
- right femur to back flexion	135.77 (18.33)	127.02 (21.94)	(22.91)	143.98 (17.61)	0.037	0.219
- left femur to back flexion	134.82 (17.80)	127.57 (22.26)	133.59 (23.09)	145.14 (20.00)	0.033	0.228

VAS: Visual Analogue Scale, IMU: Inertia measurement unit, *: p<0.05, ηp2: Partial Eta square

DISCUSSION

This study investigated the effect of using different types of saddle in hippotherapy sessions for individuals with CLBP. The results showed that using standard saddle led to a statistically significant reduction in pain intensity and increase in spinal and lumbopelvic mobility ($p<0.05$). The effect size of the findings ranged from 0.219 to 0.618, which is regarded large effect level according to the general rules of thumb given by Cohen et al. (2001). These results align with previous research linking rider movement to horseback pressure and suggest that different saddle types can generate varying downforces that directly affect rider movement (Janura et al., 2009; Angoules et al., 2015; Janura et al., 2015).

The design of saddle for hippotherapy should take into account the interplay between the horse, rider, and saddle, which has a direct effect on the effectiveness of hippotherapy (Dyson, 2012). The saddle must fit the horse's back and not limit the rider's movement. As riders in the population with CLBP are typically adults with a relatively high average body weight and BMI, using a pad saddle might cause the horse to deviate from its normal gait pattern due to excessive pressure on the horse and rider (Clayton et al., 2013). Additionally, pad saddle may cause more discomfort to the rider's pressure points such as the seat bone, than standard saddle (Kotschwar et al., 2010; Belock et al., 2012), hindering independent movement of the lumbopelvic region. Standard saddle, on the other hand, are intended to be utilized for various riding purposes, such as dressage, jumping, and riding on a different terrain, without limiting the rider's natural movements. Thus, these saddles help to engage the rider's buttocks, promote lumbopelvic mobility in synchronization with the horse's gait in a balanced, three-dimensional motion (Gómez Alvarez et al., 2006). The saddle support provided to the rider alters the pressure applied to the horse, allowing for the horse's gait rhythm to be completely attainable during hippotherapy (Wilkins et al., 2020).

The findings of this study indicate significant variations across all variables, indicating that the utilization of standard saddle in this study outperformed the use of pad saddle. The pelvic range was improved due to the direct transfer of pressure to the pelvic bones, effectively altering the three-dimensional movement especially during horse walking in hippotherapy session (Wilkins et al., 2020). Consequently, the extent of this pelvic movement had an impact on the other joints and muscles engaged in the backbend, which necessitates motion across multiple joints, including hip, pelvic, and spinal joints (Wilkins et al., 2020). Furthermore, a continuous movement of the skeletal system and muscles with the appropriate pressure from the standard saddle in three-dimensional directions is produced, mimicking the actual movement of the human body in the condition of the horse (Sahrmann et al., 2017). As a result, there is an increase in blood flow within immobile muscles, leading to a reduction in the presence of metabolic waste products, this increase in blood circulation contributes to the pain-relieving effect, potentially alleviating discomfort (jandee et al., 2021). Conversely, the utilization of pad saddle may cause the discomfort feeling through the excessive pressure on the attachment point during the hippotherapy session, thereby restricting the natural movement of participants. Furthermore, the use of pad saddle has the potential to increase the axial load and contribute to increased stiffness in the spine following the session (Stokes and Gardner-Morse, 2003; Carlson, 2009).

For the limitation of the study, this study focused on an adult population and may not be used to generalize in other demographic or disease populations. Additionally, the low average ODI scores of the participants might have led to insufficient movement variety and should be considered when recruiting participants for future studies. The study also did not examine other variables associated with the symptoms of CLBP patients, such as lumbopelvic stability, hippotherapy session duration, or daily activity. Future studies in this population should address these factors and variables to gather more conclusive data.

CONCLUSION

Individuals with CLBP demonstrated a decrease in pain levels and an increase in lumbopelvic mobility when utilizing the standard saddle during hippotherapy, in contrast to using the pad saddle.

CONFLICT OF INTEREST

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

REFERENCES

Adams, H.R., 2000. Hippotherapy as a modality in rehabilitation. Available online: https://commons.und.edu/cgi/viewcontent.cgi?article=1002&context=pt-grad

Aldridge, R.L., Morgan, A., Lewis, A., 2016. The effects of hippotherapy on motor performance in veterans with disabilities: a case report. J. Mil. Veterans. Health. 24, 24-27.

Angoules, A.G., Koukoulas, D., Balakatounis, K., Kapari, I., Matsouki, E., 2015. A review of efficacy of hippotherapy for the treatment of musculoskeletal disorders. Br. J. Med. Med. Res. 8, 289-297.

Aoki, Y., Sugiura, S., Nakagawa, K., Nakajima, A., Takahashi, H., Ohtori, S., Takahashi, K., Nishikawa, S., 2012. Evaluation of nonspecific low back pain using a new detailed visual analogue scale for patients in motion, standing, and sitting: Characterizing nonspecific low back pain in elderly patients. Pain. Res. Treat. 2012, 680496.

Bauer, C.M., Heimgartner, M., Rast, F.M., Ernst, M.J., Oetiker, S., Kool, J., 2016. Reliability of lumbar movement dysfunction tests for chronic low back pain patients. Man. Ther. 24, 81-84.

Belock, B., Kaiser, L.J., Lavagnino, M., Clayton, H.M., 2012. Comparison of pressure distribution under a conventional saddle and a treeless saddle at sitting trot. Vet. J. 193, 87-91.

Carlson, C., 2009. Axial back pain in the athlete: pathophysiology and approach to rehabilitation. Curr. Rev. Musculoskelet. Med. 2, 88-93.

Clayton, H.M., Belock, B., Lavagnino, M., Kaiser, L.J., 2013. Forces and pressures on the horse's back during bareback riding. Vet. J. 195, 48-52.

IBM, 2019. IBM SPSS Statistics for Windows, Version 26.0., New York.

Dyson, S., 2012. How to recognise hindlimb lameness: An obvious lameness to subtle gait abnormalities. In: Proceedings of the American association equine practitioners focus meeting on hindlimb lameness, Oklahoma, 24 July 2012, pp. 2-9.

Gómez Alvarez, C.B., Rhodin, M., Bobber, M.F., Meyer, H., Weishaupt, M.A., Johnston, C., Van Weeren, P.R., 2006. The effect of head and neck position on the thoracolumbar kinematics in the unridden horse. Equine. Vet. J. Suppl. 38, 445-451.

Greve, L., Dyson, S., 2013. The horse–saddle–rider interaction. Vet. J. 195, 275-281.

Harman, J., Harris, S.E., 2005. The horse's pain-free back and saddle-fit book: ensure soundness and comfort with back analysis and correct use of saddles and pads. Trafalgar Square, Kenilworth.

National Institute of Neurological Disorders and Stroke, 2020. Low Back Pain. Available online: https://www.ninds.nih.gov/disorders/patient-caregiver-education/fact-sheets/low-back-pain-fact-sheet

Hlaing, S.S., Puntumetakul, R., Khine, E.E., Boucaut, R., 2021. Effects of core stabilization exercise and strengthening exercise on proprioception, balance, muscle thickness and pain related outcomes in patients with subacute nonspecific low back pain: A randomized controlled trial. BMC Musculoskelet. Disord. 22, 998.

Jandee, S., Pimpaphon, P., Sriyabhaya, A., 2021. Effects of pilates and static stretching exercise on pain of trapeziusmuscle in office syndrome. J. Phys. Health. Phys. Educ. Recreat, 47, 242-250.

Janura, M., Gallo, J., Svoboda, Z., Svidernochová, D., Kristiníková, J., 2015. Effect of physiotherapy and hippotherapy on kinematics of lower limbs during walking in patients with chronic low back pain: a pilot study. J. Phys. Educ. Sport. 15, 663-670.

Janura, M., Peham, C., Dvorakova, T., Elfmark, M., 2009. An assessment of the pressure distribution exerted by a rider on the back of a horse during hippotherapy. Hum. Mov. Sci. 28, 387-393.

Kotschwar, A.B., Baltacis, A., Peham, C., 2010. The effects of different saddle pads on forces and pressure distribution beneath a fitting saddle. Equine. Vet. J. 42, 114-118.

Laird, R.A., Gilbert, J., Kent, P., Keating, J.L., 2014. Comparing lumbo-pelvic kinematics in people with and without back pain: a systematic review and meta-analysis. BMC Musculoskelet. Disord. 15, 229.

Lieveld, J.Y., Mostafa, M., Ismael, E.H., Herteleer, D., Low back pain with mobility deficit. Available online: https://www.physio-pedia.com/Low_Back_Pain_With_Mobility_Deficit

Linde, L.D., Duarte, F.C., Esmaeili, H., Hamad, A., Masani, K., Kumbhare, D.A., 2021. The nociceptive flexion reflex: A scoping review and proposed standardized methodology for acquisition in those affected by chronic pain. Br. J. Pain. 15, 102-113.

Menor-Rodríguez, M.J., Sevilla Martín, M., Sánchez-García, J.C., Montiel-Troya, M., Cortés-Martín, J., Rodríguez-Blanque, R., 2021. Role and effects of hippotherapy in the treatment of children with cerebral palsy: A systematic review of the literature. J. Clin. Med. 10, 2589.

National institute for health and care excellence, 2020. Low back pain and sciatica in over 16s: assessment and management. Available online: https://www.nice.org.uk/guidance/ng59

O'Connell, N.E., Cook, C.E., Wand, B.M., Ward, S.P., 2016. Clinical guidelines for low back pain: a critical review of consensus and inconsistencies across three major guidelines. Best. Pract. Res. Clin. Rheumatol. 30, 968-980.

Sahrmann, S., Azevedo, D.C., Dillen, L.V., 2017. Diagnosis and treatment of movement system impairment syndromes. Braz J Phys Ther. 21, 391-399.

Social Statistics Division National Statistical office, 2017. The food consumption behavior survey 2017. Statistical Forecasting Division Publication, Bangkok.

Stokes, I.A., Gardner-Morse, M., 2003. Spinal stiffness increases with axial load: Another stabilizing consequence of muscle action. J Electromyogr Kinesiol. 13, 397-402.

Untimano, O., Boonmeephon, K., Saipang, T., Sukanun, K., Promra, A., Julraung, P., Pornpiroonrod, S., 2016. Burden of back pain among working populations. Dis. Control. J. 42, 11.

Wilkins, C.A., Nankervis, K., Protheroe, L., Draper, S.B., 2020. Static pelvic posture is not related to dynamic pelvic tilt or competition level in dressage riders. Sports. Biomech.1-13.

Zhang, C., Greve, C., Verkerke, G.J., Roossien, C.C., Houdijk, H., Hijmans, J.M., 2022. Pilot validation study of inertial measurement units and markerless methods for 3D neck and trunk kinematics during a simulated surgery task. Sensors (Basel). 22, 8342.

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